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MANAGEMENT AND COST ACCOUNTING

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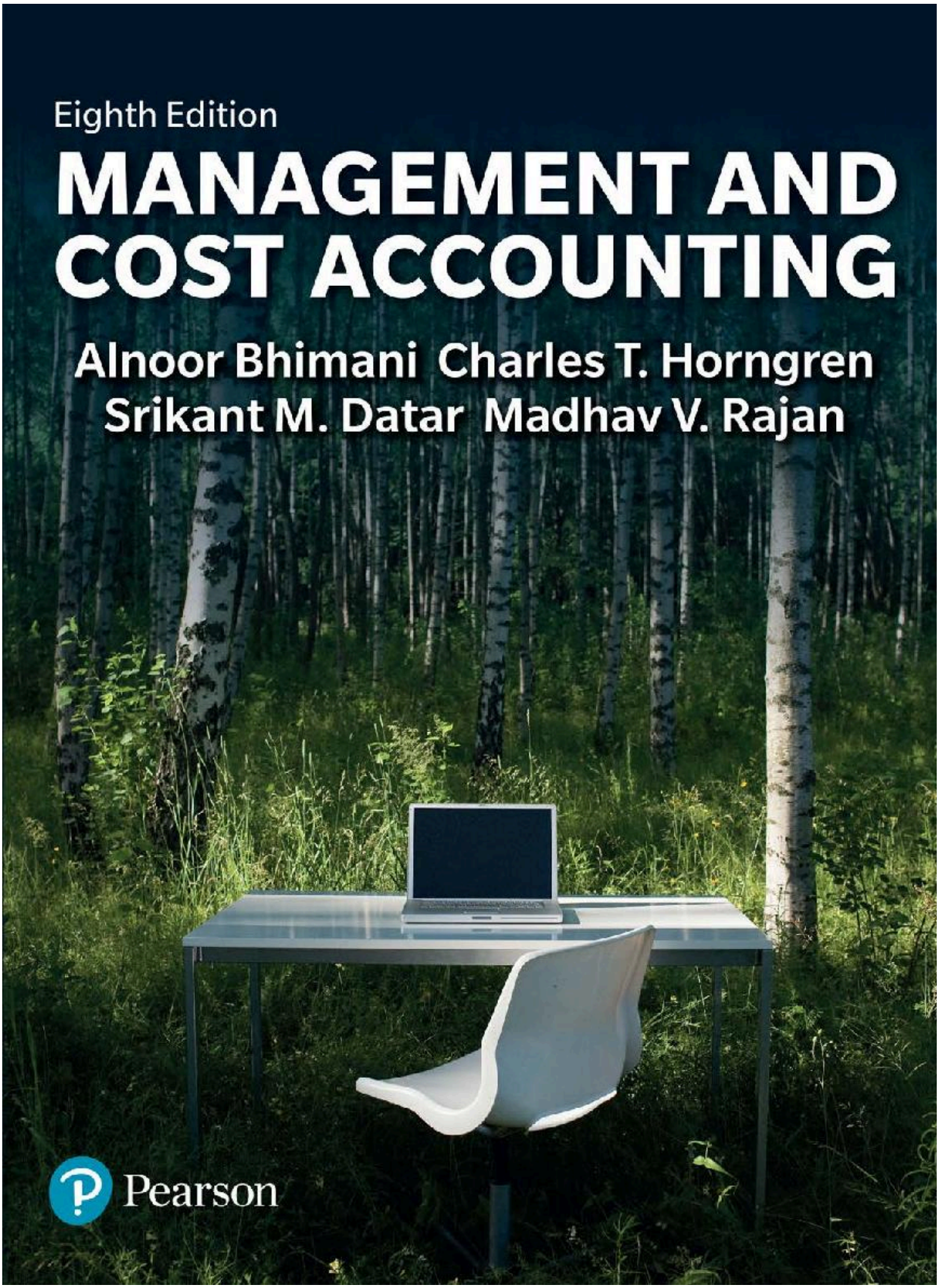

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Eighth Edition

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Chuck Horngren revolutionised cost and management accounting. He loved new ideas and introduced many new concepts. He had the unique gift of explaining these concepts in simple and creative ways. He epitomised excellence and never tired of details, whether it was finding exactly the right word or working and reworking assignment materials.

He combined his great intellect with genuine humility and warmth and a human touch that inspired others to do their best. He taught us many lessons about life through his amazing discipline, his ability to make everyone feel welcome, and his love of family.

It was a great privilege, pleasure, and honour to have known Chuck Horngren.

Few individuals will have the enormous influence that Chuck had on the

accounting profession. Fewer still will be able to do it with the class and style

that was his hallmark. He was unique, special and amazing in many, many

ways and, at once, a role model, teacher, mentor and friend.

He is deeply missed.

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London School of Economics and Political Science

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PREFACE

Accounting influences our lives. Whether or not one uses accounting information, accounting

alters our social, economic and physical environment. And of course, it impacts organisations

and altering what we do and the decisions we make. Corporate action regarding new product

developments, pricing strategy, staff recruitment and salary levels are usually directly influenced

by accounting information. At times, accounting motivates certain types of managerial

behaviours and discourages others. This book is about understanding the preparation and use of

management and cost accounting information, taking account of how it influences decisions.

But accounting is not a pre-given in form or process and in this sense accounting is also

continuously being reshaped by its context. The book therefore also extensively discusses how

different factors alter accounting techniques and processes.

As we'll see in Chapter 1, management accounting is concerned with providing managers with

financial and other types of information so they can pursue diverse goals. Cost accounting, which

is sometimes used interchangeably with management accounting, is more concerned with

information on the acquisition and consumption of resources. We want to address issues relating

to the design, use and role of accounting information in the management of organisational

activities. We will do this by balancing technical detail with enterprise insight so we can focus on

how to best support management action.

Management and cost accounting is a dynamic discipline which differs across firms, nations,

industrial settings and management functions. It entails the application of different techniques,

which must constantly adapt given the fast pace of changes facing enterprises today. Consequently,

the book covers a comprehensive suite of techniques and areas including job costing and process

costing, cost–volume–profit relationships, capital investment decisions, budgetary control and

responsibility accounting. It looks also at quality costing, throughput issues, non-financial

performance measures and strategic analysis. But we are especially concerned with the forces

that impact these management accounting practices right now. So all these techniques are

discussed in the context of changes witnessed by organisations on an ongoing basis. We argue

that the most significant force affecting firms today is technological change and innovation.

Digital technologies are rapidly impacting business models and organisational processes and

they are doing so in a deep and extensive way. This new edition of the book is thus packed with

coverage on how organisations are being digitally transformed and what this implies for

management accountants. We look at numerous illustrations of companies using ‘big data’ and

analytics as they draw insights from digitised data. We consider how the ‘Internet of Things’,

robotics, artificial intelligence and other digital innovations are impacting management

accounting information deployment. Aside from the digitalisation of enterprises, we consider

also the relevance of sustainability and environmental concerns which influence how firms deploy

management accounting information.

New to the 8th edition

To ensure currency and coverage of modern applications of management accounting, we have

added new material in this edition. Environmental issues have been of concern to organisations

for decades but the past few years have demonstrated much more active engagement by business

in this light. We have therefore introduced across several chapters, discussions and illustrations

of companies which have extensively invested in sustainability initiatives and indicators of their

performance in this domain. Chapter 1 discusses why this has become such a priority for many

enterprises and subsequent chapters provide numerous illustrations of how companies approach

sustainability factors affecting their pursuits and activities. Chapter 22 in particular reflects the

significance of sustainability issues tied to management accounting with a new title for the whole

chapter and wide-ranging content revisions and new coverage areas. Technological changes and

digitalisation have likewise evolved and altered organisational functions and processes in the very

recent past. The rise of increasingly advanced digital applications such as blockchain systems,

the Internet of Things, smart contracts and artificial intelligence are altering not only what

management accountants must report on but the very mechanisms of reporting and the growing

divisions between machine versus human decision making. This is reshaping the work and roles

played by management accounting in organisations. The impact of digital technologies is fast

transforming the field and most chapters discuss aspects of the nature and forms of such changes.

From Chapter 1 through, especially to Chapter 22, we identify how the digital technologies are

altering the substance of management accounting and the relevance of conventional as well as

new accounting and control tools deployed by firms.

Also included in this edition are novel illustrations and survey results of management accounting

mechanisms and corporate concerns. We have tried to ensure the inclusion of company-relevant

examples and illustrations of changing management and cost accounting practices. While general

aspects of different topics and issues are extensively covered, we also discuss situational and

organisational adaptations of generic techniques to ensure that you understand the applicability

of management accounting approaches. To achieve this, we have numerous case studies used by

many business schools across the globe. We ensure that the reality of enterprise management is

reflected in the book and so, rather than accord a separate chapter to consider strategic,

organisational and behavioural aspects of management accounting, we integrate this throughout

chapters in the book. We further cover global themes that are of relevance to managers in modern

enterprises in terms of corporate responsibility and ethical issues.

We draw comfort in observing that other management accounting writers try to use our

approach of practical examples, case studies and coverage of research findings, while also sharing

our preference for the format and structure adopted here. We sharpen this by providing the very

latest in corporate examples, survey findings and case studies. This ensures that you gain

familiarity with concepts that are of relevance and concern to enterprises today.

Deciding on the sequence of chapters in a management and cost accounting textbook that

spans introductory through to relatively detailed analysis of material is a challenge we have met

successfully. Professors tend to have a preferred way of organising their course material. The five-

part structure of this book and the sequencing of chapters have been designed to facilitate

flexibility and diversity in the teaching of different topic areas and the use of the text for a range

of courses and levels. An outline of the coverage and component chapters of each part is given in

the part openers.

Assessment material

This book includes a high quantity and broad range of assessment material to further facilitate

the use of the text on a diverse range of courses:

● **Review questions:** These short questions encourage students to review and/or critically discuss

their understanding of the main topics and issues covered in each chapter, either individually

or in a group.

● **Exercises:** These comprehensive questions are graded and grouped by their level of difficulty:

basic, intermediate and advanced. Each question is preceded by a note of its topic coverage

and an indication of the time it should take to complete. Where appropriate, the exercises

include questions taken from examinations of several professional accountancy bodies. Fully

worked solutions to a selection of exercises in each chapter (identified by an asterisk) are

provided in Appendix A.

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Case study problems

At the end of each of the fi ve parts are problem-based illustrative cases. Each is more substantive

and typically more demanding than the end-of-chapter exercises, integrating topics from several

chapters in each of the core parts of the text, allowing you to apply your understanding of

accounting concepts, issues and techniques within a broader organisational context, and to

develop your critical thinking and analytical skills. The questions which follow the case material

include some aspects suitable for group discussion/assignment.

Glossary

This comprises an alphabetical listing of all the key terms, including a concise defi nition, so

allowing revision of all the key concepts and techniques in the text.

Academic supplements

Academics and lecturers who adopt this text are provided with a range of additional materials to

assist in the preparation and delivery of courses. These include:

● complete, downloadable Instructor's Manual with teaching ideas and solutions to end-of-

chapter exercises not given in the text;

● suggested teaching notes to all case study problems;

● editable PowerPoint slides, organised by chapter, allowing you to provide a lecture or seminar

presentation (and/or to print handouts). These incorporate colourful graphics, outlines of

chapter material, text exhibits, additional examples and graphical explanations of diffi cult

topics;

● solutions to additional questions and spreadsheet problems.

This text is supported by its own MyLab Accounting which is an environment that gives unlimited

opportunities for practice and assessment using a range of questions, and which provides timely

feedback. Updates to MyLab Accounting include alignment of the questions to match new

content in the book and the addition of over 100 exercises that are new to this edition to improve

coverage across the most important topics. In addition to the useful self-study suggestions in the

Study Plan, and the vast range of exercises (over 800) to select from, a better mix of questions has

been incorporated into MyLab Accounting for this edition, allowing teaching staff to better test

students' performance using a greater variety of question types. Finally, four new short videos

explaining essential concepts can be used within teaching to consolidate your students'

understanding or support self-study and revision.

For access to MyLab Accounting, students need both a course ID and an access card (see the

advert on the inside front cover of the book).

Alnoor Bhimani

Srikant Datar

Madhav Rajan

November 2022

Lecturer Resources

For password-protected online resources tailored to

support the use of this textbook in teaching, please log in

as an educator on our website **www.pearson.com** and search

for this textbook, where you will find a tab providing

instructor resources.

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AUTHORS'

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The Chartered Institute of Management Accountants

The Institute of Chartered Accountants in Ireland

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PART I

Management and cost

accounting fundamentals

The first part of the book is intended to provide an introduction to fundamental

concepts and ideas in management and cost accounting. Chapter 1 considers the

role of accounting and accountants in organisations. Chapters 2–7 discuss relevant

technical and broader organisational issues in the design and functioning of cost

systems. Specifically, Chapter 2 provides an introduction to costing terminology and

its aims. Chapters 3 and 4 discuss what might be considered ends of a continuum

in costing systems: job order costing and process costing. Chapter 5 addresses

fundamental cost allocation issues while Chapter 6 deals with joint-costing situations.

The final chapter in this part discusses absorption costing and variable costing as two

distinct approaches to stock costing.

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CHAPTER 1

The manager and management accounting

Former accountants have headed many large companies across the world, including PepsiCo, Coca-Cola, BT, Siemens, 3i, Shell, Rolls-Royce, Vodafone, Burger King, Royal Bank of Scotland, Asda and Nike. Finance leaders' roles in organisations change continuously. More than half of Chief Executive Officers (CEOs) of FTSE 100 (a share index of the 100 companies listed on the London Stock Exchange with the highest market value) have a background in accounting or financial management (Global Accounting

Learning objectives

After studying this chapter, you should be able to:

- Differentiate management

accounting from financial

Network, 2022) and 30% of Fortune 500 (the 500 largest US industrial accounting

corporations by revenue) CEOs spend the first four years of their careers developing a strong foundation in finance. In the financial sector, almost a

- Recognise the growing role

quarter of CEOs previously held the role of CFO (Amato, 2022). The rapid of strategy in management

rise of accounting and finance executives is unrivalled by other corporate accounting processes

roles. This is partially because they help guide companies at the most sen-

- Identify five broad purposes of

ior level, offering strong analytical skills, organisational acumen, a dedica- accounting systems

tion to continuous improvement and widening stakeholder engagement.

- Understand how accounting can

Across virtually all organisations, accountants' duties involve man-

influence planning, control and

agement planning, control and decision making, although the enterprise decision making

context determines the specific accounting and financial management

- Distinguish between the score-

responsibilities they must deliver on. The demands on accounting and keeping, attention-directing and

finance professionals always differ and there is no one-size-fits-all in problem-solving functions of

management accounting. Recently, many accountants have broadened management accounting

their activities to include risk management, business strategy, sustainability objectives and digital transformation roles. CPA Canada, a national

- Recognise that economic benefits,

organisation representing the Canadian accounting profession, with costs as well as contextual and

210,000 qualified members, considers that its members must be ‘broad-organisational process issues are

minded, forward-thinking professionals who undertake appropriate analy-

relevant to accounting systems

sis, exercise good judgment, communicate effectively and act to protect

design and operation

the public interest' (CPA Canada 2022). Managers in all companies,

●

Assess how companies add value

whether small or large, must understand how revenues and costs behave

●

Understand why digitalisation is

or they risk losing control of the performance of their firms. But this is

management accounting's key

not sufficient and managers' use of management accounting information

challenge today

must go beyond this to include making decisions about research and development, production planning, budgeting, pricing, and the products or services to offer customers. Strategic action in enterprises is increasingly informed by management accounting input.

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How managerial activities and decisions link to accounting intelligence continuously evolves. This

book addresses questions such as: What types of decisions do managers make? How can accounting

help managers make these decisions? Are managerial needs proactively being met by management

accounting solutions? In this first chapter, we look at some dimensions of the role of management

accounting in modern enterprises, why management accounting is subject to continual change and

what digital technologies imply for the field. A consideration of these issues will give us a framework

for studying the succeeding chapters.

Management accounting, financial accounting and cost accounting

A distinction is often made in practice between management accounting and financial accounting.

Management accounting measures, analyses and reports financial information and non-financial

information that are intended primarily to assist managers in fulfilling the goals of the organisa-

tion. A management accounting system is an important facet of overall organisational control,

as is discussed later in this book. CIMA Global sees management accounting as an integral part

of management. It considers management accounting as combining accounting, finance and

management with leading-edge techniques that drive successful businesses. Individual managers

often require the information in an accounting system to be presented or reported differently.

Consider, for example, sales order information. A sales manager at Porsche may be interested in

the total amount of sales in Euros to determine the commissions payable to salespeople. A distri-

bution manager at Porsche may be interested in the sales order quantities by geographic region

and by customer-requested delivery dates to ensure vehicles get delivered to customers on time.

A manufacturing manager at Porsche may be interested in the quantities of various products and

their desired delivery dates so that they can develop an effective production schedule. To simul-

taneously serve the needs of all three managers, Porsche creates a database consisting of small,

detailed bits of information that can be used for multiple purposes. For instance, the sales order

database will contain detailed information about a product, its selling price, quantity ordered,

and delivery details (place and date) for each sales order. The database stores information in a

way that allows different managers to access the information they need.

Many managers now use data analytic techniques to gain insights into the data they collect.

This is popularly referred to as ‘big data’ and is associated with machine learning and artificial

intelligence. The most common application of machine learning and artificial intelligence is in

making predictions. For example, using historical purchase data and other characteristics of a

customer, a company like Netflix predicts which movie a particular customer might like and

recommends that movie to the customer. Netflix then obtains feedback on whether the customer

liked the movie or not and incorporates this feedback into the model, improving and refining it.

In this sense the machine learns from its correct and incorrect predictions and is seen as acting

intelligently. The vast quantity and variety of data have led to the development of many new

prediction techniques.

Professional management accountants apply the principles of accounting and financial man-

agement to create, protect, preserve and increase value for the shareholder of for-profit and not-

for-profit enterprises in the public and private sectors. They might engage in the identification,

generation, presentation, interpretation and use of relevant information relevant to:

● develop, communicate and implement strategies

● plan long-, medium- and short-term operations

● determine capital structure and fund that structure

● design reward strategies for executives and shareholders

● coordinate design, operations and marketing decisions and evaluate performance

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● control operations and ensure the efficient use of resources

● measure and report financial and non-financial information to stakeholders

● implement corporate governance procedures, risk management and internal controls

● explore the potential for managerial and organisational value creation.

Management accounting information and reports do not have to follow set principles or rules.

The key questions are always: (1) how will this information help managers do their jobs better;

(2) do the benefits of producing this information exceed the costs; and (3) does the information

recognise what is specific about the organisational context?

Financial accounting and management accounting have different goals. Financial accounting

focuses on external reporting that is directed by authoritative guidelines. Organisations are

required to follow these guidelines in their financial reports to outside parties. Financial account-

ing is guided by prescribed accounting standards. Principles define the set of revenue and cost

measurement rules and the types of items that are classified as assets, liabilities or owners' equity

in balance sheets which form the standards applicable. Sources of authority for accounting regu-

lation differ across countries. In Spain, for instance, the Instituto de Contabilidad y Auditoria de

Cuentas (ICAC) has been appointed by the government for this purpose. In the UK, the Financial

Reporting Council (FRC) has the authority to issue accounting standards. The FRC's regulator

views its objective to 'regulate auditors, accountants and actuaries' and to 'set the UK's corporate

governance and stewardship codes' (FRC, 2022). Its work is aimed at 'investors and others who

rely on company reports, audit and high-quality risk management'.

In France, the Autorité des Normes Comptable (ANC), a public body, oversees accounting

legislation, whereas in Denmark, the Føreningen af Statsautoriserede Revisører (FSR), a pro-

fessional accounting body, oversees the setting of accounting standards. Other bodies which are

concerned with accounting standards include: in Australia, the Australian Accounting Standards

Board (AASB); in China, the China Accounting Standards Committee (CASC); and in South

Africa, the South Africa Accounting Standards Board. While conceptions of how accounting

information should be reported can have a high degree of national specificity, across the world

over 140 national jurisdictions use International Financial Reporting Standards (IFRS) which are

issued by the IFRS Foundation and the International Accounting Standards Board (IASB).

In contrast to adhering to financial reporting standards, management accounting is not

restricted by accounting principles. For example, a car manufacturer may present a particular

estimated ‘value’ of a brand name (say, the Volvo brand name) in its *internal* financial reports for

marketing managers, although doing so does not have to accord with the legal framework within

which externally oriented financial reports can be prepared in Sweden.

While the work of management accountants and financial accountants tends to be

organisation-specific, some broad differences generally exist. They may be categorised as follows:

● *Regulations.* Management accounting reports are generally prepared for internal use and no

external regulations govern their preparation. Conversely, financial accounting reports are gen-

erally required to be prepared according to accounting regulations and guidelines imposed by

law and the accounting profession.

● *Range and detail of information.* Management accounting reports may encompass financial,

non-financial and qualitative information which may be very detailed or highly aggregated.

Financial accounting is usually broad-based, lacking detail and intended to provide an overview

of the position and performance of an organisation over a time period. It tends to focus on

financial information.

● *Reporting interval.* Management accounting reports may be produced frequently – on an

hourly, daily or weekly basis, possibly to span several years. The interval covered by manage-

ment accounting information will be dictated by the decision-making and control needs of the

information users. Conversely, financial accounting reports are produced annually. Some large

companies also produce semi-annual and quarterly reports.

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● *Time period.* Management accounting reports may include historical and current information,

but also often provide information on expected future performance and activities. Financial

accounting reports provide information on the performance and position of an organisation

for the past period. They tend to be backward-looking.

Exhibit 1.1 outlines the major differences between management accounting and financial account-

ing. Note, however, that reports such as balance sheets, income statements and statements of cash

flows are common to both management accounting and financial accounting.

Cost accounting measures and reports financial and non-financial information related to the

organisation's acquisition or use of resources. It provides information for both management

accounting and financial accounting. For example, calculating the cost of a product is a cost

accounting function that meets both the financial accountant's stock-valuation needs and the

management accountant's decision-making needs (such as deciding how to price products and

choosing which products to promote). However, today most accounting professionals take the

perspective that cost information is part of the management accounting information collected

to make management decisions. Thus, the distinction between management accounting and cost

accounting is not so clear-cut, and we often use these terms interchangeably in the book.

A central task of managers is cost management. We use the term cost management to describe

the actions managers undertake in the short-run and long-run planning and control of costs that

increase value for customers and lower the costs of products and services. An important com-

ponent of cost management is the recognition that prior management decisions often commit

the organisation to the subsequent incurrence of costs. Consider the costs of handling materials

in a production plant. Decisions about plant layout and the extent of physical movement of

Exhibit 1.1

Major differences between management and financial

accounting

Management Accounting

Financial Accounting

Purpose of

Help managers make

Communicate an organisation’s financial

information

decisions to fulfil an

position to investors, banks, regulators and

organisation’s goals

other outside parties

Primary users

Managers of the

External users such as investors, banks,

organisation

regulators and suppliers

Focus and emphasis

Future-oriented (budget for Past-oriented (reports on 2023

2024 prepared in 2023)

performance prepared in 2024)

Rules of measure-

Internal measures and

Financial statements must be prepared

ment and reporting

reports do not have to

in accordance with relevant accounting

follow relevant accounting

standards and be certified by external,

standards but are based on

independent auditors

cost-benefit analyses

Time span and type

Varies from hourly

Annual and quarterly financial reports,

of reports

information to 15 to 20

primarily on the company as a whole

years, with financial and

non-financial reports on

products, departments,

territories, and strategies

Behavioural

Designed to influence the

Primarily reports economic events but also

implications

behaviour of managers and influences behaviour because manager's

other employees

compensation is often based on reported

financial results

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materials required for production are usually made before production begins. These decisions

greatly influence the level of day-to-day materials handling costs once production begins. For

this reason, cost management has a broad focus. It typically includes the continuous reduction of

costs and encompasses the whole life cycle of the product from product conception to deletion.

Cost management is often carried out as a key part of general management strategies and their

implementation. Examples include enhanced customer satisfaction programmes, quality initia-

tives and more efficient supplier relationships management via the internet. In other words, cost

management is not only about reducing costs. Cost management also includes making decisions

to incur additional costs with the goal of enhancing revenues and profits. Whether or not to enter

new markets, implement new organisational processes, and change product designs are also cost

management decisions. Information from accounting systems helps managers to manage costs,

but the information and the accounting systems themselves are not cost management.

Ultimately, management accounting's primary purpose is to enhance value creation within

both private and public sector organisations. The management accountant must make use of a

sound body of knowledge, as well as abide by ethical guidelines (discussed in the appendix of

this chapter). Of particular relevance is the growing contribution which management accountants

make to strategic financial management information production and analysis and to strategic

management action itself.

Strategic decisions and management accounting

Many organisations seek to be more expansionist, entrepreneurial, risk taking and innovative

as a conscious move away from inwardly focused management techniques. Entirely new markets

are emerging for products and services and avant-garde innovative firms are reaping significant

benefits through innovative management approaches and a growing focus on action through

focused strategic information.

A company's strategy specifies how the organisation matches its own capabilities with the

opportunities in the marketplace. In other words, strategy describes how an organisation creates

value for its customers while distinguishing itself from its competitors. A business might be thought

to follow one of two broad strategies (we consider this further in Chapter 20). Some companies,

such as EasyJet and Carrefour, follow a cost leadership strategy. They profit and grow by providing

quality products or services at low prices and by judiciously managing their costs. Other compa-

nies, such as Apple and Bang & Olufsen, follow a product differentiation strategy. They generate

profits and growth by offering differentiated or unique products or services that appeal to their cus-

tomers and are often priced higher than the less popular products or services of their competitors.

Deciding between these strategies is a critical part of what managers do. Management account-

ants work closely with managers in various departments to formulate strategies by providing

information about the sources of competitive advantage, such as (1) the company's cost, produc-

tivity or efficiency advantage relative to competitors; or (2) the premium prices a company can

charge over its costs from distinctive product or service features.

Management accounting information helps managers focus on strategic issues by answering

questions such as the following:

● *Who are our most important customers, and what critical capability do we have to be compet-*

itive and deliver value to our customers? After Amazon's success selling books online, man-

agement accountants at Waterstones, a British book retailer, outlined the costs and benefits

of several alternative approaches for enhancing the company's information technology infra-

structure and developing the capability to sell books online. A similar cost–benefit analysis

led Toyota to build flexible computer-integrated manufacturing plants that enable it to use the

same equipment efficiently to produce a variety of cars in response to changing customer tastes.

● *What is the bargaining power of our customers?* Kellogg Company, for example, uses the rep-

utation of its brand to reduce the bargaining power of its customers and charge higher prices

for its cereals.

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● *What is the bargaining power of our suppliers?* Management accountants at Dell Computers

consider the significant bargaining power of Intel, its supplier of microprocessors, and Micro-

soft, its supplier of operating system software, when considering how much it must pay to

acquire these products.

● *What substitute products exist in the marketplace, and how do they differ from our product*

in terms of features, price, cost and quality? Hewlett-Packard, for example, designs, costs

and prices new printers after comparing the functionality and quality of its printers to other

printers available in the marketplace.

● *Will adequate cash be available to fund the strategy, or will additional funds need to be*

raised? Tesla CEO Elon Musk's bid to buy Twitter with a $46.5 billion takeover offer in April

2022 included debt and equity commitment letters filed with the US Securities and Exchange

Commission.

Research reveals that companies that emphasise creating long-term value for shareholders are

likely to outperform those that focus on preserving shareholder value in the short term. Compa-

nies whose primary focus is on internal control and value preservation do not increase their stock

market valuations as effectively as those that look outside for opportunities to create value. Out-

performers in business are those with the strategic and external awareness to evolve and change

when the need arises. Studies have also revealed that performance-based pay, focusing on highly

tangible near-term measurable variables damages the creation of longer-term shareholder value.

Management accounting information is called upon not only to help managers make balanced

decisions in the face of organisational challenges and the opportunities their environments bring,

but increasingly also to monitor and evaluate strategic progress.

The trend for professional institutes of management accounting has been to reorient the field

towards strategic management information preparation and analysis and the actual participation

of management accountants in such activities. Operational accounting techniques and issues

continue to be relevant, but their roles are being recast in the context of their contributions and

relationships with organisation-wide financial management and strategic concerns.

The shift towards managerial and strategic engagement rather than just acting as providers of

largely financial information about enterprises allows management accountants to align their work

to the changing business and organisational landscape. The beginning of the millennium has seen

a radical shift in the economic context in which companies operate. Early in the twentieth century,

the Ford Motor Company demonstrated the ability of mass production to lower the price of a

product by 60% or more. This enabled consumption to move its focus away from elite consumers

to the masses. Today, another transformation is taking place away from mass consumption to a

focus on individuals. Consumers, in many sectors, are building platforms, tools and relationships

which enable a high degree of personalisation. Companies such as Amazon, eBay, Apple, YouTube

and Meta fall into this new category. Digital interactive technologies allow consumers greater

self-determination. A smartphone allows the user to define the experience desired from the device

at very low cost. Assets, information, relationships and management are now ‘distributed’ as the

internet, mobile computing, wireless broadband and new software applications have been created.

As products and technology offer different experiences to the consumer, management accountants

need to adapt to understand, control and manage attendant cost structures.

Many established management accounting concepts that were developed to serve traditional

industrial and service sectors continue to find usage across many enterprises, but the manner in

which they are deployed is being reshaped. Many firms are pursuing digital transformation initi-

atives, which can involve the use of different technologies such as cloud computing, the Internet

of Things, big data and artificial intelligence (AI)**.** Consider Virgin Holidays, which uses AI to test its

email marketing approach. In one campaign, the company tested different subject lines and text

within emails to work out what was most effective. This enabled insights into how best to promote

holidays including questioning whether a big promotion (such as 50% off) requires the message

to lead in any communications sent. The AI-generated insights revealed that the best results came

from emails that had messages like ‘Book before Monday’ or offered a getaway from stress at

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work or bad weather in London instead of a specific sales message. Saul Lopes who led the AI

project at Virgin Holidays notes that ‘The AI took away all of the bullsh*t and we are no longer

led by human ego or human bias but by numbers and results' (Digitalfix, 2018). Consider also the

Lloyds Banking Group's use of big data analytics to better understand its retail and commercial

activities and to develop strategy and pricing approaches. One application has been the use of

big data analytics to explore the integrated customer information, marketing and digital aspects

of the bank. Rajput (2020) reports that, '24% of the bank's income came from leads generated

by the analytics system. The bank has also been able to establish a new product strategy using

customer data from the analytics system. It has also been able to manage costs, detect potentially

fraudulent activities, and build credit risk models.'

Organisations like Rolls-Royce (see 'Concepts in action' box below), Virgin Holidays and Lloyds

as well as smaller enterprises can use data analytics especially as more and more digital technologies

are invested into by enterprises to inform planning decisions, manage costs, unravel insights and

generally improve decision-making activities. These are all tasks at the forefront of management

accountants' raison d'être given their concern to measure, analyse and report both financial and

non-financial information intended to assist managers to identify and pursue enterprise strategies.

Accounting systems and management controls

What are the objectives of accounting systems? Is Renault's management control system more

effective than Audi's? Is Nestlé's more helpful in planning than Cadbury's? Is Equinor's superior

to BP's? This section provides an overview of the broad purposes of accounting and management

control systems, illustrating the role of accounting information.

The major purposes of accounting systems

The accounting system is among the most significant quantitative information system in almost

every organisation. This system aims to provide information for five broad purposes:

● *Purpose 1: Formulating overall strategies and plans.* This includes new product development

and investment in both tangible (equipment) and intangible (brands, patents or people) assets,

and frequently involves special-purpose reports. Increasingly, many organisations seek market-,

supplier- and customer-based information for determining longer-term strategic action.

● *Purpose 2: Resource allocation decisions such as product and customer emphasis and pricing.*

This frequently involves reports on the profitability of products or services, brand categories,

customers, distribution channels, and so on.

● *Purpose 3: Cost planning and cost control of operations and activities.* This involves reports on

revenues, costs, assets, and the liabilities of divisions, plants and other areas of responsibility.

● *Purpose 4: Performance measurement and evaluation of people.* This includes comparisons of

actual results with planned results. It can be based on financial or non-financial measures.

● *Purpose 5: Meeting external regulatory and legal reporting requirements where they exist.*

Regulations and statutes often prescribe the accounting methods to be followed. Financial

reports are provided by some organisations to shareholders who are making decisions to buy,

hold or sell company shares. These reports ordinarily attempt to adhere to authoritatively

determined guidelines and procedures which exist in many countries.

Each of the purposes stated here may require a different presentation or reporting method.

Accountants combine or adjust the method and data to answer the questions posed by different

internal or external users.

The nature of management-oriented accounting information alters in line with changes in the

business environment. Over the past decade, many enterprises have experienced a shift from a tra-

ditional monitoring and control perspective to a more business- and support-oriented focus. This

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requires a broad-based understanding of the business, with management accountants working

alongside managers, as partners within cross-functional teams rather than in a separate account-

ing function. Some present-day key influences on changes in accounting information include:

- an increased pace of change in the business world
- shorter product life cycles and competitive advantages
- organisational responses to infrequent events such as pandemics and wars
- a requirement for more strategic action by management
- digital transformation of companies and new business models
- the outsourcing of non-value-added but necessary services
- increased uncertainty and the explicit recognition of risk

● novel forms of reward structures

● increased regulatory activity and altered financial reporting requirements

● more complex business transactions

● increased focus on customer satisfaction

● new ethics of enterprise governance

● the rise of intellectual capital

● enhancing knowledge management processes.

In this book we consider the accounting information implications of many of these developments.

Planning and control

There are many definitions of planning and control. Study the left side of Exhibit 1.2, which uses

planning and control at *The Sporting News* (SN) as an illustration. We define planning (the top

box) as choosing goals, predicting results under various ways of achieving those goals, and then

deciding how to attain the desired goals. For example, one goal of SN may be to increase operating

profit. Three main alternatives are considered to achieve this goal:

1 Change the price per newspaper.

2 Change the rate per page charged to advertisers.

3 Reduce labour costs by having fewer workers at SN's printing facility.

Assume that the editor, Bérangère Saunier, increases advertising rates by 4% to €5200 per page

for March 2023. She budgets advertising revenue to be €4 160 000 (€5200 × 800) pages predicted

to be sold in March 2023. A budget is the quantitative expression of a plan of action and an aid

to the coordination and implementation of the plan.

Control (the bottom box in Exhibit 1.2) covers both the action that implements the plan-

ning decision and deciding on performance evaluation and the related feedback that will help

future decision making. With our SN example, the action would include communicating the new

advertising-rate schedule to SN's marketing sales representatives and advertisers. The performance

evaluation provides feedback on the actual results.

During March 2023, SN sells advertising, sends out invoices and receives payments. These

invoices and receipts are recorded in the accounting system. Exhibit 1.3 shows the March 2023

advertising revenue performance report for SN. This report indicates that 760 pages of advertising

(40 pages less than the budgeted 800 pages) were sold in March 2023. The average rate per page

was €5080 compared with the budgeted €5200 rate, yielding actual advertising revenue in March

2023 of €3 860 800. The actual advertising revenue in March 2023 is €299 200 less than the budg-

eted €4 160 000. Understanding the reasons for any difference between actual results and budgeted

results is an important part of management by exception, which is the practice of concentrating

on areas not operating as expected (such as a cost overrun on a project) and placing less attention

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Exhibit 1.2

How accounting facilitates planning and control

Management decisions

Management

at

accounting

The Sporting News

system

Planning

Budgets

Financial

• Increase advertising

• Expected advertising

representation

rates by 4%

pages sold, rates per

of plans

page, and revenue

Control

Accounting system

Recording

• Source documents

transactions and

(invoices to advertisers

Action

classifying

and payments received)

• Implement a 4%

them in

• Recording in general

increase in advertising

accounting

Feedback

and subsidiary ledgers

rates

records

Performance

evaluation

Reports of

• Advertising revenues

Performance reports

actions

5.4% lower than

• Actual advertising pages

comparing

budgeted

sold, average rate per

budgets with

page, and revenue

actual results

on areas operating as expected. The term variance in Exhibit 1.3 refers to the difference between

the actual results and the budgeted amounts.

The performance report in Exhibit 1.3 could spur investigation. For example, did other newspapers

experience a comparable decline in advertising revenue? Did the marketing department make suffi-

cient efforts to convince advertisers that, even with the new rate of €5200 per page, advertising in the

SN was a good buy? Why was the actual average rate per page €5080 instead of the budgeted rate of

€5200? Did some sales representatives offer discounted rates? Did a major advertiser threaten to trans-

fer its advertising to another newspaper unless it was given a large rate-per-page reduction? Answers

to these questions could prompt Saunier to take subsequent actions, including, for example, pushing

marketing personnel to renew efforts to promote advertising by existing and potential advertisers.

Planning and control for sustainability is equally challenging. What should SN do about energy

consumption in its printing presses, recycling of newsprint, and pollution prevention? Among the

uncertainties managers' face is whether customers will reward SN for these actions by being more

loyal and whether investors will react favourably to managers spending resources on sustainabil-

ity. Information to gauge customer and investor sentiment is not easy to obtain. Predicting how

sustainability efforts might pay off in the long run is far from certain. Even as managers make

Exhibit 1.3

Advertising revenue performance report at *The Sporting News*

for March 2023

Actual results

Budgeted amounts

Variance

Advertising pages sold

760

800

40 unfavourable

Average rate per page

€5 080

€5 200

€120 unfavourable

Advertising revenue

€3 860 800

€4 160 000

€299 200 unfavourable

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Accounting systems and management controls

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decisions, the sustainability landscape will doubtlessly change with respect to environmental

regulations and societal expectations, requiring managers to learn and adapt (we consider sus-

tainability issues further in Chapter 22).

A well-conceived plan includes enough flexibility so that managers can seize opportunities

unforeseen at the time the plan is formulated. In no case should control mean that managers cling

to a pre-existing plan when unfolding events indicate that actions not encompassed by the original

plan would offer the best results to the company. Planning and control are so strongly intertwined

that managers do not spend time drawing artificially rigid distinctions between them. Unless oth-

erwise stated, we use control in its broadest sense to denote the entire management process of both

planning and control. For example, instead of referring to a management planning and control

system, we will refer to a management control system. Similarly, we will often refer to the control

purpose of accounting instead of the awkward planning and control purpose of accounting.

Do not underestimate the role of individuals and groups in management control systems. Both

accountants and managers should always remember that management control systems are not

confined to technical matters such as the type of computer system used and the frequency with

which reports are prepared. Management control is primarily a human activity that tends to focus

on how to help individuals do their jobs better. For example, it is often better for managers to

discuss personally with underperforming workers how to improve performance, rather than just

sending those workers a report highlighting their underperformance.

Moreover, do not view accounting's intended roles as being shared by all organisations. Account-

ing practice tends to be informed by technical considerations but is always indicative of many

organisational, social and political processes that are specific to the enterprise context. Thus, two

equally profitable companies of the same size within the same industry and having comparable

accounting systems at their disposition may exhibit very different uses and purposes served by these

accounting systems. This is because, although accounting systems may be designed with similar

aims in mind, users of accounting information will perceive different possibilities and priorities as

to the roles accounting can play within their organisations. Do not be surprised to see accounting

systems in practice being used in ways that reflect the preferences and idiosyncrasies of their users

rather than the predefined functions identified by accounting information system designers.

Feedback: a major key

Exhibit 1.2 shows a feedback loop from control back to planning. Feedback involves managers

examining past performance and systematically exploring alternative ways to improve future

performance. It can lead to a variety of responses, including the following:

Use of feedback

Example

● Tracking growth

● Unilever monitors the attainment of its ‘Path to Growth’ sales and operating

margin targets.

● Searching for alternative

● Mbarara University Hospital compares internal processing versus third-party

means of operating

managing (outsourcing) of its accounts receivable operations.

● Changing methods for

● Lombard Odier & Cie, a Swiss private banking institution, whose success is

making decisions

built on customised confidential client service, provides tailor-made financial

information to customers after assessing client preferences in terms of

communication mode and format.

● Making predictions

●

Siemens adopts a team-based new product development process with input from

both manufacturing and marketing, following an analysis of information flows.

● Changing operations

● Land Rover reduces scrap, obsolescence and lost material and improves stock

turns after establishing innovative supplier relationships.

● Changing the reward

● Convent, Germany’s leading producer of crisps and salted snacks, has

system

established data-recording links with customers to minimise use of its shelf

space while maximising return for both retailers and Convent alike.

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Scorekeeping, attention-directing and problem-solving functions

Traditionally management accountants have tried to perform different functions which for sim-

plicity can be categorised as: scorekeeping, attention directing and problem solving. Scorekeeping

refers to the accumulation of data and the reporting of reliable results to all levels of management.

Examples are the recording of sales, purchases of materials, and payroll payments. This task is

increasingly undertaken by digital systems such a Robotic Process Automation (RPA). Attention

directing is a second function which seeks to make visible both opportunities and problems on

which managers need to focus. Examples are highlighting rapidly growing markets where the com-

pany may be underfunding its investment and highlighting products with higher-than-expected

rework rates or customer-return rates. Big data analytics and the use of machine learning deployed

in a growing number of organisations can trigger prompts for managers that relate to trends of

possible relevance which may not be picked up by humans. Attention directing should focus on

all opportunities to add value to an organisation including cost-reduction possibilities, product

pricing and operational changes. Problem solving refers to the comparative analysis undertaken

to identify the best alternatives in relation to the organisation's goals. An example is comparing

the financial advantages of leasing a fleet of vehicles rather than owning those vehicles. Many

problems can be solved by machines where the intelligence is actioned by-passing the need for

human intervention.

Accountants serving the scorekeeping function accumulate data and report the results to all

levels of management. Accountants serving this function are responsible for the reliability of

the reported information. The scorekeeping function in many organisations requires processing

numerous data items (millions of items in some cases). Computerised information systems are

used by these organisations to automate scorekeeping tasks so that they are executed as flawlessly

as possible.

Many organisations that automate scorekeeping have management accountants concentrating

solely on the attention-directing or problem-solving function. However, as we have suggested, the

adoption of technologies such as AI and the cloud is disrupting traditional roles and functions.

In other words, these three functions (scorekeeping, attention-directing and problem-solving)

that traditionally determined the management accountant's activities remain essential but are

being carried out with differing levels of human input. This is altering the world of management

accounting practice.

Costs, benefits and context

This book regards management accounting as encompassing the assessment of costs, benefits

and context. That is, one criterion for choosing among alternative accounting systems is how well

they are perceived to help achieve organisational goals in relation to the costs of those systems

and the context within which they are to operate. Many studies indicate that the functioning of

management accounting systems is affected as much by behavioural, cultural and social factors

as by technical ones. This book makes clear that the utilisation of management accounting infor-

mation can depend on the behaviour, attitudes and personal characteristics of people rather than

just the technical merits of accounting systems. At times, resistance to management accounting

change may be reflective of incompatibilities between the new system and the norms or habits of

employees in the organisation.

Managers can be regarded as customers of information system output. They need information

to serve their managerial needs. As a customer, a manager may buy a more elaborate management

accounting system when its perceived expected benefits exceed its perceived expected costs and

only after due consideration of contextual factors is undertaken. Although the benefits may take

many forms, managers take decisions to attain both personal and organisational goals. Consider

the installation of a company's first budgeting system. Previously, the company might have used

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some historical record-keeping mechanism and may have undertaken little formal planning. A

major benefit of installing the budgeting system is that managers will be compelled to plan more

formally. They may make different, more profitable decisions than if they had continued operating

with the historical mechanism. So we might say that the expected benefits exceed the expected

costs of the new budgeting system. These costs could include investments in computer hardware

and software, training people, and the ongoing operating costs of maintaining the system. But it

must be ensured that, the technically superior system should mirror with the values and inclina-

tions of the intended users. The characteristics of the system have to align with the management

style of its users and the ethos of the organisation using it.

Attempting to measure the costs of a new accounting system and working out its likely benefits

is seldom easy. When we then include the behavioural characteristics of people to see if they tally

with the technical aspects of the system, the whole exercise becomes even more complex. This is

because we cannot assume people are rational economic actors. One accounting application may

work well in one enterprise but may falter in another. Some organisations will face key barriers

in implementing new accounting systems whereas others will not. There may be differences in the

enthusiasm senior managers have towards altered accounting systems input. Managers generally

tend to differ in how they view the usefulness of accounting information. In other words, account-

ing systems do not produce the same results wherever they exist. There are differences across

organisations in the patterns and processes of adoption and in how extensively managers want to

rely on accounting information. Some managers work on the basis of tacit perceptions matter most

and others prefer hard numbers and formal explicit information. Certain organisations such as

Amazon, Capital One, Barclays Bank and Coca-Cola ‘compete on analytics’. These firms rely to a

great extent on both qualitative and quantitative information in making decisions. Their managers

seek out formalised data input to guide their decisions. The analytical nature of the information

systems they use echoes their analytical managerial style of action. Clearly, organisational context

is important to consider in the adoption of an accounting system. But just as organisational char-

acteristics are of significance, so too is country context in the design of management accounting

systems and in understanding differences in the ways in which accounting gets used. Harrison and

McKinnon (2007, p. 114) reflecting on much research evidence state that: ‘Individuals crossing

national and cultural borders to work require an understanding of the differences in management

control practices they are likely to encounter, and sensitivity to the cultural underpinnings of those

practices’. Thus a better understanding of context can help you determine how an accounting

information system might be used in an organisation. Context is all-important to consider as there

are technical factors, personal characteristics, industry dimensions and enduring cultural mores

and national forces which influence the usage of financial information in organisations.

We have argued that assessing context and process issues can be helpful in choosing and design-

ing accounting information systems and in considering how they will be used. Differences in the

choice and use of accounting systems in organisations exist and are caused by many factors. In

this book, you will be encouraged to think about both the economic aspects of management

accounting as well as the organisational and social context in which accounting systems are

deployed. The cost–benefit–context approach provides a solid point for analysing how, why and

with what effects accounting is used in an enterprise.

Value creation

The design of a management accounting system should be guided by the challenges facing man-

agers. Management accounting can play a principal role in helping managers focus on key themes

of planning and control. We highlight the following here:

1 *Customer focus.* Customers are pivotal to the success of an organisation. The number of organ-

isations aiming to be ‘customer-driven’ is large and increasing. For example, Amazon regards

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itself as the most customer-centric company in the world. The challenge facing Amazon man-

agers is to continue investing sufficient (but not excessive) resources in customer satisfaction

such that profitable customers are attracted and retained. We discuss this theme in Chapter 12,

where we address customer performance measures and customer-profitability analysis.

2 *Value-chain and supply-chain analysis.* The value chain is the sequence of business functions

(see Exhibit 1.4) in which utility (usefulness) is added to the products or services of an

organisation. These functions are as follows:

● Research and development (R&D) – the generation of, and experimentation with, ideas related

to new products, services or processes.

● Design of products, services or processes – the detailed planning and engineering of products,

services or processes.

● Production – the coordination and assembly of resources to produce a product or deliver a

service.

● Marketing – the manner by which individuals or groups (a) learn about and value the attrib-

utes of products or services, and (b) purchase those products or services.

● Distribution – the mechanism by which products or services are delivered to the customer.

● Customer service – the support activities provided to customers.

Senior managers (including those from individual parts of the value chain) are responsible for

deciding the organisation's overall strategy, how resources are to be obtained and used, and

how rewards are to be given. This task covers the entire value chain. IKEA, the Swedish home

furnishings retailer, focuses on analysing its value-added chain in order to reduce its costs while

enhancing perceived value by the customer: unassembled furniture is profitably sold direct

from the warehouse to customers who prize easy assembly instructions and family oriented

showrooms. Such efforts have helped IKEA attain the stature of a number 1 brand in Europe

and Africa according to various rankings.

To implement their corporate strategies, companies such as Sony and Unilever use customer

relationship management (CRM) to integrate people and technology in all business functions and

deepen relationships with customers, partners, and distributors. CRM initiatives use technology

to coordinate all customer-facing activities (such as marketing, sales calls, distribution and after-

sales support) and the design and production activities necessary to get products to customers.

Accounting offers a major mechanism for helping managers to administer each of the busi-

ness functions presented in Exhibit 1.4 and to coordinate their activities within the framework

of the organisation as a whole. This book extensively discusses how accounting aims to assist

managers in these tasks. Do not interpret Exhibit 1.4 as implying that managers should proceed

sequentially through the value chain. There are important gains to be realised (in terms of, say,

Exhibit 1.4

The value chain of business functions

Research

Product/service/

and

process design

Production

Marketing

Distribution

Customer

service

development

Management accounting

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Value creation

Exhibit 1.5

Supply chain for a cola bottling company

Suppliers of

Manufacturer

Bottling

Distribution

Retail

Final

cola-concentrate

of concentrate

company

company

company

consumer

ingredients

Suppliers of

non-concentrate

materials/services

cost, quality, and the speed with which new products are developed) from having the individual

parts of the value chain work concurrently.

The term supply chain describes the flow of goods, services, and information from cra-

dle to grave, regardless of whether those activities occur in the same organisation or other

organisations. Consider the beverage products of Coca-Cola or Pepsi. Many companies play

a role in bringing these products to the final consumers. Exhibit 1.5 presents an overview of

the supply chain. Cost management emphasises integrating and coordinating activities across

all companies in the supply chain as well as across each business function in an individual

company's value chain. To illustrate, both Coca-Cola and Pepsi bottling companies work with

their suppliers (such as glass and can companies and sugar manufacturers) to reduce their

materials-handling costs.

We discuss this theme in Chapter 15 on variance analysis, Chapter 12 on target costing and

Chapter 21 on just-in-time (JIT) and supply-chain analysis.

3 *Key success factors.* These operational factors directly affect the economic viability of the

organisation. Customers are demanding ever-improving levels of performance regarding

several (or even all) of the following:

● *Cost.* Organisations are under continuous pressure to reduce the cost of their products or

the services they sell to customers. To calculate and manage the cost of products, manag-

ers must understand activities, such as setting up machines or distributing products, that

cause costs to arise as well as monitor the marketplace to determine the prices customers

are willing to pay for the products. Management accounting information helps managers

calculate a target cost for a product by subtracting from the ‘target price’ the operating

income per unit of product that the company wants to earn. To achieve the target cost,

managers have to find ways to eliminate some activities (such as rework) and reduce the

costs of performing other activities in all value-chain functions – from initial R&D to

customer service.

● *Quality.* Customers expect higher levels of quality and are less tolerant of low quality than

in the past. Total quality management (TQM) is an integrative philosophy of management for

continuously improving the quality of products and processes. Managers who implement

TQM believe that every person in the value chain is responsible for delivering products

and services that exceed customers' expectations. Using TQM, companies, for example,

Toyota, design products to meet customer needs and wants, to make these products with

zero (or very few) defects and waste, and to minimise inventories. Managers use manage-

ment accounting information to evaluate the costs and revenue benefits of TQM initiatives.

● *Time.* Time has many components, including the time taken to develop and bring new prod-

ucts to market, the speed at which an organisation responds to customer requests, and the

reliability with which promised delivery dates are met. Organisations are under pressure to

complete activities faster and to meet promised delivery dates more reliably than in the past

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in order to increase customer satisfaction. The increasing pace of technological innovation

has led to shorter product life cycles and more rapid introduction of new products. To make

new product development decisions, managers need to understand the costs and benefits of

bringing products to market faster. Customer-response time – the speed at which an organ-

isation responds to customer requests – is tied to customer satisfaction. Organisations can

use management accounting to assess what is needed to meet promised delivery dates and

reduce delivery times.

● *Innovation.* There is now a heightened perception that a continuing flow of innovative prod-

ucts or services is a prerequisite for the ongoing success of most organisations. Managers

attempt to continually track their performance on the chosen key success factors vis-à-vis

competitors. This tracking of companies outside their own organisation alerts managers

to changes in the external environment that their own customers are also observing and

evaluating. We discuss this theme in Chapter 11 on using activity-based costing to guide cost

reductions; in Chapter 12 on target costing; in Chapter 20 on cost of quality reports, bottle-

necks and manufacturing lead time and Chapter 20 on strategic management accounting.

● *Sustainability.* Companies are increasingly applying the key success factors of cost and

efficiency, quality, time, and innovation to promote sustainability – the development and

implementation of strategies to achieve long-term financial, social and environmental goals.

An organisation may seek to make its operations sustainable by being more transparent and

ethically sourcing its materials, being waste-conscious in its use of packaging and diverting

landfill waste at their products' end-of-life and using environmentally conscious manufac-

turing practices and also opting for shipping means that negate the carbon footprint. Com-

panies can also prioritise sustainable office design and move to renewable energy suppliers.

There is a growing drive by many firms to incorporate sustainability into their decision

making. For instance, Osram is a German global high-tech company in semiconductor manu-

facturing. It has products serving a range of applications, including automobiles, smartphones,

and lighting solutions. Osram publishes a detailed sustainability annual report with the help of

management accountants to enable its commitment to corporate sustainability to be assessed.

It has for instance highlighted management and supply chain issues which are hurdles to its tar-

get of climate neutrality by 2030. This focuses managerial attention on sustainability priorities

aside from financial ones for external stakeholders to monitor. Another enterprise, Ørsted, is

a Danish renewable energy company that relied mainly on fossil fuels for its operations with

just 15% of the energy coming from renewable sources. The company recently committed to

totally stop using coal by 2025. It also sold its oil and gas business to concentrate on renew-

able energy and already generates 85% of the energy the company distributes to clients from

sustainable sources.

Why is sustainability of increasing importance to companies? There are several reasons:

Investors care about sustainability and often make investment decisions based on not only a

company's financial performance but also its social and environmental performance. Also,

many firms are realising that sustainability goals attract and inspire both employees and cus-

tomers who seek out products of companies with good sustainability records and avoid deal-

ing with enterprises that have poor sustainability records. There is also a growth of civil and

activist non-governmental organisations that monitor the sustainability performance of firms.

They sometimes call out on social media and even take legal action against those that violate

environmental regulations.

4 *Continuous improvement and benchmarking.* Continuous improvement by competitors creates

a never-ending search for higher levels of performance within many organisations. Phrases such

as the following capture this theme:

'A journey with no end',

'We are running harder just to stand still',

‘If you’re not going forward, you’re going backwards’.

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Value creation

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To compete, many companies concentrate on continually improving different aspects of

their own operations. Naturally, different industries will focus on improving different opera-

tional factors. For example, airlines seek to improve the percentage of their flights that arrive

on time. Internet companies want to improve the percentage of each 24-hour period that

customers can access their online systems without delay. Sumitomo Electric Industries, the

Japanese manufacturer of electric wire and cable, has daily meetings so that all employees

maintain a continuous focus on cost reduction. Continuous improvement targets are often set

by benchmarking or measuring the quality of products, services and activities of the company

against the best-known levels of performance found in competing companies. Many companies

within industry groups exchange information for the purpose of performance benchmarking.

We discuss this theme in the sections in Chapter 14 on kaizen budgeting, Chapter 15 on con-

tinuous improvement and standard costs, and Chapter 9 on learning curves.

Over time, the emphasis placed on conventional strategies and organisational aims change

and new priorities emerge. For instance, the global economic crisis, which began in 2008, altered

the role of finance specialists in the eyes of governmental regulators and financial markets.

There were calls for more accountability and transparency, and enterprises that have survived

have responded positively to these demands. As noted above, demands expressed today stress

enterprises moving towards models of functioning that are more sustainable and which show

evidence of higher standards of corporate responsibility. Compliance requirements naturally

need to be balanced with the need for high organisational performance and maintaining global

competitiveness and so firms have to balance the various demands placed on them. Changes in

markets, societal structures and norms and in the general business environment in which firms

operate have always been of concern to practising management accountants. Ongoing global

and business environment changes will continue to impact management accounting practices.

An important global shift in evidence is the digitalisation of enterprises. We now explore the

huge implication this has for management accounting.

Concepts in action

How the Internet of Things, artificial intelligence and big data make the

unknown visible at Rolls-Royce

In 2018, Rolls-Royce received more than 70 trillion data points from its in-service fleet, which it used to develop

engines that are ‘connected, contextually aware and comprehending’, according to Caroline Gorski, Director of the

global ecosystem at Rolls-Royce’s R2 Data Labs. Samuels (2018) explains that the R2 Data Labs team has 200 data

architects, engineers, scientists and specialist managers to help the company produce over £250 million in value,

through engine health-monitoring activities per year and growing. The team of internal and external talent Gorski

has put together homes in on four technologies: first, on the industrial Internet of Things (IoT), which refers to the

idea of billions of objects being connected to the internet to enable companies make things more visible and to cut

costs. IoT technology, according to Deloitte, takes inputs from the physical world, uses digital technologies to derive

insights from those inputs, and then makes outputs available for use back in the world. Additionally, autonomy and

sensing, blockchain and quantum computing, and artificial intelligence (AI) and advanced analytics are part of the

technological data generating focus of the R2 Data Labs. During that data utilisation process, the team moves from an

ideas phase through to the ‘minimum viable product’ creation, requiring rapid iteration where there is collaboration

with customers (internal or external) and the application of design thinking so business opportunities can be detected.

One example of the application of data relates to the Engine Network. This is, as Samuels (2018) explains, a tool

enabling Rolls-Royce to ‘extract IoT sensor data from engines and health-monitoring systems, and to combine those

records into a social network for the individuals who develop and use an engine’. Consequently, engineers at the

company and private jet management companies can use the data obtained to analyse engine performance. There

also exists an ‘AI-based recommendation engine that presents issues proactively to engineers, so they are aware of

issues before a problem exists’. Ultimately, for Gorski, ‘this proactive approach creates enormous benefits for our

service community and for the end customers that buy our jets’. Gorski likewise gives the example of the R2 Data



Labs deploying IoT sensors for tracking ship performance. The company couples IoT-derived data with contextual data derived from the broader market environment, which has allowed the team to produce a fuel-efficiency guidance portal for crews who sail Rolls-Royce-powered ships. The result according to Samuels, is that 'The captains piloting ours ships can have real-time messaging from us that tells how to save fuel, how to sail efficiently and how to deal with challenging sea conditions.'

Emerging digital technologies can help large and small enterprises manage business costs and enhance process

efficiency. Through connection devices, cost savings can

accrue across resource inputs and lead to insights about improving products and activities in ways organisations

have been unable to in the past. Although IoT and associated technologies are evolving, they are increasingly

being used by firms and shaping our lives. One study by logistics company DHL and IT specialists Cisco predicts

that IoT will save businesses close to £1 trillion in productivity costs alone (cited by infisim.com). The management

accounting implications of digital technologies such as IoT for firms are very real.

Sources: Samuels, M. (2018) 'Successful IoT deployment: The Rolls-Royce approach' (www.zdnet.com/article/successful-iot-deployment-the-rolls-royce-

approach/); 'The Internet of Things: Moving from cost savings to revenue generation' (www2.deloitte.com/us/en/pages/finance/articles/cfo-insights-

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reduce-business-costs-internet-things-iot/); www.bernardmarr.com/default.asp.

Digitalisation and management accounting

The most significant challenge facing accountants today is to address the impact of digitalisation.

For many enterprises, digitalisation is the process by which they become digital businesses,

where the use of digital technologies changes the business model and provides new revenue

and value-producing possibilities. What do digital technologies do? They enable businesses

to convert physical analog text into digitised formats. Consequently, firms alter their business

models and activities by digitalising their processes. Digital transformations ultimately move

enterprises into new modes of operations with all areas of business integrating digital enablers.

These digital technologies have the power to self-transform and branch out to other economic

sectors triggering further productivity increases. So while accounting information has always

been about enabling decision-making, digitalisation is forcing a massive alteration as to what

management accounting needs to achieve. The focus used to be mainly on what present and

past economic transactions and business outcomes meant for managerial action. But digital-

isation is changing the essence of accounting expertise in several ways. It is first moving away

from what has taken place to what likely will occur because information can be premised on

activities that precede financial activities. In other words, management accountants must play a

role in unravelling what is happening now, to a large degree by exploring big data, to determine

the coming shape of financial transactions. Secondly, executive action can increasingly be auto-

piloted such that financial objectives are pursued based on machine-based decisions and action

rather than through necessary human input. For the management accountant this is important

as the assessment of accounting information undertaken by non-human agents does not require

management accounting expertise input as traditionally sourced and human users of accounting

information will also have changed requirements (see Exhibit 1.6). Thirdly, we have been used

to seeing accounting capturing value creation as products or resources pass through the value

chain. But we are now seeing more and more situations where accounting itself becomes part

of the products being reported on. Information-emitting tags make products those things that

are reported on as well as the things that provide the accounting information! In effect then, the

accounting function is becoming much more complex than it has been and digitalisation is what

is driving this complexity.

Two points in relation to digital technologies specifically need highlighting at this stage:

● *Digital disruption and cognitive business.* Digital technologies are impacting many industries

and enabling new business models. Robotics and automation, for example, are replacing repet-

itive human tasks and changing the way decisions are made. The rise of cognitive business,

powered by the extreme growth of data and machine learning power and accessibility, provides

new insights which, if harnessed, can directly shape decision making. It is therefore the case

that accounting professionals need to upskill, so they can play a role in assessing and imple-

menting emerging digital technology-driven approaches to management accounting supporting

decision making.

● *Data availability.* The huge volumes of structured and unstructured data (not organised in

a predefined manner) that has become available to firms has created both opportunities and

challenges in aiding data-backed decisions and insights. Management accountants must under-

stand the different sources of data that now exists and recognise their potential utility. That is,

they need to be able to know how such data can provide insights that shape decisions. More-

over, given that the cost of information production is falling as the volume of data grows, it is

becoming impossible to ignore the power of data analytics to support financial planning and

management action.

No aspect of business today remains untouched by digital technologies, and new possibilities

for organisations have emerged in relation to altering the speed of enterprise operations, the

flexibility of their decision making, their strategic positioning and the reframing of achievable

economic efficiencies (Bhimani and Wilcocks 2014; Bhimani 2021).

What emerging technologies are there today which management accountants should be aware

of? Here are some that the business community has highlighted:

● *Artificial intelligence (AI) and robotics.* AI can be thought of as the simulation of human

intelligence processes by machines. It can increase the effectiveness of human decision making

and enhance the advice financial professionals give to other business executives. Robotics is

a field that involves the conception, design, manufacture and operation of robots. Robots

are programmable machines that can undertake a series of actions. Typically, robots interact

with the physical world via sensors; they are programmable and can be autonomous or semi-

autonomous. Robots are now increasingly engaging in accounting tasks, which reduces the risk

of human error and can remain in operation on a 24/7 basis. Robotics today enables highly

valuable input into decision making that is rooted in accounting analyses.

● *Blockchain* is an accounting technology that can be described as a 'distributed ledger', which

records transactions continuously such that the transacting parties leave a permanent record

that remains verifiable. It provides full visibility on past transactions, which cannot be altered

by any one participant vastly reducing the possibility of fraud.

● *Big data and analytics* make possible the provision of insights drawn from large amounts of

data. Data is valuable to all organisations and more and more is invested into leveraging data

for greater decision-making capacity. The physical world is being rapidly digitised via con-

nected devices and the physical world itself is becoming a sort of information system via the

Internet of Things (IoT), where sensorised objects and people (customers, machines, vehicles,

etc.) increase multiple-fold the volume of available data. Management accountants form part-

nerships with other units of their enterprises to make sure that the data analyses they engage in

are cross-functional and continuously relevant to strategic and operational decisions. Finance

professionals are called upon to be more predictive and to assist in making decisions based on

qualitative and quantitative data that link in to budgeting, internal control, risk management

and strategic action.

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● *The cloud* refers to services where information and files are kept on servers connected to the

Internet. The cloud enables enterprises to store, access and share resources at lower costs and

with greater flexibility. Cloud computing permits enterprises to obtain practically real-time

information with different organisational systems of information being fully integrated and

on-line. This allows management accountants to focus on financial management information

provision for decision-making and control purposes from different sources at lower costs and

faster.

It can be expected that as organisational structures, priorities and modes of operations

change, so pressures mount for management accounting systems to alter their information

focus. Factors like digitalisation, accountability and corporate responsibility, operational

complexity, customer responsiveness, product life-cycle concerns, strategic management, sus-

tainability concerns, and novel business models will continue to change what is expected of

management accounting.

Consider for instance the use of top brands using non-fungible tokens (NFTs) which are

online assets that double as certificates of ownership. NFTs have been much used for tokenising

digital items such as art or texts or videos, but increasingly they are used for physical items such

as cars, rugs, books, clothing etc. The market for NFTs was $40 billion in 2021 with sales in

2022 achieving near this level on a monthly basis (Kalkine Media, 2022). Luxury fashion house

Prada has schemes for customers who want something even more exclusive than its normal

range of clothing and accessories. As Boukis (2022) reports, one scheme allows customers who

buy one of only 100 black and white button-down shirts by Cassius Hirst, son of renowned

British artist Damien, to receive an NFT such that this becomes bundled into the product pur-

chase experience. Likewise, Gucci has some sales of digital products sold for more than the

real-world equivalent (one digital bag sold for US$4115 as opposed to the physical equivalent

of US$3,400). NFTs can be resold and therefore offer a trading avenue aside from the product

purchase element. Nike bought NFT pioneer RTFKT Studios in 2021. RTFKT made its name

with a collection of Manga-style 3D NFT characters called CloneX that now trade for tens of

thousands of US dollars. As Boukis (2022) explains: ‘CloneX owners were airdropped NFTs

of mystery digital boxes known as Mnlths. The Mnlths had Nike swooshes on the side and

quickly started selling for upwards of US$10,000 (£7944) on NFT marketplaces, even though

nobody knew what they contained. In April 2022, Nike announced that owners could “burn”

them to unlock a pair of digital sneakers known as CryptoKicks, plus a vial that allows users

to customise them, and another mystery box called Mnlth 2. A pair of CryptoKicks has since

reportedly sold for US$134,000.’ By mid-November 2022, the market for NFTs shrunk and

values had dropped markedly. Justin Bieber’s purchase of a Bored Ape NFT for $1.3 million

was valued at about 5% of that price.

The survival of the management accounting profession will depend on the perceived relevance

of what the field can contribute to organisations. The changing managerial demands on manage-

ment accounting are exciting to study and engage with. It is intended that this book will help you

think about operational, technological and wider organisational and strategic issues of concern

to management accountants. What is to be borne in mind throughout is that the workings of any

management accounting system must take account the peculiarities and contextual characteristics

of the enterprise. Management accounting systems across enterprises sometimes can appear to

be similar but their organisational context lends high differentiation in their operations such that

organisational specificity can never be ignored.

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Summary

Exhibit 1.6

Executive decisions and action versus machine action

Machine

action

Economic

transactions

Accounting

data

Financial

information

Executive decisions

Summary

The following points are linked to the chapter’s learning objectives.

1 Management accounting is used to provide future-oriented information to help managers (internal users) make

decisions and pursue an organisation's goals. Financial accounting is used to develop reports for external users on

past financial performance using authoritative guidelines.

2 Strategy concerns affect management accounting processes.

3 Accounting systems are intended to provide information for five broad purposes: (a) formulating overall strat-

egies and long-range plans, (b) resource allocation decisions such as product and customer emphasis, (c) cost

planning and cost control, (d) performance measurement, and (e) meeting external regulatory and legal reporting

obligations.

4 Accounting influences planning, control and decision making through budgets and other financial benchmarks,

its systematic recording of actual results and its role in performance evaluation.

5 In most organisations, management accountants perform scorekeeping, attention-directing and problem-solving

functions.

6 Economic benefits and costs in the design, implementation and use of accounting systems need to be assessed in

the light of organisational context and process issues. Assessing costs, benefits and context is important to under-

standing management accounting processes.

7 Companies add value through research and development (R&D), design of products and processes, production,

marketing, distribution and customer service. Customers want companies to deliver performance through cost

and efficiency, quality, timeliness and innovation.

8 Technologies have always impacted management accounting practices. Today, digitalisation presents management

accounting with its most important challenge.

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Appendix

Professional ethics

Ethical guidelines

Professional accounting organisations representing management accountants exist in many coun-

tries. For example, CIMA in the UK provides a programme leading to membership of the insti-

tute. Membership signals that the holder has passed the admission criteria and demonstrated the

competence of technical knowledge required by the CIMA to become a chartered management

accountant. To become a CIMA member, students complete examinations on operational, man-

agement and strategic aspects of the field and must show professional competence in management

accounting (see www.cimaglobal.com for more information).

Management accounting topics are also covered by several other professional bodies. The sylla-

bus for the examinations of the Association of Chartered Certified Accountants (ACCA) includes

a variety of examinations, practical work experience and knowledge of ethics requirements (see

www.accaglobal.com). Other accounting bodies include the Institute of Chartered Accountants in England and Wales (ICAEW) (see www.icaew.co.uk) and the Institute for Chartered Accountants of Scotland (ICAS) (see www.icas.org.uk). These institutes have requirements that cover proficiency in general management topics as well as professional accounting and ethics topics.

Professional accounting organisations play an important role in promoting a high standard

of ethics. CIMA has issued a code of ethics for its members. Exhibit 1.7 presents a summary of

CIMA's 'fundamental principles'.

Typical ethical challenges

Ethical issues can confront management accountants in many ways. The following examples are

illustrative.

Exhibit 1.7

Summary of CIMA's Code of Ethics

To achieve the objectives of the profession, accountants have to observe the following fundamental

principles:

● **Integrity.** Being straightforward, honest and truthful in all professional and business

relationships. You should not be associated with any information that you believe contains a

materially false or misleading statement, or which is misleading by omission.

● **Objectivity.** Not allowing bias, conflict of interest or the influence of other people to override

your professional judgement.

● **Professional competence and due care.** An ongoing commitment to your level of professional

knowledge and skill. Base this on current developments in practice, legislation and techniques.

Those working under your authority must also have the appropriate training and supervision.

● **Confidentiality.** You should not disclose professional information unless you have specific

permission or a legal or professional duty to do so.

● **Professional behaviour.** To comply with relevant laws and regulations. You must also avoid any

action that could negatively affect the reputation of the profession.

Source: www.cimaglobal.com/Professionalism/Ethics/CIMAs-code-at-a-glance/

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References and further reading

● **Case A.** A management accountant, knowing that reporting a loss for a software division will

result in yet another 'rightsizing initiative' (a euphemism for lay-offs), has concerns about the

commercial viability of software for which R&D costs are currently being capitalised. The

divisional manager argues vehemently that the new product will be a 'winner' but has no

credible evidence to support the opinion. The last two products from this division have not

been successful in the market. The management accountant has many friends in the division

and wants to avoid a personal confrontation with the division manager. Should the manage-

ment accountant require the R&D to be expensed immediately, owing to the lack of evidence

regarding its commercial viability?

● **Case B.** A packaging supplier, bidding for a new contract, offers the management accountant

of its customer an all-expenses-paid weekend to Disneyland Paris for her and her family. The

supplier does not mention the new contract when making the invitation. The accountant is

not a personal friend of the supplier. She knows operating cost issues are critical in approving

the new contract and is concerned that the supplier will ask details about bids by competing

packaging companies.

In each case the management accountant is faced with an ethical challenge. Case A involves

competence, objectivity and integrity, whereas case B involves confidentiality and integrity. Ethical

issues are not always black or white. For example, the supplier in case B may have no intention of

raising issues associated with the bid. However, the appearance of a conflict of interest in case B

is sufficient for many companies to prohibit employees from accepting free 'gifts' from suppliers.

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CHAPTER 1

Assessment material

Review questions

1.1

The accounting system should provide information for five broad purposes. Describe them.

1.2

Distinguish between *management accounting* and *financial accounting.*

1.3

Describe the business functions in the value chain.

1.4

Explain the meaning of *cost management.*

1.5

'Knowledge of technical issues such as computer technology is necessary but not sufficient to

becoming a successful accountant.' Do you agree? Why?

1.6

Peter Drucker, a noted business observer, made the following comment in an address to manage-

ment accountants: 'I am not saying that you do not need a "cop on the beat", you do . . . But your

great challenge is to get across to your associates your ability to identify the opportunities – to

identify the wealth-producing characteristics.' Do you agree? Explain.

1.7

As a new accountant, reply to this comment by a plant manager: 'As I see it, our accountants

may be needed to keep records for shareholders and for the tax authorities – but I don't want

them sticking their noses in my day-to-day operations. I do the best I know how. No pen-pushing

bean-counter knows enough about my responsibilities to be of any use to me.'

1.8

When explaining a motor vehicle market-share turnaround, a car manufacturer stated: 'We listened

to what our customers wanted and acted on what they said. Good things happen when you pay

attention to the boss.' How might management accountants apply the same perspective to their own

tasks?

1.9

A leading management observer stated that the most successful companies are those which have an

obsession for their customers. Is this statement pertinent to management accountants? Explain.

1.10 Changes in the way managers operate require rethinking the design and operation of management

accounting systems. Describe five themes that are affecting both the way managers operate and

developments in management accounting.

Chapter 1 The manager and management accounting

Exercises

Basic level

***1.11 Financial and management accounting** (15–20 minutes)

Anne-Jorun Sørensen, an able electrical engineer, was informed that she was going to be promoted

to assistant plant manager. Anne-Jorun was elated but uneasy. In particular, her knowledge of

accounting was sparse. She had taken one course in financial accounting but had not been exposed

to the management accounting that her superiors found helpful. Sørensen planned to take a man-

agement accounting course as soon as possible. Meanwhile, she asked Siri Aspelund, an assistant

controller, to state two or three of the principal distinctions between financial and management

accounting using some concrete examples.

As the assistant controller, prepare a written response to Sørensen.

***1.12 Purposes of accounting systems** (10 minutes)

The European Sports Management Group (ESMG) manages and promotes sporting events and

sporting personalities. Its managers are currently examining the following reports and accounting

statements:

a Five-year projections for expanding into managing sports television networks for satellite

television.

b Income statement to be included in a six-month interim report to be sent to investors.

c Profitability comparison of cricket tournaments directed by different managers, each of whom

receives a percentage of that tournament's profits.

d Monthly reports of office costs for each of the 14 ESMG offices throughout Europe.

e Statement showing the revenues ESMG earns from different types of sporting event (for exam-

ple, squash, triathlon and cricket).

Required

Classify the reports in parts a–e into one of the five major purposes of accounting systems.

1.13 Value chain and classification of costs at Compaq (15 minutes)

Compaq Computer incurs the following costs:

a Electricity costs for the plant assembling the Presario computer line of products.

b Transportation costs for shipping Presario software to a retail chain.

c Payment to David Kelley Designs for design of the Armada Notebook.

d Salary of a computer scientist working on the next generation of minicomputers.

e Cost of Compaq employees' visit to a major customer to illustrate Compaq's ability to inter-

connect with other computers.

f Purchase of competitors' products for testing against potential future Compaq products.

g Payment to a television station for running Compaq advertisements.

h Cost of cables purchased from an outside supplier to be used with the Compaq printer.

*Fully worked solutions to exercises thus marked are provided in Appendix A.

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Required

Classify each of the cost items in parts a–h into a component of the value chain shown in

Exhibit 1.4.

1.14 Value chain and classification of costs at Boots (15 minutes)

Boots, which operates a chain of pharmacies in the UK, incurs the following costs:

a Cost of redesigning blister packs to make drug containers more tamperproof.

b Cost of videos sent to doctors to promote sales of a new drug.

c Cost of website's 'frequently asked questions' for customer enquiries about usage, side-effects

of drugs, and so on.

d Equipment purchased by a scientist to conduct experiments on drugs yet to be approved by the

government.

e Payment to actors on a feature to be shown on television promoting new hair-growing product

for balding men.

f Labour costs of workers in the packaging area of a production facility.

g Bonus paid to a salesperson for exceeding the monthly sales quota.

h Cost of the courier service to deliver drugs to hospitals.

Required

Classify each of the cost items in parts a–h into a component of the value chain shown in

Exhibit 1.4.

1.15 Uses of feedback (10 minutes)

Six uses of feedback are described in the chapter:

a Changing goals.

b Searching for alternative means of operating.

c Changing methods for making decisions.

d Making predictions.

e Changing the operating process.

f Changing the reward system.

Required

Match the appropriate letters from the preceding list to each of the following items.

1 The Potters Bar University system explores subcontracting its gardening operations to a private

company instead of hiring its own gardeners.

2 Sales commissions are to be based on total operating profit instead of total revenue.

3 Fiat adjusts its elaborate way of forecasting demand for its cars by including the effects of

expected changes in the price of crude oil.

4 The hiring of new sales personnel will include an additional step: an interview and evaluation

by the company psychologist.

5 Quality inspectors at Volvo are now being used in the middle of the production process as well

as at the end of the process.

6 Virgin enters the telecommunications industry.

7 Worker assignments on an assembly line are made by teams instead of directed by a foreman.

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1.16 Scorekeeping, attention directing and problem solving (15 minutes)

For each of the following activities, identify the major function (scorekeeping, attention directing

or problem solving) the accountant is performing.

a Preparing a monthly statement of Spanish sales for the BMW marketing vice-president.

b Interpreting differences between actual results and budgeted amounts on a performance report

for the customer warranty department of Tefal.

c Preparing a schedule of depreciation for forklift trucks in the receiving department of a

Hewlett-Packard plant in Scotland.

d Analysing, for a Toshiba international manufacturing manager, the desirability of buying some

semiconductors made in Ireland.

e Interpreting why a Birmingham distribution centre did not adhere to its delivery costs budget.

f Explaining a Niceday shipping department's performance report.

g Preparing, for the manager of production control of a German steel plant, a cost comparison

of two computerised manufacturing control systems.

h Preparing a scrap report for the finishing department of a Volvo parts plant.

i Preparing the budget for the maintenance department of Mont-Blanc Hospital.

j Analysing, for a Volkswagen product designer, the impact on product costs of some new head-

light lamps.

1.17 Scorekeeping, attention directing and problem solving (15 minutes)

For each of the following activities, identify the major function the accountant is performing –

scorekeeping, attention directing or problem solving.

a Interpreting differences between actual results and budgeted amounts on a shipping manager's

performance report at a Lada distribution centre.

b Preparing a report showing the benefits of leasing motor vehicles versus owning them.

c Preparing adjusting journal entries for depreciation on the personnel manager's office equip-

ment at Crédit Suisse.

d Preparing a customer's monthly statement for an Argos store.

e Processing the weekly payroll for the University College Dublin maintenance department.

f Explaining the product-design manager's performance report at an Audi division.

g Analysing the costs of several different ways to blend materials in the foundry of a Krupp plant.

h Tallying sales, by branches, for the sales vice-president of Unilever.

i Analysing, for a senior manager of British Telecom, the impact of a contemplated new product

on net income.

j Interpreting why a Moulinex sales district did not meet its sales quota.

1.18 Changes in management and changes in management accounting (15 minutes)

A survey on ways organisations are changing their management accounting systems reported the

following:

a Company A now reports a value-chain income statement for each of the brands it sells.

b Company B now presents in a single report all costs related to achieving high quality levels of

its products.

c Company C now presents estimates of the manufacturing costs of its two most important

competitors in its performance reports, in addition to its own internal manufacturing costs.

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d Company D reduces by 1% each month the budgeted labour-assembly cost of a product when

evaluating the performance of a plant manager.

e Company E now reports profitability and satisfaction measures (as assessed by a third party)

on a customer-by-customer basis.

Required

Link each of the above changes to the role management accounting can play in helping managers

focus on key themes of planning and control.

1.19 Planning and control, feedback (15–20 minutes)

In April 2023, Bérangère Saunier, editor of *The Sporting News* (SN), decides to reduce the price

per newspaper from €0.70 in April 2023 to €0.50 starting 1 May 2023. Actual paid circulation in

April is 7.5 million (250 000 per day * 30 days). Saunier estimates that the €0.20 price reduction

would increase paid circulation in May to 12.4 million (400 000 * 31 days). The actual May cir-

culation turns out to be 13 640 000 (440 000 * 31 days). Assume that one goal of SN is to increase

operating profit. The budgeted increase in circulation would enable SN to charge higher adver-

tising rates in later months of 2023 if those budgeted gains actually occur. The actual price paid

in May 2023 was the budgeted €0.50 per newspaper.

Required

1 Distinguish between planning and control at SN, giving an example of each.

2 Prepare a newspaper revenue performance report for SN for May 2023 showing the actual

results, budgeted amounts and the variance.

3 Give two types of action Saunier might take based on feedback on the May 2023 circulation

revenue.

1.20 Professional ethics and reporting divisional performance (10–15 minutes)

Marguerite Devallois is division controller and Jacques Clément is division manager of the

Royaume de la Chaussure SARL, a shoe company. Devallois has line responsibility to Clément,

but she also has staff responsibility to the company controller.

Clément is under severe pressure to achieve budgeted division income for the year. He has asked

Devallois to book €200 000 of sales on 31 December. The customers' orders are firm, but the shoes

are still in the production process. They will be shipped on or about 4 January. Clément said to

Devallois, 'The key event is getting the sales order, not shipping of the shoes. You should support

me, not obstruct my reaching division goals.'

Required

1 Describe Devallois's ethical responsibilities.

2 What should Devallois do if Clément gives her a direct order to book the sales?

Intermediate level

1.21 Responsibility for analysis of performance (20–30 minutes)

Kari-Anna Nedregotten is the new corporate controller of a multinational company that has just

overhauled its organisational structure. The company is now decentralised. Each division is under

an operating vice-president who, within wide limits, has responsibilities and authority to run the

division like a separate company.

Nedregotten has a number of bright staff members. One of them, Signy Henriksen, is in charge

of a newly created performance-analysis system. Henriksen and staff members prepare monthly

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division performance reports for the company president. These reports are division income state-

ments, showing budgeted performance and actual results, and they are accompanied by detailed

written explanations and appraisals of variances. In the past, each of Henriksen's staff members

was responsible for analysing one division; each consulted with division line and staff executives

and became generally acquainted with the division's operations.

After a few months, Øyvind Hedby, vice-president in charge of Division C, stormed into the

controller's office. The gist of his complaint follows:

'Your staff are trying to take over part of my responsibility. They come in, snoop around, ask

hundreds of questions, and take up plenty of our time. It's up to me, not you and your detectives,

to analyse and explain my division's performance to central headquarters. If you don't stop trying

to grab my responsibility, I'll raise the whole issue with the president.'

Required

1 What events or relationships may have led to Hedby's outburst?

2 As Nedregotten, how would you answer Hedby's contentions?

3 What alternative actions can Nedregotten take to improve future relationships?

***1.22 Software procurement decision, ethics** (30 minutes)

Walter von Stolzing is the Innsbrück-based controller of Beckmesser GmbH, a rapidly growing

manufacturer and marketer of Austrian food products. Stolzing is currently considering the pur-

chase of a new cost management package for use by each of its six manufacturing plants and

its many marketing personnel. There are four major competing products being considered by

Stolzing.

Pogner 1-2-3 is an aggressive software developer. It views Beckmesser as a target of opportunity.

Every six months Pogner has a three-day users' conference on the Costa del Sol. Each conference

has substantial time left aside for ‘rest and recreation’. Pogner offers Stolzing an all-expenses-paid

visit to the coming conference. Stolzing accepts the offer believing that it will be very useful to

talk to other users of Pogner software. He is especially looking forward to the visit as he has close

relatives living near Marbella.

Prior to leaving, Stolzing received a visit from the president of Beckmesser. She shows him an

anonymous letter sent to her. It argues that Pogner is receiving unfair favourable treatment in the

Beckmesser software decision-making process. The letter specifically mentions Stolzing’s coming

‘all-expenses-paid trip to Marbella during the depths of Innsbrück’s winter’. Stolzing is deeply

offended. He says he has made no decision and believes he is very capable of making a software

choice on the merits of each product. Beckmesser currently does not have a formal written code

of ethics.

Required

1 Do you think Stolzing faces an ethical problem as regards his forthcoming visit to the Pogner’s

users’ group meeting? Refer to the chapter’s appendix. Explain.

2 Should Beckmesser allow executives to attend users' meetings while negotiating with other

vendors about a purchase decision? Explain. If yes, what conditions on attending should

apply?

3 Would you recommend Beckmesser develop its own code of ethics to handle situations such as

this one? What are the pros and cons of having such a written code?

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1.23 Planning and control decisions: Internet company (30 minutes)

WebNews.co.uk is an Internet company. It offers subscribers multiple online services ranging from an annotated TV guide to local-area information on restaurants and cinemas. It has two main

revenue sources:

● Monthly fees from subscribers. Recent data are:

Actual number of	**Actual monthly fee per**
Month/Year	
subscribers	

subscriber

June 2022

28 642

£14.95

December 2022

54 813

£19.95

June 2023

58 178

£19.95

December 2023

86 437

£19.95

June 2023

146 581

£19.95

●

Banner advertising fees from companies advertising on WebNews.co.uk page sites. Recent data are: **Month/Year**

Advertising revenues

June 2022

£400 988

December 2022

£833 158

June 2023

£861 034

December 2023

£1 478 072

June 2023

£2 916 962

The following decisions were made in the June to October 2023 period:

a June 2023. Decision to raise the monthly subscription fee from £19.95 per month in June 2023

to £24.95 per month in July 2023. The £19.95 fee first applied in December 2022.

b June 2023. Decision to inform existing subscribers that the July 2023 subscription fee would

be £24.95.

c July 2023. Decision to upgrade the content of its online services and to offer better Internet

mail services.

d October 2023. Demotion of manager of marketing after significant slowing of subscriber

growth in accounts and revenues. Results include:

Actual number of

Actual monthly fee per

Month/Year

subscribers

subscriber

July 2023

128 933

£24.95

August 2023

139 419

£24.95

September 2023

143 131

£24.95

Budgeted amounts (set in June 2023) for the number of subscribers were 140 000 for July 2023,

150 000 for August 2023, and 160 000 for September 2023.

e October 2023. Decision to reduce the monthly subscription fee from £24.95 per month in

September 2023 to £21.95 in October 2023.

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Required

1 Distinguish between planning decisions and control decisions at WebNews.co.uk.

2 Classify each of the decisions a–e as a planning or a control decision.

1.24 Problem solving, scorekeeping and attention directing: Internet company (continuation

of Exercise 1.23) (30 minutes)

Management accountants at WebNews.co.uk can play three key roles in each of the five decisions described in Exercise 1.23: problem solving, scorekeeping and attention directing.

Required

1 Distinguish between the problem-solving, scorekeeping and attention-directing roles of a

management accountant at WebNews.co.uk.

2 For each of the five decisions outlined in Exercise 1.23, describe a problem-solving, scorekeeping

or attention-directing role. Where possible, provide your own example of an information item

that a management accountant could provide for each decision.

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CHAPTER 2

An introduction to cost terms and purposes

Learning objectives

After studying this chapter, you should be able to:

- Define and illustrate a cost object
- Distinguish between direct costs

Cost concepts and terms are useful in many enterprise contexts. They help managers decide such issues as: How much should we spend on research and development? What is the effect of product design changes on production costs? Should we replace some assembly workers with a robot? Should we spend more of the marketing budget on sales promotion coupons and less on advertising? Should we outsource some engineering and production activities? Should we provide a free phone number for customer enquiries regarding our products? Such questions

require an understanding of costs. This chapter explains several widely

and indirect costs

used cost concepts and terms. They will help us demonstrate the multiple

●

Explain variable costs and fixed

purposes of cost accounting systems.

costs

In many companies, especially smaller ones, when times are

●

Understand why unit costs must

good, managers focus on selling as much as they can. Costs gain less

be interpreted with caution

attention. When times are difficult, they shift their emphasis toward cost

●

Distinguish between service-

containment. But as firms get larger, the focus on costs often becomes

sector, merchandising-sector and

relentless. A large scale survey of 1089 global executives carried out

manufacturing-sector companies

by Deloitte (2021) reported that 78% regarded the inability to adjust

cost structures to meet demand as the top internal challenge globally

●

Differentiate between capitalised

and in all regions. The survey also revealed that ‘automation is the top

costs and period costs

transformation action arising from the COVID-19 crisis. Globally and

●

Explain how different ways of

across all regions, roughly two out of three companies expect to pursue

computing product costs are

automation in all three stages of Respond-Recover-Thrive’. Organisations

appropriate for different purposes

will typically, in the aftermath of a crisis, respond with some action which leads to recovery and then re-join a path of increased growth.

Another 2021 survey conducted by CFO Research of Industry Dive polled 166 senior finance executives in US companies with up to $500 million in annual revenue. The survey revealed that more than 80% of the CFOs, CEOs and other finance executives said that maintaining a high degree of cost discipline over the next 24 months will be critical for growth. The executives put cost analysis at the top of their list of priorities

for their finance teams over the next 12 months (CFO Dive, 2022).

Typically, when uncertainty exists in times of war, pandemics or major political upheaval, the economic outlook is impacted and cost reduction becomes high on the agenda of executives.

An understanding of where costs exist and how they behave is of great relevance to most business decisions. At times, managerial strategies can also change organisational and reporting structures in companies as wel as impact costs. Consider Unilever, the FTSE 100 company with

149 000 employees, well known for brands such as Ben & Jerry's ice cream,

Marmite and Hel mann's mayonnaise. The company revealed plans to cut

1500 management jobs global y in 2022 with the intention of removing

layers to simplify the business (CNBC, 2022; Kol ewe and Jolly, 2022).

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Another large global company, Exxon Mobil Corp, made public in March 2022 that it would exit its

last Russia operations in response to the invasion of Ukraine that sent oil prices to their highest level

in eight years. Cost cutting was also accelerated with Exxon expecting to cut annual costs by $9 billion

in 2022, $3 billion more than a previous target, in a drive to quickly pay down debt taken on during

the pandemic and double earnings by 2027 (Valle and Khan, 2022). Many large companies undertake

extreme cost-cutting measures, especially during times of economic uncertainty. Understanding the

behaviour of costs proves useful to any cost management effort.

Costs in general

Cost objects

Accountants usually define cost as a resource sacrificed or forgone to achieve a specific objective.

Most people consider costs as monetary amounts (such as shillings, euros, pounds or yen) that

must be paid to acquire goods and services. For now, we can think of costs in this conventional

way. An actual cost is the cost incurred (a historical or past cost), as distinguished from a budgeted

cost, which is a predicted, or forecasted, cost (a future cost).

To guide their decisions, managers often want to know how much a certain thing (such as a

new product, a machine, a service or a process) costs. We call this ‘thing’ a cost object, which is

anything for which a separate measurement of costs is desired. Exhibit 2.1 provides examples of

several different types of cost object.

A costing system typically accounts for costs in two basic stages:

1 It *accumulates* costs by some 'natural' classification such as materials, labour, fuel, advertising

or shipping.

2 It *assigns* these costs to cost objects.

Cost accumulation is the collection of cost data in some organised way through an accounting

system. Cost assignment is a general term that encompasses both (1) tracing accumulated costs

to a cost object, and (2) allocating accumulated costs to a cost object. Costs that are *traced* to a

cost object are direct costs, and costs that are *allocated* to a cost object are indirect costs. Many

accounting systems accumulate actual costs, which as noted above are the costs incurred (histor-

ical costs), as distinguished from budgeted or forecasted costs.

Exhibit 2.1

Examples of cost objects

Cost object

Illustration

Product

An eight-speed bicycle

Service

An airline flight from Paris to Dubai

Project

An aeroplane assembled by Airbus for Qantas

Customer

All products purchased by Rolls-Royce (the customer) from Lucas

Brand category

All soft drinks sold by a PepsiCo bottling company with ‘Pepsi’ in their name

Activity

A test to determine the quality level of a laptop screen

Department

A department within a government environmental agency that studies air emissions standards

Programme

An entrepreneurship showcase programme of a university

Direct costs and indirect costs

35

In some organisations, stage 1 (cost accumulation) and stage 2 (cost assignment) occur simulta-

neously. Consider the purchase by Airbus of 76 business-class seats to be installed in an A350-1000

aeroplane to be sold to Qantas. This transaction could be coded to a general ledger account such

as materials (the cost accumulation stage) and simultaneously coded to three separate cost objects

(the cost assignment stage):

- a department (assembly)
- a product (A350-1000 product line)
- a customer (Qantas).

Alternatively, stage 1 (cost accumulation) could occur first, followed by stage 2 (cost assignment).

For example, the 76-seat purchase by Airbus could first be coded to the materials account, then

subsequently assigned to a department, then reassigned to a product, and finally reassigned to

a customer. Advances in information-gathering technology (such as barcoding) are facilitating

the simultaneous assignment of costs to more than one cost object at the time costs are incurred.

Remember, managers assign costs to designated cost objects to help decision making. For

example, costs may be assigned to a department to facilitate decisions about departmental effi-

ciency. Costs may also be assigned to a product or a customer to facilitate product or customer

profitability analysis.

Direct costs and indirect costs

Cost tracing and cost allocation

A major question concerning costs is whether they have a direct or an indirect relationship to a

particular cost object.

● Direct costs of a cost object are costs that are related to the particular cost object and that can

be traced to it in an economically feasible (cost-effective) way.

● Indirect costs of a cost object are costs that are related to the particular cost object but cannot

be traced to it in an economically feasible (cost-effective) way. Indirect costs are allocated to

the cost object using a cost-allocation method.

Take a tennis racket as a cost object. The cost of the carbon fibre used to make that racket is a

direct cost. Why? Because the amount of material used in making the racket can easily be traced

to the racket. The cost of lighting in the factory where the racket was made is an indirect cost

of the racket. Why? Because although lighting helped in the making of the racket (the workers

needed to see), it is not cost-effective to try to determine exactly how much lighting cost was used

for a specific racket.

Managers prefer to make decisions on the basis of direct costs rather than indirect costs.

Why? Because they know that direct costs are more accurate than indirect costs. The relationship

between these terms is summarised in Exhibit 2.2.

Cost tracing is the assigning of direct costs to the chosen cost object. Cost allocation is the

assigning of indirect costs to the chosen cost object. *Cost assignment* encompasses both cost

tracing and cost allocation.

Factors affecting direct/indirect cost classifications

Several factors will affect the classification of a cost as direct or indirect:

1 *The materiality of the cost in question.* The higher the cost in question, the more likely the

economic feasibility of tracing that cost to a particular cost object. Consider a mail-order

Exhibit 2.2

Relationship of direct and indirect costs to a cost object

Cost tracing

Direct

costs

Cost

Cost

assignment

object

Cost allocation

Indirect

costs

catalogue company. It would probably be economically feasible to trace the courier charges

for delivering a package directly to each customer. In contrast, the cost of the invoice paper

included in the package sent to the customer is likely to be classified as an indirect cost because

it is not economically feasible to trace the cost of this paper to each customer. The benefits of

knowing the exact number of (say) 0.5p worth of paper included in each package typically do

not justify the costs of money and time in tracing the costs to each package.

2 *Available information-gathering technology.* Improvements in this area are enabling an increas-

ing percentage of costs to be classified as direct. Barcodes, for example, allow many manufac-

turing plants to treat certain materials previously classified as indirect costs as direct costs of

products. Barcodes can be read into a manufacturing-cost file by waving a 'wand' in the same

quick and efficient way that supermarkets now enter the cost of many items purchased by their

customers.

3 *Design of operations.* Facility design can impact on cost classification. For example, classifying

a cost as direct is helped if an organisation's facility (or part thereof) is used exclusively for a

specific product or specific cost object, such as a particular customer.

This book examines different ways to assign costs to cost objects. For now, be aware that one

particular cost may be both direct and indirect. How? *The direct/indirect classification depends*

on the choice of the cost object. For example, the salary of an assembly-department supervisor

may be a direct cost of the assembly department at Fiat but an indirect cost of a product such as

the Fiat 500 Punto.

Cost drivers and cost management

The continuous cost-reduction efforts of competitors create a never-ending need for organisations

to reduce their own costs. Cost-reduction efforts frequently identify two key areas:

1 Focusing on value-added activities, that is, those activities that customers perceive as adding

value to the products or services they purchase.

2 Efficiently managing the use of the cost drivers in those value-added activities.

A cost driver (also called a *cost generator* or *cost determinant*) is any factor that affects total costs.

That is, a change in the level of the cost driver will cause a change in the level of the total cost of

a related cost object. Costs that do not vary in the short run and have no identifiable cost driver

in the short run may in fact have a cost driver in the long run.

Exhibit 2.3 presents examples of cost drivers in each of the business functions of the value

chain. Some cost drivers are financial measures found in accounting systems (such as direct

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Exhibit 2.3

Examples of cost drivers of business functions in the value chain

Business function

Cost driver

- Research and development
- Number of research projects
- Labour hours on a project
- Technical complexity of projects
- Design of products, services and processes
- Number of products in design
- Number of parts per product
- Number of engineering hours
- Production
- Number of units produced
- Direct manufacturing labour costs

- Number of set-ups
- Number of engineering change orders
- Marketing
- Number of advertisements run
- Number of sales personnel
- Sales
- Distribution
- Number of items distributed
- Number of customers
- Weight of items distributed
- Customer service
- Number of service calls
- Number of products serviced
- Hours spent servicing products

manufacturing labour costs and sales), while others are non-financial variables (such as the num-

ber of parts per product and the number of service calls). We now discuss the role of cost drivers

in describing cost behaviour.

Cost management is the set of actions that managers take to satisfy customers while continu-

ously reducing and controlling costs. A caveat on the role of cost drivers in cost management is

appropriate. Changes in a particular cost driver do not automatically lead to changes in overall

costs. Consider the number of items distributed as a driver of distribution labour costs. Suppose

that management reduces the number of items distributed by 25%. This reduction does not auto-

matically translate to a reduction in distribution labour costs. Managers must take steps to reduce

distribution labour costs, perhaps by shifting workers out of distribution into other business

functions needing additional labour or by laying off some distribution employees.

Cost behaviour patterns: variable costs and fixed costs

Management accounting systems record the cost of resources acquired and track their subse-

quent use. Tracing these costs allows managers to understand how these costs behave. Let us

now consider two basic types of cost behaviour pattern found in many of these systems: variable

costs and fixed costs. A variable cost is a cost that changes in total in proportion to changes in the

related level of total activity or volume. A fixed cost is a cost that does not change in total despite

changes in the related level of total activity or volume. Costs are defined as variable or fixed with

respect to a specific cost object and for a given time period. Consider costs at Opel's Zaragoza

plant in Spain (Global Happenings, 2022). The company passed a milestone of 11 million units

in 2022 since it started production 40 years prior. The Corsa is Opel's best-selling model.

● *Variable costs.* If Opel buys a steering wheel at €600 for each of its Corsa cars, then the total

cost of steering wheels should be €600 times the number of cars assembled. This is an example

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Exhibit 2.4

Examples of variable costs

Panel A: Steering wheel costs at

Panel B: Sales commissions at 5%

€600 per car assembled

of sales

200 000

400

150 000

300

100 000

200

50 000

100

Total steering wheel costs (€)

Total sales commissions (€)

1000

2000

3000

4000

1000

2000

3000

4000

Units produced

Sales (€)

of a variable cost, a cost that changes in total in proportion to changes in the cost driver

(number of cars). The variable cost per car does change with the number of cars assembled.

Exhibit 2.4 (Panel A) illustrates this variable cost. A second example of a variable cost is a

sales commission of 5% of each sales euro. Exhibit 2.4 (Panel B) shows this variable-cost

example.

● *Fixed costs.* Opel may incur €20 million in a given year for the leasing and insurance of its

Corsa plant. Both are examples of fixed costs: costs that are unchanged in total over a des-

ignated range of the cost driver during a given time span. Fixed costs become progressively

smaller on a per-unit basis as the cost driver increases. For example, if Opel assembles 10 000

Corsa vehicles at this plant in a year, the fixed cost for leasing and insurance per vehicle is

€2000 (€20 million ÷ 10 000). In contrast, if 50 000 vehicles are assembled, the fixed cost per

vehicle becomes €400.

Do not assume that individual cost items are inherently variable or fixed. Consider labour

costs. An example of purely variable labour costs is the case where workers are paid on a piece-

work basis. Some textile workers are paid on a per-shirt-sewn basis. Often, labour costs are

appropriately classified as fixed where employment conditions restrict an organisation's flexibility

to assign workers to any area that has extra labour requirements.

Major assumptions

The definitions of variable costs and fixed costs have important underlying assumptions:

1 Costs are defined as variable or fixed with respect to a specific cost object.

2 The time span must be specified. Consider the €20 million rent and insurance that Opel pays

for its Corsa assembly operations. This amount may be fixed for one year. Beyond that time,

the rent and insurance may be renegotiated to be, say, €22 million for a subsequent year.

3 Total costs are linear. That is, when plotted on ordinary graph paper, a total-variable-cost or

a total-fixed-cost relationship to the cost driver will appear as an unbroken straight line.

4 There is only one cost driver. The influences of other possible cost drivers on total costs are

held constant or deemed to be insignificant.

5 Variations in the level of the cost driver are within a relevant range (which we discuss in the

next section).

Cost behaviour patterns: variable costs and fixed costs

Variable costs and fixed costs are the two most frequently recognised cost behaviour patterns in

existing management accounting systems. Additional cost behaviour patterns are discussed in

subsequent chapters (see Chapters 9 and 11).

Relevant range

A relevant range is the range of the cost driver in which a specific relationship between cost and the

level of activity or volume is valid. A fixed cost is fixed only in relation to a given relevant range (usu-

ally wide) of the cost driver and a given time span (usually a particular budget period). Consider

the Swedish-based Trans-Europe Transport Company (TETC), which operates two refrigerated

vehicles that carry agricultural produce to market. Each vehicle has an annual fixed cost of €400 000

(including an annual insurance cost of €150 000 and an annual registration fee of €80 000) and a

variable cost of €12 per kilometre of hauling. TETC has chosen kilometres of hauling to be the

cost driver. The maximum annual usage of each vehicle is 120 000 kilometres. Suppose that in the

current year (2018) the predicted combined total hauling of the two vehicles is 170 000 kilometres.

Exhibit 2.5 shows how annual fixed costs behave at different levels of kilometres of hauling. Up

to 120 000 kilometres, TETC can operate with one vehicle; from 120 001 to 240 000 kilometres,

it can operate with two vehicles; and from 240 001 to 360 000, it can operate with three vehicles.

This pattern would continue as TETC added vehicles to its fleet. The bracketed section from 120

001 to 240 000 is the range at which TETC expects the €80 000 fixed costs to be valid given the

predicted 170 000-kilometre usage for the year.

Fixed costs may change from one year to the next. For example, if the annual registration fee

for refrigerated vehicles is increased in 2022, the total level of fixed costs will increase (unless

offset by a reduction in other fixed items).

Relationships of types of costs

We have introduced two major classifications of costs: direct/indirect and variable/fixed. Costs

may simultaneously be:

- direct and variable
- direct and fixed

● indirect and variable

● indirect and fixed.

Exhibit 2.6 presents examples of simultaneous cost classifications with each of the four cost types.

Exhibit 2.5

Fixed-cost behaviour at Trans-Europe Transport Company

Relevant

120 000

range

in 2023

80 000

40 000

Toal fi co

120 000

240 000

360 000

Kilometres of hauling

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Exhibit 2.6

Examples of simultaneous direct/indirect and variable/

fixed-cost classifications

Assignment of costs to cost object

Direct cost

Indirect cost

Variable *Cost object*: Assembled car

Cost object: Assembled car

Example: Tyres used in

Example: Power costs where power

Cost

cost

assembly of car

usage is metered only to the plant

behaviour

pattern

Fixed

Cost object: Assembled car

Cost object: Assembled car

cost

Example: Salary of supervisor

Example: Annual lease cost at Corsa

on Opel's Corsa assembly

plant line

Total costs and unit costs

Meaning of unit costs

Accounting systems typically report both total-cost and unit-cost numbers. A unit cost (also

called an average cost) is calculated by dividing some amount of total cost by the related number

of units.

The units might be expressed in various ways. Examples are hours worked, packages deliv-

ered or cars assembled. Suppose that €980 000 of manufacturing costs were incurred to produce

10 000 units of a finished good. Then the unit cost would be €98:

Total manufacturing costs

= €980 000 = €98 per unit

Number of units manufactured

10 000

If 8000 units are sold and 2000 units remain in ending stock, the unit-cost concept helps in the

assignment of total costs for the income statement and balance sheet:

Cost of goods sold in the income statement, 8000 units × €98

€784 000

Closing stock of finished goods in the balance sheet, 2000 units × €98

196 000

Total manufacturing costs of 10 000 units

€980 000

Unit costs are found in all areas of the value chain – for example, there are unit costs for product

design, sales calls and customer-service calls.

Use unit costs cautiously

Unit costs are averages. As we shall see, they must be interpreted with caution. For decision

making, it is best to think in terms of total costs rather than unit costs. Nevertheless, unit-cost

numbers are frequently used in many situations. For example, assume that the President of the

Jazz Society at the Católica Lisbon School of Business & Economics is deciding whether to hire

a music group for a forthcoming party. The group charges a fixed fee of €1000. The president

may intuitively calculate a unit cost for the group when thinking about an admission price. Given

the fixed fee of €1000, the unit cost is €10 if 100 people attend, €2 if 500 attend, and €1 if 1000

attend. Note, however, that with a fixed fee of €1000 the *total cost* is unaffected by the attendance

level, while the *unit cost* is a function of the attendance level. In this example, each attendee is

considered to be one unit.

Costs are often neither inherently fixed nor variable. Much depends on the specific context.

Consider the €1000 fixed fee that we assumed was to be paid to the music group. This is just

one way the music group could be paid. Possible payment schedules that might be considered

include:

● Schedule 1: €1000 fixed fee

● Schedule 2: €1 per person attending + €500 fixed fee

● Schedule 3: €2 per person attending.

Under schedules 2 and 3, the euro amount of the payment to the music group is not known until

after the event.

Concepts in action

Reducing fixed costs and managing profit growth at Porsche

All companies seeking to show profits have to be concerned about fixed costs. Investments to achieve future

profitability often imply that as fixed costs rise, volume of sales should rise also, so they can be allocated to a larger

sales-volume base. But there may be a time lag between investing heavily and seeing volumes grow. Consider

Porsche's plans to invest €3 billion over the 2018–2022 period for electrified vehicles (EVs), which its CFO Lutz

Meschke says is '. . . an enormous burden for a company our size'. But, Porsche does not wish to reduce its 15 per cent

operating margin profitability target despite the heavy investments that EVs will need to make – at least not in the

long run. Approximately €8000 to €10 000 is the added cost of content added to an electrified vehicle. Customers

do not just fathom these costs being passed on to them as price increases. Yet, Porsche's strategy, like other global

motor car players, is to move in the direction of EV. So the answer for Porsche is to make investments such that its

strategy pays off in the long-term, whereby it retains its high profitability. Managing costs is crucial. As Meschke

explains: 'To protect your margin, you have to look at substantial fixed-cost cuts, but there's only so much potential

since the biggest chunks are personnel and development. As sales shift toward EVs, a temporary drop in profitability

in the midterm may be expected.'

So Porsche does not slow down its cost containment efforts. The company recognises that 'identifying and extract-

ing efficiencies is our everyday business'. Consequently, it has operationalised its Porsche Improvement Process,

whereby Meschke aims for ‘Annual savings of at least 3 per cent in indirect areas and 6 per cent in direct ones’. On top

of that, Porsche reviews its ‘core cross-departmental processes every year for another 10 per cent savings’. By March

2021, Meschke was able to report that its profits were 4.4 billion euros higher than the previous year and an opera-

tional return on sales of 14.6%. He indicated that ‘Our top priority in the crisis was liquidity. We needed to reduce all

costs that were not absolutely necessary. We didn’t scrimp at all when it comes to the future topics. We continue to

proceed at full speed on transformation, digitalisation and electrification.’

Source: Hetzner, C. (2017) ‘Porsche CFO outlines how company will thrive in EV era’ (http://europe.autonews.com/article/20171101/ANE/171029772/

porsche-cfo-outlines-how-company-will-thrive-in-ev-era) (27/1/2018); Porsche (2021) ‘Porsche achieves sustainable growth in 2020 financial year’

(https://newsroom.porsche.com/en/2021/company/porsche-annual-press-conference-financial-year-2020-annual-and-sustainability-report-23936.html).

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Exhibit 2.7

The effects of the three payment levels on unit costs and total

costs for five attendance levels

Schedule 1:

Schedule 2:

Schedule 3:

€1 per person

Number

€1000 fixed

attending + €500 fixed

€2 per person

of persons

attending

Total cost

Unit cost

Total cost

Unit cost

Total cost

Unit cost

50

€1000

€20

€550

€11

€100

€2

100

1000

10

600

6

200

2

250

1000

4

750

3

500

2

500

1000

2

1000

2

1000

2

1000

1000

1

1500

1.5

2000

2

The effects of these three payment schedules on unit costs and total costs for five attendance

levels are shown in Exhibit 2.7.

The unit cost under schedule 1 is calculated by dividing the fixed cost of €1000 by the attend-

ance level. For schedule 2, the unit cost is calculated by first determining the total cost for each

attendance level and then dividing that amount by that attendance level. Thus, for 250 people,

schedule 2 has a total cost of €750 (€500 + 250 × €1), which gives a unit cost of €3 per person.

Schedule 3 has a unit cost of €2 per person for any attendance level because the music group is to

be paid €2 per person with no fixed payment.

All three payment schedules would yield the same unit cost of €2 per person only if 500 people

attend. The unit cost is not €2 per person under schedule 1 or schedule 2 for any attendance level

except 500 people. Thus, it would be incorrect to use the €2 per person amount in schedule 1 or

2 to predict what the total costs would be for 1000 people. Consider what occurs if 250 people

attend and the group is paid a fixed fee of €1000. The unit cost is then €4 per person. *While unit*

costs are often useful, they must be interpreted with extreme caution if they include fixed costs

per unit. When estimating total cost, think of variable costs as an amount per unit and fixed costs

as a lump-sum total amount.

The key relationships between total costs and unit costs are summarised in Panel A of

Exhibit 2.8. Panel B illustrates these relationships for schedule 3 where the university social club

pays the music group on a variable basis (cost of €2 per person). Panel C illustrates schedule 1

where the music group is paid a fixed amount (cost of €1000).

Behaviour of total costs and unit costs when the level of the cost

Exhibit 2.8

driver changes with illustration of alternative payment schedules

for music group

Panel A: Summary of key relationships

Cost behaviour pattern

Total costs

Unit costs

When item is a variable cost

Total costs change with changes in

Unit costs remain the

level of cost driver

same with changes in

level of cost driver

When item is a fixed cost

Total costs remain the same with

Unit costs change

changes in level of cost driver

with changes in level

of cost driver

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Financial statements, business sectors and the recognition of costs

43

Exhibit 2.8

continued

Panel B: Payment is €2 per attendance

100

)

)

80

2

60

40

1

20

Unit cost per attendee (€

Total cost of music group (€

10

20

30

40

50

10

20

30

40

50

Attendees

Attendees

Panel C: Payment is a fixed €1000

1000

1000

)

)

800

800

600

600

400

400

200

200

Unit cost per attendee (€

Total cost of music group (€

10

20

30

40

50

10

20

30

40

50

Attendees

Attendees

Financial statements, business sectors and the recognition of costs

We now consider the different sectors of the economy, the different types of stock that compa-

nies hold, and how these factors affect commonly used classifications of capitalised and reve-

nue-based costs, which tie into the income statements or balance sheets of service, merchandising

and manufacturing-sector companies. Let’s first look at service companies.

Service-sector companies provide services or intangible products to their customers – for exam-

ple, legal advice or an audit. These companies do not have any stock of tangible product at the

end of an accounting period. Examples include law firms, accounting firms, advertising agencies

and television stations. Labour costs are typically the most significant cost category, often being

as high as 70% of total costs.

Exhibit 2.9 presents an income statement for Ahamed & Partners, a law firm specialising in

libel lawsuits. The customers (clients) of this law firm receive legal advice and representation on

their behalf in court and in negotiations. Salaries and wages constitute 67.3% of total operating

costs (€970 000 ÷ €1 442 000).

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Chapter 2 An introduction to cost terms and purposes

Exhibit 2.9

Service-sector income statement

Ahamed & Partners income statement for the year ended 31 December 2022

Revenues

€1 600 000

Costs

Salaries and wages

€970 000

Rent

180 000

Depreciation

105 000

Other costs

187 000

1 442 000

Operating profit

€158 000

The operating-cost line items for service companies will include costs from all areas of the

value chain (production of services, marketing, and so on). There is not a line item for cost of

goods sold in the income statement of Ahamed & Partners. Why? Because the business sells only

services or intangible products to its customers.

As opposed to service companies, merchandising-sector companies provide tangible products

they have previously purchased in the same basic form from suppliers. Merchandise purchased

from suppliers but not sold at the end of an accounting period is held as stock. The merchandising

sector includes companies engaged in retailing (such as book stores or department stores), distrib-

uting or wholesaling. Manufacturing-sector companies provide tangible products that have been

converted to a different form from that of the products purchased from suppliers. At the end of

an accounting period, a manufacturer has stock that can include direct materials, work in progress

or finished goods (see below). Examples are computer, food processing and textile companies.

Manufacturing-sector companies purchase materials and components and convert them into

finished goods. These companies typically have one or more of the following three types of stock:

1 Direct materials stock. Direct materials is stock that will be used in the manufacturing process

(for example, computer chips and components needed to manufacture mobile phones).

2 Work-in-process stock. Goods partially worked on but not yet completed (for example, mobile

phones at various stages of completion in the manufacturing process). This is also called

work-in-progress.

3 Finished-goods stock. Goods (for example, mobile phones) completed, but not yet sold.

Merchandising-sector companies purchase tangible products and then sell them without changing

their basic form. These companies hold only one type of stock, which is products in their origi-

nal purchased form, called *merchandise stock.* As noted, service-sector companies provide only

services or intangible products and do not hold stock of tangible products.

How to classify manufacturing costs

Three terms commonly used when describing manufacturing costs are *direct materials costs,*

direct manufacturing labour costs and *indirect manufacturing costs.* These terms build on the

direct versus indirect cost distinction we described earlier in the context of manufacturing

costs.

1 Direct materials costs are the acquisition costs of all materials that eventually become part of

the cost object (work in process and then finished goods) and can be traced to the cost object

in an economically feasible way. The aluminium and tyres used to make the Porsche Panamera

and the computer chips used to make mobile phones are examples of direct material costs.

Note that the costs of direct materials include not only the cost of the materials themselves,

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but the freight-in (inward delivery) charges, sales taxes and customs duties that must be paid

to acquire them.

2 Direct manufacturing labour costs include the compensation of all manufacturing labour that

can be traced to the cost object (work in process and then finished goods) in an economically

feasible way. Examples include wages and fringe benefits paid to machine operators and assem-

bly-line workers who convert direct materials to finished goods.

3 Indirect manufacturing costs are all manufacturing costs that are related to the cost object

(work in process and then finished goods), but cannot be traced to that cost object in an

economically feasible way. Examples include supplies, indirect materials such as lubricants,

indirect manufacturing labour such as plant maintenance and cleaning labour, plant rent,

plant insurance, property taxes on the plant, plant depreciation, and the compensation of

plant managers. This cost category is also referred to as manufacturing overhead costs or fac-

tory overhead costs. We use *indirect manufacturing costs* and *manufacturing overhead costs*

interchangeably in this book.

We now describe the distinction between stock-related and revenue cost. One key distinction of

costs is their classification as capitalised costs that are first recorded as an asset (capital) when

they are incurred. These costs are presumed to provide future benefits to the company. Examples

are costs to acquire computer equipment and motor vehicles. These costs are written off to those

periods assumed to benefit from their incurrence. For example, the cost of acquiring motor vehi-

cles is written off as a depreciation expense that occurs each year of the expected useful life of the

vehicle. And then, there are revenue costs, which are recorded as expenses of the accounting period

when they are incurred. Examples are salaries paid to marketing personnel and monthly rent paid

for administrative offices. In this book, we also refer to operating costs as all costs associated with

generating revenues, other than cost of goods sold. For now, in relation to the company's financial

statements, we want to focus on the following, which tie into how we regard accounting for stock.

Stock-related costs (also called inventoriable costs) are all costs of a product that are considered

assets in a company's balance sheet when the costs are incurred and that are expensed as cost of

goods sold only when the product is sold. For manufacturing-sector companies, all manufacturing

costs are inventoriable costs. The costs first accumulate as work-in-process inventory assets (in

other words, they are 'inventoried') and then as finished goods assets. Note that the cost of goods

sold includes all manufacturing costs (direct materials, direct manufacturing labour, and manufac-

turing overhead costs) incurred to produce them. Thus, inventorying manufacturing costs in the

balance sheet during the accounting period when the products are manufactured (i.e. capitalising

these costs) and expensing the manufacturing costs in a later income statement when the products

are sold matches revenues and expenses.

For merchandising-sector companies such as Primark, inventoriable costs are the costs of pur-

chasing goods that are resold in their same form. These costs are made up of the costs of the

goods themselves plus any incoming freight, insurance, and handling costs for those goods. Ser-

vice-sector companies provide only services or intangible products. The absence of inventories of

tangible products for sale means service-sector companies have no inventoriable costs.

Period costs are all costs in the income statement other than cost of goods sold. Period costs,

such as design costs, marketing, distribution and customer-service costs, are treated as expenses of

the accounting period in which they are incurred, because managers expect these costs to increase

revenues in only that period and not in future periods. For manufacturing-sector companies, all

non-manufacturing costs in the income statement are period costs. For merchandising-sector

companies, all costs in the income statement not related to the cost of goods purchased for resale

are period costs. Examples of these period costs are labour costs of sales floor personnel and

advertising costs. Because there are no inventoriable costs for servicesector companies, all costs

in the income statement are period costs. These are in effect, revenue costs, which are recorded as

expenses of the accounting period when they are incurred. Examples are salaries paid to market-

ing personnel and monthly rent paid for administrative offices.

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In this chapter, we assume that all manufacturing costs are inventoriable. The term *absorption*

costing is used to describe the method in which all manufacturing costs are inventoriable. Chap-

ter 6 further discusses this method and *variable costing,* in which only variable manufacturing

costs are inventoriable. Fixed manufacturing costs under variable costing are treated as *period*

costs, that is, they are treated as expenses in the period in which they are incurred rather than

being inventoried.

Two further terms used in manufacturing-cost systems are prime costs and conversion costs.

Prime costs are all direct manufacturing costs. As information-gathering technology improves,

companies may add other direct-cost categories. For example, power costs might be metered in

specific areas of a plant that are dedicated to the assembly of separate products. In this case,

prime costs would include direct materials, direct manufacturing labour and direct metered

power. Computer software companies often have a ‘purchased technology’ direct manufactur-

ing-cost item. This item, which covers payments to third parties who develop software programs

included in a product, would also be included in prime costs. Conversion costs are all manufac-

turing costs other than direct materials costs. These costs are for transforming direct materials

into finished goods.

Consider the income statement of a manufacturer, Cellular Products, which is shown in

Exhibit 2.10 (Panel A). Cost of goods sold in a manufacturing company is calculated as follows:

Opening finished

Cost of goods

Closing finished

+

−

= Cost of goods sold

goods stock

manufactured

goods stock

For Cellular Products in 2018, the corresponding amounts (in thousands, Panel A) are

€22 000 + €104 000 − €18 000 = €108 000

Cost of goods manufactured refers to the cost of goods brought to completion, whether they

were started before or during the current accounting period. In 2022, these costs amount to

€104 000 for Cellular Products (see the schedule of cost of goods manufactured in Panel B of

Exhibit 2.10). The manufacturing costs incurred during 2022 (€105 000) is a line item in Panel B.

This item refers to the ‘new’ direct manufacturing costs and the ‘new’ manufacturing overhead

costs that were incurred during 2022 for all goods worked on during 2022, regardless of whether

all those goods were fully completed during this year.

The manufacturing costs of the finished goods include direct materials, other direct manufac-

turing costs, and indirect manufacturing costs. All these are inventoriable costs; they are assigned

to work-in-progress stock or finished goods stock until the goods are sold. Inventoriable costs

include the costs of assets that facilitate the manufacturing process and (typically) become part

of indirect manufacturing costs. For example, the costs of the blast furnace of a steel company

are first capitalised at the time of construction. These costs subsequently become part of steel

stock costs, as depreciation on the blast furnace is included in indirect manufacturing costs over

the useful life of the blast furnace.

Newcomers to management accounting frequently assume that indirect costs such as rent,

telephone and depreciation are always costs of the period in which they are incurred and are

unconnected with stocks. However, if these costs are related to manufacturing per se, they are

indirect manufacturing costs and are inventoriable. Operating-cost items in the income statement

in Panel A of Exhibit 2.10 include: (1) the expensing of capitalised costs (such as depreciation on

a fleet of delivery vehicles or depreciation on computers purchased for marketing personnel), and

(2) the cost of items recorded as an expense as incurred (such as the salaries of customer-service

representatives).

Differences exist across companies in the way accounting terms are defined. Consider a direct

labourer, such as a lathe operator or an assembly-line worker, who earns gross wages calculated

on the basis of a regular wage rate of €20 per hour. This person receives fringe benefits (employer

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Exhibit 2.10

Income statement and schedule of cost of goods manufactured

or manufacturing-sector company

Panel A: Cellular Products income statement for the year ended 31 December 2022

(€000)

Revenues

€210 000

Cost of goods sold

Opening finished goods, 1 January 2023

€22 000

Cost of goods manufactured (see Panel B)

104 000

Cost of goods available for sale

126 000

Closing finished goods, 31 December 2023

18 000

108 000

Gross margin (or gross profit)

102 000

Operating costs

70 000

Operating profit

€32 000

Panel B: Cellular Products schedule of cost of goods manufactured* for the year ended

31 December 2023 (€000)

Direct materials

Opening stock, 1 January 2023

€11 000

Purchases of direct materials

73 000

Cost of direct materials available for use

84 000

Closing stock, 31 December 2023

8 000

Direct materials used

€76 000

Direct manufacturing labour

17 750

Indirect manufacturing costs

Indirect manufacturing labour

4 000

Supplies

1 000

Heat, light and power

1 750

Depreciation – plant building

1 500

Depreciation – plant equipment

2 500

Miscellaneous

500

11 250

Manufacturing costs incurred during 2023

105 000

Add opening work-in-progress stock, 1 January 2023

6 000

Total manufacturing costs to account for

111 000

Deduct closing work-in-progress stock, 31 December 2023

7 000

Cost of goods manufactured (to income statement)

€104 000

*Note that the term cost of goods manufactured refers to the cost of goods brought to completion (finished) during the year,

whether they were started before or during the current year. Some of the manufacturing costs incurred during the year are held back as costs of the closing work-in-progress stock; similarly, the costs of the opening work-in-progress stock become part of the cost of goods manufactured for the year. Note too that this schedule can become a schedule of cost of goods manufactured and

sold simply by including the opening and closing finished goods stock figures in the supporting schedule rather than directly in the body of the income statement as in Panel A.

contributions to the employee's National Insurance, life insurance, and so on) totalling, say,

€8 per hour. Some companies classify the €20 as direct manufacturing labour cost and the

€8 as manufacturing overhead cost. Other companies classify the entire €28 as direct manufac-

turing labour cost. The latter approach is conceptually preferable because these payroll fringe

benefit costs are a fundamental part of acquiring manufacturing labour services. The magnitude

of fringe benefits makes this issue important. Countries where fringe benefit costs are over 30%

of wage rates include Italy (105%), France (90%), Germany (86%), the UK (43%) and the USA

(38%) (PWC, 2019).

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The many meanings of product costs

An important theme of this book is 'different costs for different purposes'. This theme can be

illustrated with respect to product costing. A product cost is the sum of the costs assigned to a

product for a specific purpose. Exhibit 2.11 illustrates three different purposes:

1 *Product pricing and product emphasis.* For this purpose, the costs of all those areas of the value

chain required to bring a product to a customer should be included.

2 *Contracting with government agencies.* Government agencies frequently provide detailed guide-

lines on the allowable and non-allowable items in a product-cost amount. For example, some

government agencies explicitly exclude marketing costs from reimbursement to contractors

and may reimburse only a part of R&D costs. Hence, the bracket in Exhibit 2.11 shows that a

specific contract may provide for recovering all design and production costs and part of R&D

costs.

3 *Financial statements.* The focus here is on inventoriable costs. In most countries, generally

accepted accounting principles in manufacturing companies allow only manufacturing costs

to be assigned to products reported in the financial statements.

Exhibit 2.11 illustrates how a product-cost amount may include only inventoriable costs in the

financial statements, a broader set of costs for reimbursement under a government contract, and

a still broader set of costs for pricing and product emphasis.

Classification of costs

This chapter has provided many examples of cost classifications that have various purposes.

Classifications can be made on the basis of:

1 Business function

a Research and development

b Design of products, services and processes

Exhibit 2.11

Different product costs for different purposes

R&D

Design

Production

Customer

Marketing

Distribution

costs

costs

costs

service

costs

costs

costs

Product costs

for financial

statements

Product costs for reimbursement

under government contracts

Product costs for pricing and product-mix decisions

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Summary

c Production

d Marketing

e Distribution

f Customer service

2 Assignment to a cost object

a Direct costs

b Indirect costs

3 Behaviour pattern in relation to changes in the level of a cost driver

a Variable costs

b Fixed costs

4 Aggregate or average

a Total costs

b Unit costs

5 Assets or expenses

a Inventoriable (product) costs

b Period costs.

Summary

The following points are linked to the chapter's learning objectives.

1 A cost object is anything for which a separate measurement of costs is desired. Examples include a product, service,

project, customer, brand category, activity, department and programme.

2 A direct cost of a cost object is any cost that is related to the cost object and can be traced to that cost object in an

economically feasible way. Indirect costs are costs that are related to the cost object but cannot be traced to that

cost object in an economically feasible way. A cost may be direct regarding one cost object and indirect regarding

other cost objects. This book uses the term *cost tracing* to describe the assignment of direct costs to a cost object

and the term *cost allocation* to describe the assignment of indirect costs to a cost object.

3 A cost driver is any factor that affects costs. Examples include the number of set-ups and direct-labour hours in

manufacturing and the number of sales personnel and sales euros in marketing. A variable cost is a cost that does

change in total in proportion to changes in a cost driver. A fixed cost is a cost that does not change in total despite

changes in a cost driver.

4 Unit costs of a cost object should be interpreted with caution when they include a fixed-cost component. When

making total cost estimates, think of variable costs as an amount per unit and fixed costs as a total amount.

5 Service-sector companies provide services or intangible products to their customers. In contrast, merchandising-

and manufacturing-sector companies provide tangible products to their customers. Merchandising companies

do not change the form of the products they acquire and sell. Manufacturing companies convert materials and

other inputs into finished goods for sale. These differences are reflected in both the balance sheets and income

statements of companies in these sectors.

6 Capitalised costs are first recorded as an asset when they are incurred. They become cost of goods sold when the

product is sold. Period costs are expensed in the period in which they are incurred.

7 Managers may assign different costs to the same cost object depending on its purpose. For example, for financial

reporting purposes, the (inventoriable) costs of a product include only manufacturing costs. In contrast, costs from

all areas of the value chain can be assigned to a product for decisions on pricing and product emphasis.

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CHAPTER 2

Assessment material

Review questions

2.1

Define *cost object* and give three examples.

2.2

Which costs are considered direct? Indirect? Give an example of each.

2.3

Describe how a given cost item can be both a direct cost and an indirect cost.

2.4

Give three factors that will affect the classification of a cost as direct or indirect.

2.5

What is a *cost driver*? Give one example for each area in the value chain.

2.6

What is the *relevant range*? What role does the relevant range concept play in explaining how costs

behave?

2.7

Explain why *unit costs* must often be interpreted with caution.

2.8

Describe how service-, merchandising- and manufacturing-sector companies differ from each

other.

2.9

What are the three major categories of the inventoriable costs of a manufactured product?

2.10 Define the following: direct materials costs, direct manufacturing labour costs, indirect manufac-

turing costs, prime costs and conversion costs.

Exercises

Basic level

2.11 Total costs and unit costs (10 minutes)

A student association has hired a music group for a graduation party. The cost will be a fixed

amount of €40 000.

Required

1 Suppose 500 people attend the party. What will be the total cost of the music group? The unit

cost per person?

2 Suppose 2000 people attend. What will be the total cost of the music group? The unit cost per

person?

3 For prediction of total costs, should the manager of the party use the unit cost in requirement 1?

The unit cost in requirement 2? What is the major lesson of this problem?

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Chapter 2 An introduction to cost terms and purposes

***2.12 Total costs and unit costs** (15 minutes)

George Mathenge is a well-known motivational speaker. The Europe Speaker's Bureau (ESB)

wants Mathenge to be the sole speaker at an all-day seminar. Mathenge's agent offers ESB the

choice of three possible fee arrangements:

- Schedule 1: €8000 fee
- Schedule 2: €20 per person + €2000 fixed fee
- Schedule 3: €50 per person.

Each attendee will be charged a €200 fee for the all-day seminar.

Required

1 What is ESB's fixed cost and variable cost for hiring Mathenge under each alternative schedule?

2 For each schedule, calculate the total cost and unit cost per seminar attendee if (a) 50 attend,

(b) 200 attend, and (c) 500 attend. Comment on the results.

2.13 Total costs and unit costs (10 minutes)

Weltferien AG markets package holidays to Tenerife from Dresden. The package includes a

round-trip flight on Saxon-Air. Weltferien pays Saxon-Air €60 000 for each round-trip flight. The

maximum load on a flight is 300 passengers.

Required

1 What is the unit cost to Weltferien of each passenger on a Saxon-Air round-trip flight if there

are (a) 200, (b) 250 or (c) 300 passengers?

2 What role can the unit-cost figures per passenger calculated in requirement 1 play when

Weltferien is predicting the total air-flight costs to be paid next month for Saxon-Air carrying

4000 passengers on 15 scheduled round-trip flights?

2.14 Classification of costs, service sector (15–20 minutes)

Presta-Serviços SA is a marketing research firm that organises focus groups for consumer

product companies. Each focus group has eight individuals who are paid €9000 per session to

provide comments on new products. These focus groups meet in hotels and are led by a trained

independent marketing specialist hired by Presta-Serviços. Each specialist is paid a fixed retainer

to conduct a minimum number of sessions and a per-session fee of €360 000. A Presta-Serviços

staff member attends each session to ensure that all the logistical aspects run smoothly.

Required

Classify each of the following cost items as:

a Direct or indirect (D or I) costs with respect to each individual focus group.

b Variable or fixed (V or F) costs with respect to how the total costs of Presta-Serviços change as

the number of focus groups changes. (If in doubt, select the cost type on the basis of whether

the total costs will change substantially if a large number of groups are conducted.)

You will have two answers (D or I; V or F) for each of the following items:

Cost item

D or I V or F

A Payment to individuals in each focus group to provide comments on new

products

B Annual subscription of Presta-Serviços to *Consumer Reports* magazine

C Phone calls made by Presta-Serviços staff member to confirm individuals will

attend a focus group session. (Records of individual calls are not kept)

Cost item

D or I V or F

D Retainer paid to focus group leader to conduct 20 focus groups per year on

new medical products

E Hotel meals provided to participants in each focus group

F Lease payment by Presta-Serviços for corporate office

G Cost of tapes used to record comments made by individuals in a focus group

session. (These tapes are sent to the company whose products are being tested)

H Petrol costs of Presta-Serviços staff for company-owned vehicles. (Staff

members submit monthly bills with no mileage breakdowns)

2.15 Classification of costs, merchandising sector (15–20 minutes)

Crescendo Srl operates a large entertainment store in Milan. The store has both a film (DVDs)

section and a musical (CDs and vinyl) section. Crescendo reports revenues for the film section

separately from the musical section.

Required

Classify each of the following cost items as:

a Direct or indirect (D or I) costs with respect to the film section.

b Variable or fixed (V or F) costs with respect to how the total costs of the film section change

as the number of films sold changes. (If in doubt, select the cost type on the basis of whether

the total costs will change substantially if a large number of films are sold.)

You will have two answers (D or I; V or F) for each of the following items:

Cost item

D or I

V or F

A Annual retainer paid to a film distributor

B Electricity costs of Crescendo store (single bill covers entire store)

C Costs of films purchased for sale to customers

D Subscription to *Video-Novo* magazine

E Leasing of computer software used for financial budgeting at Crescendo

store

F Cost of popcorn provided free to all customers of Crescendo

G Earthquake insurance policy for Crescendo store

H Freight-in costs of films purchased by Crescendo

Intermediate level

2.16 Cost drivers and the value chain (15 minutes)

A Toyota analyst is preparing a presentation on cost drivers. Unfortunately, both the list of its

business function areas and the accompanying list of representative cost drivers are accidentally

randomised. The two lists now on the computer screen are as follows:

Business function area

Representative cost driver

A Design of Products/Processes

1 Number of cars recalled for defective parts

B Customer Service

2 Number of machine assembly hours

C Marketing

3 Number of research scientists

D Research and Development

4 Hours of computer-aided design (CAD) work

E Distribution

5 Number of sales personnel

F Production

6 Weight of cars shipped

Required

1 Match each business function area with its representative cost driver.

2 Give a second example of a cost driver for each of the business function areas of Toyota.

2.17 Computing cost of goods manufactured and cost of goods sold (20–25 minutes)

Calculate cost of goods manufactured and cost of goods sold from the following account balances

relating to 2022 (in € millions):

Property tax on plant building

0.45

Marketing, distribution and customer-service costs

5.55

Finished goods stock, 1 January 2022

4.05

Plant utilities

2.55

Work-in-progress stock, 31 December 2022

3.90

Depreciation of plant building

1.35

General and administrative costs (non-plant)

6.45

Direct materials used

13.05

Finished goods stock, 31 December 2022

5.10

Depreciation of plant equipment

1.65

Plant repairs and maintenance

2.40

Work-in-progress stock, 1 January 2022

3.00

Direct manufacturing labour

5.10

Indirect manufacturing labour

3.45

Indirect materials used

1.65

Miscellaneous plant overhead

0.60

2.18 Income statement and schedule of cost of goods manufactured (25–30 minutes)

Howell Ltd has the following account balances (in millions):

For specific date

For year 2022

Direct materials, 1 January 2022

£15

Purchases of direct materials

£325

Work in progress, 1 January 2022

10

Direct manufacturing labour

100

Finished goods, 1 January 2022

70

Depreciation – plant building

80

and equipment

Direct materials, 31 December 2022

20

Plant supervisory salaries

5

Work in progress, 31 December 2022

5

Miscellaneous plant overhead

35

Finished goods, 31 December 2022

55

Revenues

950

Marketing, distribution and

240

customer-service costs

Plant supplies used

10

Plant utilities

30

Indirect manufacturing labour

60

Required

Prepare an income statement and a supporting schedule of cost of goods manufactured for

the year ended 31 December 2022. (For additional questions regarding these facts, see the next

problem.)

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2.19 Interpretation of statements (continuation of Exercise 2.18) (20–25 minutes)

Refer to the preceding problem.

Required

1 How would the answer to the preceding problem be modified if you were asked for a schedule

of cost of goods manufactured and sold instead of a schedule of cost of goods manufactured?

Be specific.

2 Would the sales manager's salary (included in marketing, distribution and customer-service

costs) be accounted for differently if Howell Ltd were a merchandising company instead of a

manufacturing company?

3 Plant supervisory salaries are usually regarded as indirect manufacturing costs. Under what

conditions might some of these costs be regarded as direct manufacturing costs? Give an

example.

4 Suppose that both the direct materials used and the plant depreciation were related to the man-

ufacture of 1 million units of product. What is the unit cost for the direct materials assigned

to those units? What is the unit cost for plant building and equipment depreciation? Assume

that yearly plant depreciation is calculated on a straight-line basis.

5 Assume that the implied cost behaviour patterns in requirement 4 persist. That is, direct mate-

rials costs behave as a variable cost and depreciation behaves as a fixed cost. Repeat the com-

putations in requirement 4, assuming that the costs are being predicted for the manufacture of

1.2 million units of product. How would the total costs be affected?

6 As a management accountant, explain concisely to the CEO why the unit costs differed in

requirements 4 and 5.

2.20 Finding unknown balances (20–25 minutes)

An auditor for the Inland Revenue is trying to reconstruct some partially destroyed records of

two taxpayers. For each of the cases in the accompanying list, find the unknowns designated by

letters A to D (figures are assumed to be in £000).

Case 1

Case 2

Debtors, 31 December 2022

£6 000

£2 100

Cost of goods sold

A

20 000

Creditors, 1 January 2022

3 000

1 700

Creditors, 31 December 2022

1 800

1 500

Finished goods stocks, 31 December 2022

B

5 300

Gross margin

11 300

C

Work in progress, 1 January 2022

0

800

Work in progress, 31 December 2022

0

3 000

Finished goods stocks, 1 January 2022

4 000

4 000

Direct material used

8 000

12 000

Direct manufacturing labour

3 000

5 000

Indirect manufacturing costs

7 000

D

Purchases of direct material

9 000

7 000

Revenues

32 000

31 800

Debtors, 1 January 2022

2 000

1 400

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2.21 Fire loss, computing stock costs (30–40 minutes)

A distraught employee, Guy Pirault-Manne, put a torch to a manufacturing plant on a blus-

tery day, 26 February 2022. The resulting blaze completely destroyed the plant and its contents.

Fortunately, certain accounting records were kept in another building. They revealed the following

for the period from 1 January 2022 to 26 February 2022:

Direct materials purchased

€3.2 million

Work in progress, 1 January 2022

€680 000

Direct materials, 1 January 2022

€320 000

Finished goods, 1 January 2022

€600 000

Indirect manufacturing costs

40% of conversion costs

Revenues

€10 million

Direct manufacturing labour

€3.6 million

Prime costs

€5.88 million

Gross margin percentage based on sales

20%

Cost of goods available for sale

€9 million

The loss was fully covered by insurance. The insurance company wants to know the historical

cost of the stocks as one factor considered when negotiating a settlement.

Required

Calculate the cost of:

1 Finished goods stock, 26 February 2022.

2 Work-in-progress stock, 26 February 2022.

3 Direct materials stock, 26 February 2022.

2.22 Comprehensive problem on unit costs, product costs (30 minutes)

Overtoom International Nederland BV manufactures and sells metal shelving. It began operations

on 1 January 2022. Costs incurred for 2022 (V stands for variable; F stands for fixed) are as

follows:

Direct materials used costs

€280 000 V

Direct manufacturing labour costs

60 000 V

Plant energy costs

10 000 V

Indirect manufacturing labour costs

20 000 V

Indirect manufacturing labour costs

32 000 F

Other indirect manufacturing costs

16 000 V

Other indirect manufacturing costs

48 000 F

Marketing, distribution and customer-service costs

245 700 V

Marketing, distribution and customer-service costs

80 000 F

Administrative costs

100 000 F

Vriable manufacturing costs are variable with respect to units produced. Variable marketing,

distribution, and customer-service costs are variable with respect to units sold. Stock data are as

follows:

Opening

Closing

1 January 2022

31 December 2022

Direct materials

0 kg

2000 kg

Work in progress

0 units

0 units

Finished goods

0 units

? units

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Production in 2022 was 100 000 units. Two kilograms of direct materials are used to make one

unit of finished product.

Revenues in 2022 were €873 600. The selling price per unit and the purchase price per kilogram of

direct materials were stable throughout the year. The company's ending stock of finished goods

is carried at the average unit manufacturing costs for 2022. Finished goods stock, at 31 December

2022, was €41 940.

Required

1 Direct materials stock, total cost, 31 December 2022.

2 Finished goods stock, total units, 31 December 2022.

3 Selling price per unit 2022.

4 Operating profit 2022. Show your computations.

***2.23 Budgeted income statement** (continuation of Exercise 2.22) (30 minutes)

Assume management predicts that the selling price per unit and variable cost per unit will be the same

in 2024 as in 2022. Fixed manufacturing costs and marketing, distribution and customer-service costs

in 2024 are also predicted to be the same as in 2022. Sales in 2024 are forecast to be 122 000 units.

The desired closing stock of finished goods, 31 December 2024, is 12 000 units. Assume zero closing

stock of both direct materials and work in progress. The company's closing stock of finished goods

is carried at the average unit manufacturing costs for 2024. The company uses the first-in, first-out

stock method. Management has asked that you prepare a budgeted income statement for 2024.

Required

1 Units of finished goods produced in 2024.

2 Budgeted income statement for 2024.

Advanced level

***2.24 Variable costs and fixed costs** (5–20 minutes)

Lutukka Oy owns the rights to extract minerals from beach sands in Enare Lappmark. Lutukka

has costs in three areas:

a Payment to a mining subcontractor who charges €80 per tonne of beach sand mined and

returned to the beach (after being processed on the mainland to extract three minerals: ilmen-

ite, rutile and zircon).

b Payment of a government mining and environmental tax of 50 per tonne of beach sand mined.

c Payment to a barge operator. This operator charges €150 000 per month to transport each batch

of beach sand – up to 100 tonnes per batch per day – to the mainland and then return to Enare

Lappmark (that is, 0 – 100 tonnes per day = €150 000 per month; 101 – 200 tonnes = €300 000

per month, and so on). Each barge operates 25 days per month. The €150 000 monthly charge

must be paid even if less than 100 tonnes is transported on any day and even if Lutukka requires

fewer than 25 days of barge transportation in that month.

Lutukka is currently mining 180 tonnes of beach minerals per day for 25 days per month.

Required

1 What is the variable cost per tonne of beach sand mined? What is the fixed cost to Lutukka

per month?

2 Plot one graph of the variable costs and another graph of the fixed costs of Lutukka. Your

plots should be similar to Exhibits 2.4 and 2.5. Is the concept of relevant range applicable to

your plots?

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3 What is the unit cost per tonne of beach sand mined (a) if 180 tonnes are mined each day, or

(b) if 220 tonnes are mined each day? Explain the difference in the unit-cost figures.

2.25 Revenue and cost recording and classifications, ethics (25–30 minutes)

Aran Sweaters Ltd designs and markets wool jumpers to many retailers and distributors around

Europe. Its corporate headquarters are situated in Dublin, Ireland. Manufacturing is done by a

subcontractor (O'Neil's Clothing Ltd) on Achill Island. The local council in Achill Island grants

locally-owned companies a 20% income tax rebate if the ratio of their domestic labour costs

to total costs exceeds 25%. Domestic labour costs are defined as the employment costs of all

employees who are Achill residents. Siobhan Sheridan, the newly appointed controller of Aran

Sweaters, has recently been examining payments made to O'Neil's. She observes that O'Neil's

purchased wool from Aran Sweaters (€3 million in 2022). Aran Sweaters paid O'Neil's €12 million

for the jumpers manufactured on Achill in 2022. Based on her industry experience, the €12 million

amount is very low. She was told it was 'a great deal' for Aran Sweaters. There is also a sizeable

payment by Aran Sweaters to the Swiss subsidiary of O'Neil's (€4.8 million in 2022). Sheridan is

told by the O'Neil's CEO that this payment is for fabric design work that O'Neil does with Aran

Sweaters. Aran Sweaters has included the €4.8 million payments in its own product design cost.

The director of product design at Aran Sweaters told Sheridan it is an 'off-statement' item that

historically he has neither responsibility for nor any say about. To his knowledge, O'Neil's uses

only Aran Sweaters designs with either zero or minimal changes.

O'Neil's domestic labour costs in 2022 were €3.6 million while its total costs were €10 million.

Included in this €3.6 million was €1.3 million for labour fringe benefits (for health insurance,

etc.). A component of this €1.3 million is €600 000 for life insurance for O'Neil's executives.

Aran Sweaters helped arrange this life insurance policy. It negotiated with the insurance company

managing its own executive life insurance plans to include the O'Neil's executives at rates much

more favourable than those available in Achill.

Required

1 What concerns should Sheridan have about the revenue and cost numbers in Aran Sweaters'

financial reports?

2 Which (if any) of the concerns in requirement 1 raise ethical issues for Sheridan? Explain.

3 What steps should Sheridan take to address the ethical issues you identify in requirement 2?

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CHAPTER 3

Job costing

How much does it cost Ernst & Young to audit Yamaha? How much does it cost Kraft to promote its new pre-sliced, cracker-sized cheese? How much

Learning objectives

does it cost Peugeot to manufacture and sell an e-208 all-electric car to a customer? How much does it cost Apple to incorporate wi-fi and Blue-

After studying this chapter, you

tooth within an iPad? Managers ask these questions for many reasons, should be able to:

including formulating overall strategies, determining product and service

- Describe the building block con-

emphasis and pricing, engaging in cost control and meeting external

cept of costing systems

reporting obligations. This chapter presents concepts and techniques that guide the responses to such questions. Chapter 11 will refine some ideas

●

Distinguish between job costing

presented here.

and process costing

Costing systems aim to report cost numbers that indicate the man-

●

Outline a six-step approach to job

ner in which particular cost objects – such as products, services and

costing

customers – use the resources of an organisation. Before we explore the

●

Distinguish actual costing from

details of costing systems, three points are worth noting:

normal costing

1 The cost–benefit–context approach we discussed in Chapter 1 is of

●

Understand job costing in service

relevance in designing and choosing costing systems. The costs of

and manufacturing contexts

elaborate systems, including the costs of educating managers and

- Describe key source documents
- Understand how the steps in the
- Describe alternative methods of

other personnel, can be quite high. Managers may choose to install a
used in job-costing systems
more sophisticated system if they believe that its benefits will
outweigh its costs. In practice, experienced managers tend to act on
production process are tracked in
intuition rather than a fully quantified cost–benefit analysis.
a job-costing system
Behavioural, political and institutional factors generally influence
accounting information systems choice and design.

dealing with period-end under- or
Systems tend to be tailored to the underlying operations and not vice
overallocated indirect costs
versa. Any significant change in underlying operations is likely to justify

a corresponding change in the accompanying costing systems. Systems fail when operating managers perceive them as misleading, useless or incompatible with their management style.

3 Costing systems are only one source of information for managers. Generally, managers combine cost information with non-financial metrics and qualitative information when making decisions.

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The building block concept of costing systems

Let us briefly review some terms introduced in Chapter 2 that we will use in discussing costing systems:

- *Cost object* – anything for which a separate measurement of costs is desired.
- *Direct costs of a cost object* – costs that are related to the particular cost object and can be traced to it in an economically feasible (cost-effective) way.
- *Indirect costs of a cost object* – costs that are related to the particular cost object but cannot be traced to it in an economically feasible (cost-effective) way. Indirect costs are allocated to

the cost object using a cost-allocation method.

The relationship among these three concepts is shown in Exhibit 3.1.

Two concepts not previously defined are also important when discussing costing systems:

● Cost pool – a grouping of individual cost items. Cost pools can range from the very broad (such

as a company-wide total-cost pool for telephones and fax machines) to the very narrow (such

as the costs of operating a car used by a travelling salesperson).

● Cost-allocation base – a factor that is the common denominator for systematically linking an

indirect cost or group of indirect costs to a cost object. A cost-allocation base can be financial

(such as direct-labour costs) or non-financial (such as the number of car kilometres travelled).

Companies often seek to use the cost driver of the indirect costs as the cost-allocation base.

For example, the number of kilometres travelled may be used as the base for allocating motor

vehicle operating costs among different sales districts. Or, for example, if the indirect costs

of operating metal-cutting machines is £500 000 based on running these machines for 10 000

hours, the cost-allocation rate is £500 000 divided by 10 000 hours = £50 where machine-

hours is the cost-allocation base. If a product uses 800 machine-hours, it will be allocated

£40 000, or £50 per machine per hour times 800 machine-hours.

These five terms constitute the building blocks that are considered relevant in the design of costing

systems.

Job-costing and process-costing systems

Companies frequently adopt one of two basic types of costing system to assign costs to products

or services:

● Job-costing system. In this system, costs are assigned to a distinct unit, batch or lot of a prod-

uct or service. A job is a task for which resources are expended in bringing a distinct product

Exhibit 3.1

Relationship between a cost object and direct and indirect costs

Direct

Cost tracing

costs

Cost

Cost

assignment

object

Indirect

Cost allocation

costs

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Job-costing and process-costing systems

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or service to market. The product or service is often custom-made, such as an audit by an

accounting firm or a gearbox system for a particular car system.

● Process-costing system. In this system, the cost object is masses of identical or similar units.

The cost of a product or service is obtained by using broad averages to assign costs to masses

of identical or similar units. The customers all receive the same product (such as teddy bears

or soda ash).

These two types of costing system are best viewed as ends of a continuum:

Job-costing system

Process-costing system

Distinct unit

Masses of identical

of a product

or similar units of a

or service

product or service

Most companies have costing systems that are neither pure job costing nor pure process cost-

ing. Rather, they combine elements of both job costing and process costing. For now, we introduce

these two systems by focusing on their pure versions. Exhibit 3.2 presents examples of job and

process costing in the service, merchandising and manufacturing sectors.

The products or services accounted for with job costing can differ greatly. Accounting firms

typically define individual audits as jobs, which can differ markedly in complexity among cli-

ents. An aircraft assembly company may define an individual aircraft for a specific customer as

a job. Customers usually differ in their specifications about electronic equipment, size of toilet

cubicles, and so on. Consider also job-order costing in bespoke cars production. Many luxury

car brands such as Rolls-Royce, Ferrari and Aston Martin make bespoke cars – cars that are

built to customers' specific specifications. Wealthy buyers are willing to pay millions for a per-

sonalised, one-off car. The Rolls-Royce 'Boat tail' reportedly cost an anonymous patron £202

million. In this market, customers may 'desire to curate, commission and collect' and 'demand

true personalisation in the goods they seek to commission', according to Torsten Müller-Ötvös,

CEO of Rolls-Royce (Harvey, 2017). Such bespoke cars can take more than a year to build due to

their uniqueness. The car-makers incur various types of costs and use job-order costing to track

them. Alex Innes, Head of Rolls-Royce Coachbuild Design, notes that 'The Boat Tail is not about

reaching a destination, it is the destination itself' (Banks, 2021). Encrusting diamonds into the car

requires direct-labour input from an in-house bespoke team of car designers, clay-model makers,

manufacturers, mechanics crew, as well as those of diamond specialists. The direct materials

include the auto parts outsourced from material production companies, such as bodies, roofs,

Exhibit 3.2

Examples of job costing and process costing in the service,

merchandising and manufacturing sectors

Service sector

Merchandising sector

Manufacturing sector

Job costing ● Accounting firm audits ● Sending a catalogue to a ● Aircraft assembly

used

mailing list

● Advertising agency

● Special promotion of a

● House construction

campaigns

new store product

Process

● Deposit processing

● Grain dealing

● Oil refining

costing

● Postal delivery (standard ● Processing new

● Beverages production

items)

magazine subscriptions

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wheels, engines, cooling system and, in this case, diamonds and special paints. Overhead costs

include depreciation of equipment, utilities in the factories and headquarters, R&D, marketing

and executive salaries. Creating bespoke cars in general involves unusual and rare materials, more

crafting and labour input into every process. The costs of making each bespoke car differ due to

their ‘personalised’ nature. A careful track must be kept of all costs involved to ultimately provide

accurate information for pricing and profit-determination purposes. In such cases, the service or

product is distinct and identifiable. Job-costing systems are designed to accommodate the cost

accounting for these individual services or products.

Job costing in service organisations using actual costing

Service-sector companies provide their customers with services or intangible products. Within the

service sector, jobs often differ considerably in terms of their length, complexity and resources

used. Examples include a service call to repair a television, an audit engagement, the making of

a musical and a university research project for a government agency.

Job costing of an audit engagement

Lindsay & Associates is a public accounting firm. Each audit engagement is viewed as an indi-

vidual job. Lindsay bids a fixed fee for each audit in advance of doing the work. A key issue for

Lindsay is the cost of an audit engagement. A record of costs on previous jobs enables it to make

informed estimates of the costs of potential future jobs. The more knowledgeable Lindsay is

about its own costs, the more likely it is to price jobs so that it makes a profit on those accepted.

First, consider the actual costing system Lindsay uses to determine the cost of individual jobs.

Actual costing is a costing method that traces direct costs to a cost object by using the actual

direct-cost rate(s) times the actual quantity of the direct-cost input(s) and allocates indirect costs

based on the actual indirect-cost rate(s) times the actual quantity of the cost-allocation base. The

Tracy Transport audit illustrates actual costing. In November 2022, Lindsay was awarded the 2023

Tracy Transport audit job for a fee of €86 000. The 2023 audit job was done in the January to

March 2023 period and covers Tracy Transport's 2022 financial year.

General approach to job costing

The six steps taken in assigning costs to individual jobs are presented here. They apply equally to

job costing in the service, merchandising or manufacturing sectors.

Step 1: Identify the job that is the chosen cost object In this example, the job is the annual audit

of the financial statements of Tracy Transport.

Step 2: Identify the direct costs for the job Lindsay identifies only one category of direct costs

when costing individual audit jobs – professional labour. Each auditor keeps a daily time record

for tracing professional labour-hours to individual audit jobs. These records show that the Tracy

Transport job used 800 professional labour-hours. The actual direct-labour cost rate is €51 per

hour. The actual direct-labour cost rate is the average rate at which professional labour is paid

(actual total professional compensation divided by actual total direct-labour-hours worked) dur-

ing the period in which the Tracy Transport audit was done. Lindsay traces the actual direct-

labour costs for the Tracy Transport job as €40 800 (€51 × 800).

Step 3: Identify the indirect-cost pools associated with the job Lindsay groups all its individual

indirect costs into a single cost pool called audit support. This cost pool represents all costs in

Lindsay's Audit Support Department. The indirect-cost pool consists of a variety of individual

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costs, such as general audit and secretarial support, which are less predictable and less traceable

to jobs than direct labour. Hence, the actual indirect-cost rate can often only be calculated on

an actual basis at the end of the year. In 2023, indirect costs totalled €12 690 000 (€4 990 000 for

'other-labour-related costs' plus €7 700 000 for 'non-labour-related costs').

Step 4: Select the cost-allocation base to use in allocating each indirect-cost pool to the job

The allocation base selected for the audit support indirect-cost pool is professional labour-hours.

Total professional labour-hours worked in 2023 were 270 000.

Step 5: Develop the rate per unit of the cost-allocation base used to allocate indirect costs

to the job The actual indirect-cost rate for Lindsay in 2023 is €47 per professional labour-hour:

Actual total costs in indirect-cost pool

Actual indirect-cost rate = Actual total quantity of cost-allocation base

€4 990 000

€7 700 000

=

+

270 000

€12 690 000

=

270 000

= €47 per professional labour-hour

The actual indirect costs allocated to the Lindsay audit job are €37 600 (€47 × 800).

Step 6: Assign the costs to the cost object by adding all direct costs and all indirect costs The

information from steps 1 to 5 can now be used to calculate the 2023 actual cost of the Lindsay audit:

Direct job costs traced

Professional labour, €51 × 800

€40 800

Indirect job costs allocated

Audit support, €47 × 800

37 600

€78 400

Recall that Lindsay was paid €86 000 for the 2023 Tracy Transport audit. Thus, the actual costing

system shows a €7600 operating profit (€86 000 − €78 400) on this audit job.

Exhibit 3.3 presents an overview of the Lindsay job-costing system. This exhibit includes the

five building blocks of this chapter: cost object, cost pool, direct costs of a cost object, indirect

costs of a cost object and cost-allocation base. Costing-system overviews like Exhibit 3.3 are

important learning tools. We urge you to sketch one when you need to understand a costing sys-

tem. (The symbols in Exhibit 3.3 are used consistently in the costing-system overviews presented

in this book. For example, a triangle always identifies a direct cost.)

Source documents

Managers and accountants gather the information that goes into their cost systems through source

documents, which are the original records that support journal entries in an accounting system.

Time records are Lindsay's main source documents. All professional staff members record how they

spend each half-hour of the day. At the end of each week, the number of total professional labour-

hours spent on each job (both for the most recent week and the cumulative total since the start of

the job) is tabulated. The accuracy of information on how employees spend their time is impor-

tant, especially in service organisations, where labour costs often make up over half of total costs.

Accounting and law firms often impose penalties on personnel who do not submit accurate time

records when required. Computers simplify the recording and preparation of job cost information.

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Exhibit 3.3

Job-costing overview at Lindsay & Associates

Indirect cost

Audit

pool

support

Indirect

Professional

cost-allocation

labour-hours

base

Cost object:

job of

Indirect costs

auditing

Tracy

Direct costs

Transport

Direct costs

Professional

labour

Normal costing

The difficulty of calculating actual indirect-labour costs for each job means that Lindsay &

Associates has to wait until the end of 2023 to calculate the actual costs on individual jobs done

in 2023. Managers often want more timely information about ‘actual’ job costs. This demand

for more timely information has prompted the use of alternatives to the actual costing method

described earlier in this chapter. The alternatives are practical responses to the desire for a timely

approximation of average actual costs of various jobs. Now we discuss normal costing, whereby

budgeted rather than actual amounts are used to calculate indirect-cost rates. The following 2023

budgeted data pertain to the total operations of Lindsay & Associates:

Budget

Total professional labour-hours worked

288 000

Direct costs

Total professional labour costs

€14 400 000

Indirect costs

Total other labour-related costs

5 328 000

Total non-labour-related costs

7 632 000

€12 960 000

Exhibit 3.4 provides details underlying these amounts.

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Exhibit 3.4

Income statement for Lindsay & Associates: 2023 budget and 2023 actual results

	2023 Budget	2023 Actual
Revenues	€33 120	€29 700
Costs		
Professional labour costs	14 400	13 770
Other labour-related costs		
Office staff	€2 030	€1 840

Information specialists

1 008

1 230

Administrative

1 252

1 100

Other

1 038

5 328

820

4 990

Non-labour-related costs

Professional liability insurance

2 160

2 069

Professional development

880

540

Occupancy

2 000

1 913

Telephone/fax/copying

1 430

1 530

Travel

770

718

Other

392

7 632

930

7 700

Total costs

27 360

26 460

Operating profit

€5 760

€3 240

A normal costing method traces direct costs to a cost object by using the actual direct-cost

rate(s) times the actual quantity of the direct-cost input and allocates indirect costs based

on the budgeted indirect-cost rate(s) times the actual quantity of the cost-allocation base(s).

Both actual costing and normal costing trace direct costs to jobs in the same way. For the

Lindsay & Associates 2023 audit of Tracy Transport, the actual direct costs traced equal

€40 800 – the actual direct-cost rate of €51 per professional labour-hour times the actual

quantity of 800 hours.

The difference between the actual costing and normal costing methods is that actual costing

uses an actual indirect-cost rate, while normal costing uses a budgeted indirect-cost rate to cost

jobs. Recall that Lindsay & Associates groups all its individual indirect costs into a single cost

pool called audit support. The budgeted amount for audit support in 2023 is €12 960 000. The

allocation base for the audit support indirect-cost pool is professional labour-hours. In 2023, the

budgeted quantity is 288 000 hours. The budgeted indirect-cost rate for 2023 is €45 per profes-

sional labour-hour:

Budgeted total costs in indirect-cost pool

Budgeted indirect-cost rate = Budgeted total quantity of cost-allocation base

€5 328 000

€7 632 000

=

+

288 000 hours

€12 690 000

= 288 000 hours

= €45 per professional labour-hour

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Chapter 3 Job costing

Under normal costing, each hour of professional labour on jobs in 2023 is assigned the actual

direct-cost rate of €51 and the budgeted indirect-cost rate of €45. The 2023 cost of the Tracy

Transport audit using normal costing is €76 800:

Direct job costs traced

Professional labour, €51 × 800

€40 800

Indirect job costs allocated

Audit support, €45 × 800

36 000

€76 800

Normal costing uses actual direct costs because these costs are known and can be quickly traced

to a job. Indirect costs, by definition, cannot be traced to jobs. Moreover, actual indirect costs

are less predictable and not known until the end of the year. Normal costing uses budgeted rates

for indirect costs to estimate or approximate the actual indirect costs of a job soon after the job

is completed.

The building industry illustrates the use of normal costing. Here, materials are purchased

at a price known at the purchase date and labour is paid on an hourly rate basis that is set

at the time workers are hired. Actual cost information on both major direct-cost catego-

ries can thus be calculated as construction takes place. Indirect costs are allocated using a

budgeted rate.

Note that normal costing uses a predetermined (budgeted) rate for allocating indirect costs,

€45 here. In contrast, actual costing used a €47 rate. Later in the book, we'll discuss alternative

approaches to accounting for these differences when reporting individual job costs and when

preparing income statements and balance sheets.

Job costing in manufacturing

We now discuss job costing in manufacturing. This includes a transaction-by-transaction sum-

mary of how a costing system tracks the purchase of manufacturing inputs, their conversion into

work in progress and then into finished goods and finally their sale. The six-step approach to job

costing illustrated above is also applicable to the manufacturing sector. We illustrate this approach

using the Wallace Company, which manufactures specialised machinery for the papermaking

industry at its Glasgow plant. Wallace uses a normal costing method – that is, actual costs for

direct-cost items and budgeted costs for indirect-cost items.

Step 1: Identify the job that is the chosen cost object The job in this case is a pulp machine

manufactured for the Merseyside Paper Company in 2023.

Step 2: Identify the direct costs for the job Wallace identifies two direct manufacturing cost

categories: direct materials and direct manufacturing labour.

Step 3: Identify the indirect-cost pools associated with the job For product-costing purposes,

Wallace uses a single indirect manufacturing cost pool termed manufacturing overhead. This

pool represents the indirect costs of the Glasgow Manufacturing Department. It includes items

such as depreciation on equipment, energy costs, indirect materials and indirect manufacturing

labour and salaries.

Step 4: Select the cost-allocation base to use in allocating each indirect-cost pool to the job

Wallace uses machine-hours as the allocation base for manufacturing overhead.

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Step 5: Develop the rate per unit of each cost-allocation base used to allocate indirect costs to

the job Wallace budgets 2023 manufacturing overhead costs to be €1 280 000 and the 2023 quan-

tity of machine-hours as 16 000. Hence, the 2023 budgeted indirect-cost rate for manufacturing

overhead is €80 per machine-hour (€1 280 000 ÷ 16 000 hours).

Step 6: Assign the costs to the cost object by adding all direct costs and all indirect costs The

cost of the machine job for Merseyside Paper is €10 135.

Direct manufacturing costs

Direct materials

€4 606

Direct manufacturing labour

1 329

€5 935

Indirect manufacturing costs

Manufacturing overhead

(€80 × 52.5 machine-hours)

4 200

Total manufacturing costs of job

€10 135

Exhibit 3.5 presents an overview of the job-costing system for the manufacturing costs of the

Wallace Company.

Wallace uses its job-costing system to help manage the costs in its Glasgow Manufacturing

Department as well as to determine the cost of individual jobs such as the Merseyside Paper

machine. The Manufacturing Department is an important cost object, as is each job manufac-

tured. The relationship between these two important goals of a job-costing system is shown in

Exhibit 3.6.

Exhibit 3.5

Job-costing overview for manufacturing costs at the Wallace

Company

Indirect cost

Manufacturing

pool

overhead

Cost-allocation

Machine-hours

base

Cost object:

Indirect costs

specialised

machinery

Direct costs

Direct costs

Direct

Direct

materials

manufacturing

labour

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Exhibit 3.6

Department and job costing at the Wallace Company

Direct-cost tracing

Direct

material

Direct-cost tracing

Direct

manufacturing

Cost object:

labour

manufacture of

specialised

machinery job for

Depreciation on

Merseyside Paper

plant and equipment

Energy costs

Cost object:

Indirect-cost

Glasgow plant

allocation

manufacturing

Indirect

department

manufacturing labour

Other indirect

manufacturing costs

Source documents

Source documents are the original records that support journal entries in an accounting system.

The key source document in a job-costing system is a job cost record (also called a job cost sheet).

This document records and accumulates all the costs assigned to a specific job. Exhibit 3.7, Panel

A, shows a typical job cost record at the Wallace Company. Source documents also exist for

individual items in a job cost record. Consider direct materials. The basic source document is a

materials requisition record, which is a form used to charge departments and job cost records for

the cost of the materials used on a specific job. Panel B shows a materials requisition record for

the Wallace Company. The basic source document for direct manufacturing labour is a labour

time record, which is used to charge departments and job cost records for labour time used on a

specific job. Panel C in Exhibit 3.7 shows a typical labour time record for the Wallace Company.

The reliability of job cost records depends on the reliability of the inputs. Problems occurring

in this area include materials recorded on one job being ‘borrowed’ and used on other jobs and

erroneous job numbers being assigned to material or labour inputs.

In many costing systems, the source documents exist only in the form of computer records.

With barcoding and other forms of online information recording, the materials and time used on

jobs are increasingly being recorded without human intervention.

An illustration of a job-costing system in manufacturing

We will use the Wallace Company to illustrate in some detail how a job-costing system operates

in manufacturing. Recall that its job-costing system has two direct-cost categories (direct mate-

rials and direct manufacturing labour) and one indirect-cost pool (manufacturing overhead). See

Exhibit 3.7. We will shortly consider events that took place in September 2023. But first, before

we look at specific journal entries, let's briefly consider job costing in relation to the two financial

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An illustration of a job-costing system in manufacturing

Exhibit 3.7

Source documents at the Wallace Company: Job cost record,

materials requisition record and labour time record

Panel A

JOB COST RECORD

JOB NO:

WPP298

CUSTOMER:

Merseyside Paper

Date started:

7 Feb. 2023

Date completed:

3 April 2023

DIRECT MATERIALS

Materials

Date

Quantity

Unit

requisition no.

Part no.

received

used

cost

3 2015:198

MB 468-A

9 Feb. 2023

8

€14

€112

2015:268

TB 267-F

11 Feb. 2023

12

€63

756

Total

€4606

DIRECT MANUFACTURING LABOUR

Labour time

Employee

Hours

Hourly

record no.

no.

used

rate

3 LT 232

551-87-3076

023

25

€18

€450

LT 247

287-31-4671

023

16

18

288

Total

€1329

MANUFACTURING OVERHEAD

Cost pool

Allocation

Allocation base

Allocation

category

base

units used

base rate

Manufacturing

Machine-hours

52.50

€80

€4200

Total

€4200

TOTAL BILLABLE JOB COST

€10135

Panel B

Panel C

MATERIALS REQUISITION RECORD

LABOUR TIME RECORD

Labour time record no: LT 232

Materials requisition record no: 2023:198

Job No: WPP 298 Date: 9 Feb. 2023

Employee name: G.L. Cook Employee no: 551-87-3076

Part

Part

Unit

Total

no.

description

Quantity

cost

cost

Employee classification code: Grade 3 Machinist

MB468-A

Metal brackets

8

€14

€112

Week start: 16 Feb. 2023 Week end: 22 Feb. 2023

Issued by:

Date: 9 Feb. 2023

Received by:

Date: 9 Feb. 2023

Job. no.

M

T

W

Th

F

S

Su

Total

WPP298

4

8

3

6

4

0

0

25

Supervisor: Date: 23 Feb. 2023

reports – the balance sheet and the income statement – which we come back to later in the book.

Exhibit 3.8 shows the flow of inventoriable costs from the purchase of materials and other man-

ufacturing inputs to their conversion into work-in-process and finished goods, to the sale of fin-

ished goods. Direct materials used and direct manufacturing labour can be easily traced to jobs.

They become part of work-in-process inventory on the balance sheet because direct manufacturing

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Exhibit 3.8

Flow of costs in job costing

BALANCE SHEET

INCOME STATEMENT

Revenues

Purchases of

Direct Materials

Traced

When

Conversion

Conversion

sales

Direct Manufacturing Labour

to

Inventoriable

into

into

occur

Cost of Goods Sold

Costs:

Work-in-Process

Finished Goods

Manufacturing Overhead

Allocated

Inventory

Inventory

Including Indirect Materials

to

and Indirect Manufacturing

Labour

Period

Marketing Expense

Costs:

Customer-Service Expense

labour transforms direct materials into another asset, work-in-process inventory. Wallace also incurs

manufacturing overhead costs (including indirect materials and indirect manufacturing labour) to

convert direct materials into work-in-process inventory. The overhead (indirect) costs, however,

cannot be easily traced to individual jobs. As we described earlier in this chapter, manufacturing

overhead costs are first accumulated in a manufacturing overhead account and then allocated to

individual jobs. As manufacturing overhead costs are allocated, they become part of work-in-pro-

cess inventory. When individual jobs are completed, work-in-process inventory becomes another

balance sheet asset, finished-goods inventory. Only when finished goods are sold is the expense of

cost of goods sold recognised in the income statement and matched against revenues earned. The

lower part of Exhibit 3.8 shows the period costs – marketing and customer-service costs. These

costs do not create any assets on the balance sheet because they are not incurred to transform

materials into a finished product. Instead, they are expensed in the income statement, as they are

incurred to best match revenues. Let's now consider the specific job-order costing transactions.

General ledger and subsidiary ledgers

As we have noted, a job-costing system has a separate job cost record for each job. This record is

typically found in a subsidiary ledger. The general ledger combines these separate job cost records

in the Work-in-Progress Control account, which pertains to all jobs undertaken.

Exhibit 3.9 shows T-account relationships for the Wallace Company's general ledger and

illustrative records in the subsidiary ledgers. Panel A shows the general ledger section that gives

a 'bird's-eye view' of the costing system; the amounts are based on the illustration that follows.

Panel B shows the subsidiary ledgers and the basic source documents that contain the underlying

details – the 'worm's-eye view'. General ledger accounts with the word *control* in their titles (such

as Materials Control and Creditors Control) are supported by underlying subsidiary ledgers.

Software programs guide the processing of transactions in most accounting systems. Some programs

make general ledger entries simultaneously with entries in the subsidiary ledger accounts. Other soft-

ware programs make general ledger entries at, say, weekly or monthly intervals, with entries made in the

subsidiary ledger accounts on a more frequent basis. The Wallace Company makes entries in its sub-

sidiary ledger when transactions occur and then makes entries in its general ledger on a monthly basis.

A general ledger should be viewed as only one of many tools that assist management in planning

and control. To control operations, managers not only use the source documents in the subsidiary

ledgers, they also study non-financial variables such as the percentage of jobs requiring rework.

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An illustration of a job-costing system in manufacturing

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Exhibit 3.9

Manufacturing job-costing system using normal costing diagram of ledger

relationships for September 2023

Panel A: General ledger

Panel B: Subsidiary ledgers

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Chapter 3 Job costing

Explanations of transactions

The following transaction-by-transaction summary analysis explains how a job-costing system

serves the twin goals of (1) department responsibility and control, and (2) product costing. These

transactions track stages (a) to (d):

(a)

(b)

(c)

(d)

Purchases of

Conversion

Conversion

materials and

into

into

Sale of

other

work in

finished

finished

manufacturing

progress

goods

goods

inputs

stock

It is the existence of stages (b) and (c) that makes the costing of manufactured products more

detailed than the costing of services and merchandise described earlier.

1 *Transaction*: Purchases of materials (direct and indirect), €89 000 on account.

Analysis: The asset Materials Control is increased. The liability Creditors Control is increased.

Both accounts have the word control in their title in the general ledger because they are sup-

ported by records in the subsidiary ledger. The subsidiary records for materials at the Wallace

Company – called Materials Records – maintain a continuous record of additions to, and

reductions from, stock. At a minimum, these records would contain columns for quantity

received, issuance to jobs and balance (see Panel B of Exhibit 3.9). There is a separate subsid-

iary materials record for each type of material in the subsidiary ledger. The following journal

entry summarises all the September 2023 entries in the materials subsidiary ledgers:

Journal Entry:

Materials Control

89 000

Creditors Control

89 000

Post to General Ledger:

Materials Control

Creditors Control

a

89 000

a

89 000

Materials Control includes all material purchases, whether the items are classified as direct or

indirect costs of products.

2 *Transaction*: Materials sent to manufacturing plant floor: direct materials, €81 000 and indirect

materials, €4000.

Analysis: The accounts Work-in-Progress Control and Manufacturing Overhead Control are

increased. The account Materials Control is decreased. The assumption is that costs incurred

on the work in progress ‘attach’ to the work in progress, thereby making it a more valuable

asset. Responsibility is fixed by using materials requisition records as a basis for charging

departments for the materials issued to them. Requisitions are accumulated and posted

monthly to the general ledger at the Wallace Company. As direct materials are used, they are

charged to individual job records, which are the subsidiary ledger accounts for the Work-

in-Progress Control account in the general ledger account. Indirect materials are charged to

individual Manufacturing Departments' overhead cost records, which comprise the subsidi-

ary ledger for Manufacturing Overhead Control at the Wallace Company. The cost of these

indirect materials is allocated to individual jobs as a part of the Manufacturing Overhead.

The Manufacturing Overhead Control account is the record of the actual costs in all the indi-

vidual overhead categories.

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Each indirect-cost pool in a job-costing system will have its own account in the general ledger.

Wallace has only one indirect-cost pool: manufacturing overhead.

Journal Entry:

Work-in-Progress Control

81 000

Manufacturing Overhead Control

4 000

Materials Control

85 000

Post to General Ledger:

Materials Control

Work-in-Progress Control

a

89 000 **b** 85 000 **b**

81 000

Manufacturing Overhead Control

b

4 000

3 *Transaction*: Manufacturing labour wages liability incurred, direct (€39 000) and indirect (€15 000).

Analysis: The accounts Work-in-Progress Control and Manufacturing Department Overhead

Control are increased. Wages Payable Control is also increased. Labour time records are used

to trace direct manufacturing labour to Work-in-Progress Control (see Panel B of Exhibit 3.9)

and to accumulate the indirect manufacturing labour in Manufacturing Department Overhead

Control. The indirect manufacturing labour is, by definition, not being traced to the individual

job. Department managers are responsible for making efficient use of available labour.

Journal Entry:

Work-in-Progress Control

39 000

Manufacturing Overhead Control

15 000

Wages Payable Control

54 000

Post to General Ledger:

Wages Payable Control

Work-in-Progress Control

c 54 000 **b**

81 000

c

39 000

Manufacturing Overhead Control

b

4 000

c

15 000

4 *Transaction*: Payment of total manufacturing payroll for the month, €54 000. (For simplicity,

payroll withholdings from employees are ignored in this example.)

Analysis: The liability Wages Payable Control is decreased. The asset Cash Control is decreased.

*Journal Entry***:**

Wages Payable

54 000

Cash Control

54 000

*Post to General Ledger***:**

Wages Payable Control

Cash Control

d

54 000 **c**

54 000

d

54 000

For convenience here, wages payable for the month is assumed to be completely paid at

month-end.

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5 *Transaction:* Additional manufacturing overhead costs incurred during the month, €75 000.

These costs consist of utilities and repairs, €23 000; insurance expired, €2000; and depreciation

on equipment, €50 000.

Analysis: The indirect-cost account of Manufacturing Overhead Control is increased. The liability

Creditors Control is increased, the asset Prepaid Insurance Control is decreased and the asset Equip-

ment is decreased by means of a related contra asset account Accumulated Depreciation Control.

The detail of these costs is entered in the appropriate columns of the individual manufacturing

overhead cost records that make up the subsidiary ledger for Manufacturing Overhead Control.

The source documents for these distributions include invoices (for example, an electricity bill) and

special schedules (for example, a depreciation schedule) from the accounting officer responsible.

Journal Entry:

Manufacturing Overhead Control

75 000

Creditors Control

23 000

Accumulated Depreciation Control

50 000

Prepaid Insurance Control

2 000

Post to General Ledger:

Creditors Control

Manufacturing Overhead Control

a

89 000 **b**

4 000

e

23 000 **c**

15 000

e

75 000

Accumulated Depreciation Control

Prepaid Insurance Control

e

50 000

e 2 000

6 *Transaction*: Allocation of manufacturing overhead to products, €80 000.

Analysis: The asset Work-in-Progress Control is increased. The indirect-cost account of Man-

ufacturing Overhead Control is, in effect, decreased by means of its contra account, called

Manufacturing Overhead Allocated. This is the record of manufacturing overhead allocated to

individual jobs on the basis of the budgeted rate multiplied by actual units used of the allo-

cation base. It comprises all manufacturing costs that are assigned to a product (or service)

using a cost-allocation base because they cannot be traced to it in an economically feasible way.

The 2023 budgeted overhead rate used by Wallace is €80 per machine-hour. The overhead cost

allocated to each job depends on the machine-hours used on that job. The job record for each

individual job in the subsidiary ledger will include a debit item for manufacturing overhead

allocated. It is assumed that 1000 machine-hours were used for all jobs, resulting in a total

manufacturing overhead allocation of 1000 × €80 = €80 000.

Note that a subsidiary entry is made for Manufacturing Overhead Allocated when machine-

hours are used on a job. These entries are made to the individual job records in the subsidiary

ledger. In contrast, subsidiary entries are made for Manufacturing Overhead Control when

actual transactions occur during the period.

Journal Entry:

Work-in-Progress Control

80 000

Manufacturing Overhead Allocated

80 000

Post to General Ledger:

Manufacturing Overhead Allocated

Work-in-Progress Control

f 80 000

b

81 000

c

39 000

f

80 000

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7 *Transaction*: Completion and transfer to finished goods of eight individual jobs, €188 800.

Analysis: The asset Finished Goods Control is increased. The asset Work-in-Progress Control

is decreased. The total costs of each job are calculated in the subsidiary ledger as each job is

completed. Given Wallace's use of a normal costing method, this total will consist of actual

direct materials, actual direct manufacturing labour and budgeted manufacturing overhead

that is allocated to each job.

Journal Entry:

Finished Goods Control

188 800

Work-in-Progress Control

188 800

Post to General Ledger:

Work-in-Progress Control

Finished Goods Control

b

81 000 **g**

188 800

g

188 800

c

39 000

f

80 000

8 *Transaction*: Cost of Goods Sold, €180 000.

Analysis: The €180 000 amount represents the cost of goods sold in sales transactions with

customers during September 2023. The account Cost of Goods Sold is increased. The asset

Finished Goods Control is decreased.

Journal Entry:

Cost of Goods Sold

180 000

Finished Goods Control

180 000

Post to General Ledger:

Finished Goods Control

Cost of Goods Sold

g

188 800 **h**

180 000 **h**

180 000

Information technology gives managers quick and accurate job-costing information, making it

easier for them to manage and control jobs. Consider, for example, the direct materials charged

to jobs. Managers control these costs as materials are purchased and used. Using Electronic

Data Interchange (EDI) technology, companies like Wallace order materials from their suppli-

ers by clicking a few keys on a computer keyboard. EDI, an electronic computer link between

a company and its suppliers, ensures that the order is transmitted quickly and accurately with

minimal paperwork and costs. A bar code scanner records the receipt of incoming materials,

and a computer matches the receipt with the order, prints out a check to the supplier, and

records the materials received. When an operator on the production floor transmits a request

for materials via a computer terminal, the computer prepares a materials requisition record,

instantly recording the issue of materials in the materials and job cost records. Each day, the

computer sums the materials requisition records charged to a particular job or manufactur-

ing department. A performance report is then prepared monitoring the actual costs of direct

materials. The use of direct materials can be reported hourly if managers believe the benefits

exceed the cost of such frequent reporting.

Similarly, information about direct manufacturing labour is obtained as employees log into

computer terminals and key in job numbers, their employee numbers, and the start and end

times of their work on different jobs. The computer automatically prints the labour time record

and, using hourly rates stored for each employee, calculates the direct manufacturing labour

costs of individual jobs. Information technology can also give managers instant feedback to

help them control manufacturing overhead costs, jobs in process, jobs completed, and jobs

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shipped and installed at customer sites. In retail settings particularly, many companies have

turned to ‘Automated Replenishment’ (AR) systems that harness real world, historical sales

data to manage the required reorder levels for store replenishment as well as the optimum

inventory to purchase from suppliers (see also Chapter 21 on economic order quantity determi-

nation). In addition to producing the numbers, the AR system can also automate the physical

processes of stock transfers and purchase order generation. This is undertaken by intelligent

AI algorithms that combines real-time data analysis based on a multitude of metrics across

stores and e-commerce activities like daily sales, supplier lead times and current stock levels.

Such systems can be set to either automatically order or suggest to humans replenishment

possibilities as a guide to decisions.

At this point, please pause and review all entries in the illustration. Be sure to trace each journal

entry, step by step, to the general-ledger accounts in the general ledger section in Panel A of

Exhibit 3.9.

Budgeted indirect costs and end-of-period adjustments

Budgeted indirect-cost rates have the advantage of being more timely than actual indirect-cost

rates. With budgeted rates, indirect costs can be assigned to individual jobs on an ongoing basis,

rather than waiting until the end of the accounting period when actual costs will be known.

However, the disadvantage of budgeted rates is that they will probably be inaccurate, having been

made up to 12 months before actual costs are incurred. We now consider adjustments made when

the indirect costs allocated differ from the actual indirect costs incurred.

Underallocated indirect costs occur when the allocated amount of indirect costs in an accounting

period is less than the actual (incurred) amount in that period. Overallocated indirect costs occur

when the allocated amount of indirect costs in an accounting period exceeds the actual (incurred)

amount in that period.

Under or overallocated indirect costs = Indirect costs incurred − Indirect costs allocated

Equivalent terms are underapplied (or overapplied) indirect costs and underabsorbed (or overab-

sorbed) indirect costs.

The Wallace Company has a single indirect-cost pool (Manufacturing Overhead) in its

job-costing system. There are two indirect-cost accounts in its general ledger that pertain to

manufacturing overhead:

● Manufacturing Overhead Control, which is the record of the actual costs in all the individual

overhead categories (such as indirect materials, indirect manufacturing labour, power and rent).

● Manufacturing Overhead Allocated, which is the record of the manufacturing overhead allo-

cated to individual jobs on the basis of the budgeted rate multiplied by actual machine-hours.

Assume the following annual data for the Wallace Company:

Manufacturing Overhead Control

Manufacturing Overhead Allocated

Bal. 31 Dec. 2023 1 200 000

Bal. 31 Dec. 2023 1 000 000

The €80 budgeted indirect-cost rate is calculated by dividing budgeted manufacturing overhead

of €1 280 000 (the numerator) by the 16 000 budgeted quantity of machine-hours (the denomi-

nator). The €1 200 000 debit balance in Manufacturing Overhead Control is the sum of all the

actual costs incurred for manufacturing overhead in 2023. The €1 000 000 credit balance in Man-

ufacturing Overhead Allocated results from 12 500 actual machine-hours worked on all the jobs

in 2023 times the budgeted rate of €80 per hour.

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Budgeted indirect costs and end-of-period adjustments

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The €200 000 difference (a net debit) is an underallocated amount because actual manufactur-

ing overhead costs exceed the allocated amount. This €200 000 difference in 2023 arises from two

reasons related to the computation of the €80 budgeted hourly rate:

1 *Numerator reason* (*budgeted indirect costs*). Actual manufacturing overhead cost of €1 200 000

is less than the budgeted amount of €1 280 000.

2 *Denominator reason* (*budgeted quantity of allocation base*). Actual machine-hours of 12 500

are less than the budgeted amount of 16 000 hours.

There are two main approaches to disposing of this €200 000 underallocation of manufacturing

overhead in Wallace's costing system: (1) the adjusted allocation rate approach and (2) the pro-

ration approach.

Concepts in action

Better job costing through big data and data analytics

Across the globe, companies are looking to glean meaningful

intelligence from large data sets and translate that into com-

petitive advantage. Among Fortune 1000 companies, 73% are

currently leveraging big data to decrease their expenses. One

way companies can achieve this is by using big data and data

analytics to improve their job costing.

Thanks to big data, companies can now analyse millions of

internal and external data points to identify the costs and rev-

enues associated with various activities. By aggregating all this

data and benchmarking it against historical performance and

current activities, it is possible to extract meaningful informa-

tion about the profitability of doing certain work. Using big

data, it is possible to accurately answer specific questions like whether a construction company should bid on a job

or whether a consulting firm should hire another business development person.

Companies effectively leveraging data-driven decision making are, on average, 5% more productive and 6% more

profitable than their competitors. As a result, new software programs are using big data to help companies improve

their job costing capabilities to ensure that each new job is a profitable job.

Sources: Andrew McAfee and Erik Brynjolfsson (2012) 'Big data: The management revolution', *Harvard Business Review,* October (https://hbr.org/2012/10/

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& costing Tool to Australian agencies', 20 January, Sydney, Australia (https://www.thevirtugroup.com/2017/01/20/tangram-partnership).

Adjusted allocation rate approach

The adjusted allocation rate approach, in effect, restates all entries in the general ledger by using actual

cost rates rather than budgeted cost rates. First, the actual indirect-cost rate is calculated at the end of

each period. Then, every job to which indirect costs were allocated during the period has its amount

recalculated using the actual indirect-cost rate (rather than the budgeted indirect-cost rate). Finally,

end-of-period closing entries are made. The result is that every single job cost record – as well as the

closing stock and cost of goods sold accounts – accurately represents actual indirect costs incurred.

The widespread adoption of computerised accounting systems has greatly reduced the cost

of using the adjusted allocated rate approach. Consider the Wallace Company example. The

actual manufacturing overhead (€1 200 000) exceeds the manufacturing overhead allocated

(€1 000 000) by 20%. The actual 2023 manufacturing overhead rate was €96 per machine-hour

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(€1 200 000 ÷ 12 500 machine-hours) rather than the budgeted €80 per machine-hour. At year-

end, Wallace could increase the 2023 manufacturing overhead allocated to each job in that year

by 20% using a single software directive. The directive would apply to the subsidiary ledger as

well as to the general ledger. This approach increases the accuracy of each individual product cost

amount and the accuracy of the end-of-year account balances for stocks and cost of goods sold.

This increase in accuracy is an important benefit. After-the-fact analysis of individual product

profitability can provide managers with useful insights for future decisions about product pricing

and about which products to emphasise. Such decisions are improved by having more accurate

product-profitability numbers on prior jobs.

Proration approach

Proration is the term we use to refer to spreading of under- or overallocated overhead among closing

stocks and cost of goods sold. Consider the Wallace Company where manufacturing overhead is allo-

cated on the basis of machine-hours. Materials are not allocated any overhead costs. It is not until

materials are put into work in progress that machining of them commences. Only the closing work-in-

progress and finished goods stocks will have an allocated manufacturing overhead component. Hence,

in our Wallace example, it is only these two Closing Stock accounts (and Cost of Goods Sold) for which

end-of-period proration is an issue. Assume the following actual results for the Wallace Company in 2023:

Manufacturing Overhead Allocated

End-of-year balances

component of year-end balances

(before proration)

(before proration)

Work in Progress

€50 000

€13 000

Finished Goods

75 000

25 000

Cost of Goods Sold

2 375 000

962 000

€2 500 000

€1 000 000

There are three methods for prorating the underallocated €200 000 manufacturing overhead at

the end of 2023.

Method 1

Proration is based on the total amount of indirect costs allocated (before proration) in the closing

balances of Work in Progress, Finished Goods and Cost of Goods Sold. In our Wallace Company

example, the €200 000 underallocated overhead is prorated over the three pertinent accounts in

proportion to their total amount of indirect costs allocated (before proration) in column 3 in the

following table, resulting in the closing balances (after proration) in column 5.

Indirect costs

Account

allocated

balance component in

Proration of €200 000

(before the balance in

Manufacturing Overhead

Account balance

proration) column (2)

Underallocated

(after proration)

(1)

(2)

(3)

(4)

(5) = (2) + (4)

Work in Progress

€50 000

€13 000

(1.3%) 0.013 × €200 000 =

€2 600

€52 600

Finished Goods

75 000

25 000

(2.5%) 0.025 × 200 000 =

5 000

80 000

Cost of Goods Sold 2 375 000

962 000

(96.2%) 0.962 × 200 000 = 192 400

2 567 400

€2 500 000

€1 000 000

(100.0%)

(100.0%)1.000 ×

€200 000

€2 700 000

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Budgeted indirect costs and end-of-period adjustments

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The journal entry for this proration would be:

Work-in-Progress Control

2 600

Finished Goods Control

5 000

Cost of Goods Sold

192 400

Manufacturing Overhead Allocated

1 000 000

Manufacturing Overhead Control

1 200 000

This journal entry results in the 2023 closing balances for Work in Progress, Finished Goods and

Cost of Goods Sold being restated to what they would have been had actual cost rates rather

than budgeted cost rates been used. Method 1 reports the same 2023 closing balances as does the

adjusted allocation rate approach.

Method 2

Proration is based on total closing balances (before proration) in Work in Progress, Finished

Goods and Cost of Goods Sold. In our Wallace Company example, the €200 000 underallocated

overhead is prorated over the three pertinent accounts in proportion to their total closing bal-

ances (before proration) in column 2 in the following table, resulting in the closing balances (after

proration) in column 4:

Account

balance

Proration of €200 000

(before

Manufacturing Overhead

Account balance(after

proration)

Underallocated

proration)

(1)

(2)

(3)

(4) = (2) + (3)

Work in Progress

€50 000

(2%) 0.02 × €200 000 =

€4 000

€54 000

Finished Goods

75 000

(3%) 0.03 × 200 000 =

6 000

81 000

Cost of Goods Sold 2 375 000

(95%) 0.95 × 200 000 =

190 000

2 565 000

€2 500 000

100% 1.00

€200 000

€2 700 000

For example, work in progress is 2% of the €2 500 000 total, so we allocate 2% of the under-

allocated amount (0.02 × €200 000 = €4000) to work in progress.

The journal entry for this proration would be:

Work-in-Progress Control

4 000

Finished Goods Control

6 000

Cost of Goods Sold

190 000

Manufacturing Overhead Allocated

1 000 000

Manufacturing Overhead Control

1 200 000

Note that if manufacturing overhead had been overallocated, the Work in Progress, Finished

Goods and Cost of Goods Sold accounts would be decreased (credited) instead of increased

(debited).

Method 3

Proration is based on year-end write-off to Cost of Goods Sold. Here the total under- or overallo-

cated overhead is included in this year's Cost of Goods Sold. In our Wallace Company example,

the journal entry would be:

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Chapter 3 Job costing

Cost of Goods Sold

200 000

Manufacturing Overhead Allocated

1 000 000

Manufacturing Overhead Control

1 200 000

Wallace's two Manufacturing Overhead accounts are closed out with all the difference between

them now included in Cost of Goods Sold. The Cost of Goods Sold after proration is €2 375 000

before proration + €200 000 underallocated overhead amount = €2 575 000.

Choice among approaches

Choice among the approaches should be guided by how the resultant information is to be used.

The reported account balances under the approaches are:

Proration approach

Method 1:

Proration based Proration on indirect costs

Method 2:

Method 3:

Adjusted allocation allocated component of based on total ending Write-off to Cost

rate approach

ending balances

balances

of Goods Sold

Work in Progress

€52 600

€52 600

€54 000

€50 000

Finished Goods

80 000

80 000

81 000

75 000

Cost of Goods Sold

2 567 400

2 567 400

2 565 000

2 575 000

€2 700 000

€2 700 000

€2 700 000

€2 700 000

If managers wish to develop the most accurate record of individual job costs for profitability

analysis purposes, the adjusted allocation rate approach is preferred. The proration approaches

do not make any adjustment to individual job cost records.

If the purpose is confined to reporting the most accurate stock and cost of goods sold figures,

either the adjusted allocation rate or the method 1 proration should be used. Both give the same

ending balances of Work in Progress, Finished Goods and Cost of Goods Sold that would have

been reported had an actual indirect-cost rate been used. Method 2 is frequently justified as

being a lower-cost way of approximating the results from method 1. The implicit assumption in

method 2 is that the ratio of manufacturing overhead costs allocated to total manufacturing costs

is similar in Work in Progress, Finished Goods and Cost of Goods Sold. Where this assumption is

not appropriate, method 2 can yield numbers quite different from those of method 1. Many com-

panies use method 3 for several reasons. First, it is the simplest. Second, the three methods often

result in similar amounts for ending Work in Progress, Finished Goods and Cost of Goods Sold.

This section has examined end-of-period adjustments for under- or overallocated indirect costs.

The same issues also arise when budgeted direct-cost rates are used and end-of-period adjustments

must be made.

Summary

The following points are linked to the chapter's learning objectives.

1 The building blocks of a costing system are cost object, direct costs, indirect costs, cost pool and cost-allocation

base. Costing-system overview diagrams present these concepts in a systematic way. Costing systems aim to

report cost numbers that reflect the way that chosen cost objects (such as products, services or customers) use

the resources of an organisation.

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References

2 Job-costing systems assign costs to a distinct unit of a product or service. In contrast, process-costing systems

assign costs to masses of similar units and calculate unit costs on an average basis. These two costing systems are

best viewed as opposite ends of a continuum. The costing systems of many companies combine some elements

of both job costing and process costing.

3 A general approach to job costing involves identifying (a) the job, (b) the direct-cost categories, (c) the indirect-cost

categories, (d) the cost-allocation bases, (e) the cost-allocation rates, and (f) adding all direct and indirect costs.

4 Actual costing and normal costing differ in their use of actual or budgeted indirect-cost rates.

Actual costing

Normal costing

Direct-cost rates

Actual rates

Actual rates

Indirect-cost rates

Actual rates

Budgeted rates

Both methods use actual quantities of direct-cost inputs and actual quantities of the allocation bases for allocating

indirect costs.

5 Costing systems aim to report cost numbers that reflect the way chosen cost objects use the resources of an

organisation. This is the case for service, merchandising and manufacturing environments.

6 Three key source documents in a job-costing system are a job cost record, a materials requisition record and a

labour time record.

7 The transactions in a job-costing system in manufacturing track (a) the acquisition of materials and other manu-

facturing inputs, (b) their conversion into work in progress, (c) their eventual conversion into finished goods, and

(d) the sale of finished goods. Each of the stages (a) to (d) in the manufacture/sale cycle can be represented by

journal entries in the costing system.

8 The theoretically correct alternative to disposing of under- or overallocated indirect costs is to prorate that amount

on the basis of the total amount of the allocated indirect cost in the ending balances of stocks and cost of goods

sold. For simplicity, many organisations write-off any such amount to Cost of Goods Sold.

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CHAPTER 3

Assessment material

Review questions

3.1

Define cost pool, cost tracing, cost allocation and cost allocation base.

3.2

‘In the production of services, direct materials are usually the major cost.’ Is this quote accurate?

Explain.

3.3

How does a job-costing system differ from a process-costing system?

3.4

Why might an advertising agency use job costing for an advertising campaign for Pepsi while a

bank uses process costing for the cost of current account withdrawals?

3.5

Distinguish between actual costing and normal costing.

3.6

What are two major goals of a job-costing system?

3.7

Describe the role of a manufacturing overhead allocation base in job costing.

3.8

Give two reasons for under- or overallocation of indirect costs at the end of an accounting period.

3.9

Describe alternative ways to prorate end-of-period adjustments for under- or overallocated indi-

rect costs.

3.10 Why might a company prefer the adjusted allocation rate approach over a proration approach to

under- or overallocated indirect costs?

Exercises

Basic level

***3.11 Computing indirect-cost rates, job costing** (20–30 minutes)

Michel Scaramouche, the president of Tax-Assistance SA, is examining alternative ways to cal-

culate indirect-cost rates. He collects the following information from the budget for the year:

● Budgeted variable indirect costs: €10 per hour of professional labour time

● Budgeted fixed indirect costs: €50 000 per quarter.

The budgeted billable professional labour-hours per quarter are:

January–March

20 000 hours

April–June

10 000 hours

July–September

4 000 hours

October–December

6 000 hours

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Scaramouche pays all tax professionals employed by Tax-Assistance on an hourly basis (€30 per

hour, including all fringe benefits).

Tax-Assistance's job-costing system has a single direct-cost category (professional labour at

€30 per hour) and a single indirect-cost pool (office support that is allocated using professional

labour-hours).

Tax-Assistance charges clients €65 per professional labour-hour.

Required

1 Calculate budgeted indirect-cost rates per professional labour-hour using:

a Quarterly budgeted billable hours as the denominator

b Annual budgeted billable hours as the denominator.

2 Calculate the operating profit for the following four customers using:

a Quarterly-based indirect-cost rates

b An annual indirect-cost rate:

● Jean-Baptiste Roquelin: 10 hours in February

● Violette Leduc: 6 hours in March and 4 hours in April

● Alphonse Dudet: 4 hours in June and 6 hours in August

● Francine Leclerc: 5 hours in January, 2 hours in September and 3 hours in November.

3 Comment on your results in requirement 2.

3.12 Computing direct-cost rates, consulting firm (15–20 minutes)

Zimmermann GmbH is an international consulting firm. Its annual budget includes the following

for each category of professional labour:

Average Billable time Vacation and Professional Unbilled time

Average

fringe

for clients

sick leave development due to lack of

Category

salary

benefits

(hours)

(hours)

(hours)

demand

Director

€140 000

€60 000

1 600

160

240

0

Partner

105 000

45 000

1 600

160

240

0

Associate

60 000

20 000

1 600

160

240

0

Assistant

38 000

12 000

1 600

160

240

0

Required

1 Calculate the budgeted direct-cost rate for professional labour (salary and fringe benefits) per

hour for (a) directors, (b) partners, (c) associates, and (d) assistants. Use budgeted billable time

for clients as the denominator in these computations.

2 Repeat requirement 1. Use the sum of budgeted billable time, vacation and sick leave time and

professional development time as the denominator in these calculations.

3 Why are the rates different between requirements 1 and 2? How might these differences affect

job costing by Zimmermann GmbH?

3.13 Accounting for manufacturing overhead (15 minutes)

Consider the following selected cost data for Schwarzmetal GmbH for 2023.

Budgeted manufacturing overhead

€7 000 000

Budgeted machine-hours

200 000

Actual manufacturing overhead

€6 800 000

Actual machine-hours

195 000

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Schwarzmetal's job-costing system has a single manufacturing overhead cost pool (allocated using

a budgeted rate based on actual machine-hours). Any amount of under- or overallocation is

immediately written off to Cost of Goods Sold.

Required

1 Calculate the budgeted manufacturing overhead rate.

2 Journalise the allocation of manufacturing overhead.

3 Calculate the amount of under- or overallocation of manufacturing overhead. Is the amount

significant? Journalise the disposition of this amount on the basis of the closing balances in

the relevant accounts.

3.14 Proration of overhead (Z. Iqbal, adapted) (20 minutes)

Ti-Enne Srl uses a normal costing system with a single manufacturing overhead cost pool and

machine-hours as the allocation base. The following data are for 2023:

Budgeted manufacturing overhead

€4 800 000

Overhead allocation base

Machine-hours

Budgeted machine-hours

80 000

Manufacturing overhead incurred

€4 900 000

Actual machine-hours

75 000

Machine-hours data and the closing balances (before proration of underallocated or overallocated

overhead) are as follows:

Actual

2023 end-of-year

machine-hours

balance

Cost of Goods Sold

60 000

€8 000 000

Finished Goods

11 000

€1 250 000

Work in Progress

4 000

€750 000

Required

1 Calculate the budgeted manufacturing overhead rate for 2023.

2 Calculate the under- or overallocated manufacturing overhead of Ti-Enne in 2023. Prorate this

under- or overallocated amount using:

a Immediate write-off to Cost of Goods Sold

b Proration based on closing balances (before proration) in Work in Progress, Finished Goods

and Cost of Goods Sold

c Proration based on the allocated overhead amount (before proration) in the closing balances

of Work in Progress, Finished Goods and Cost of Goods Sold.

3 Which proration method do you prefer in requirement 2? Explain.

3.15 Job costing with single direct-cost category, single indirect-cost pool, law firm

(15–20 minutes)

Tricheur et Associés is a recently formed law partnership. Jean Racine, the managing partner

of Tricheur et Associés, has just finished a tense telephone call with Blaise Rascal, president of

Morges-Guyère, Sarl. Rascal complained about the price Tricheur charged for some conveyancing

legal work done for Morges-Guyère. He requested a breakdown of the charges. He also indi-

cated to Racine that a competing law firm, Andrault & Maque, was seeking more business with

Morges-Guyère and that he was going to ask them to bid for a conveyancing job next month.

Rascal ended the telephone call by saying that if Tricheur bid a price similar to the one charged

last month, Tricheur would not be hired for next month's job.

Racine is dismayed by the telephone call. He is also puzzled because he believes that convey-

ancing is an area where Tricheur et Associés has much expertise and is highly efficient. The

Morges-Guyère telephone call is the bad news of the week. The good news is that yesterday Racine

received a call from its only other client (Verrerie de Lausanne) saying it was very pleased with

both the quality of the work (primarily litigation) and the price charged on its most recent case.

Racine decides to collect data on the Morges-Guyère and Verrerie de Lausanne cases. Tricheur

et Associés uses a cost-based approach to pricing (billing) each legal case. Currently, it uses a

single direct-cost category (for professional labour time) and a single indirect-cost pool (general

support). Indirect costs are allocated to cases on the basis of professional labour-hours per case.

The case files show the following:

Morges-Guyère

Verrerie de Lausanne

Professional labour time

104 hours

96 hours

Professional labour costs at Tricheur et Associés are €70 an hour. Indirect costs are allocated to

cases at €105 an hour. Total indirect costs in the most recent period were €21 000.

Required

1 Why is it important for Tricheur et Associés to understand the costs associated with individual

cases?

2 Present an overview diagram of the existing job-costing system.

3 Calculate the costs of the Morges-Guyère and Verrerie de Lausanne cases.

3.16 Job costing: fill in the blanks (20–30 minutes)

Eldorado SA is a management consulting firm. Its job-costing system has a single direct-cost cate-

gory (consulting labour) and a single indirect-cost pool (consulting support). Consulting support

is allocated to individual jobs using actual consulting labour-hours worked on a job. It is currently

examining the actual and normal costs of a strategy review job for Pablo Café that required 70

actual hours of consulting labour. The internal cost expert decides to test your understanding of

cost concepts.

Required

1 Fill in the blanks for the Pablo Café job:

Actual

Normal

costing

costing

Direct job costs

€ ?

(€55 * ?)

€ ?

(€ ? * ?)

Indirect job costs

2 660

(€55 * ?)

2 800

(€ ? * 70)

Total job costs

€ ?

€ ?

2 Fill in the blanks for Eldorado:

Budgeted amounts

Actual amounts

for 2023

for 2023

Consulting labour compensation

?

?

Consulting labour-hours

18 000 hours

?

Consulting support costs

?

€798 000

***3.17 Job costing, normal and actual costing** (20 minutes)

Idergard AB assembles residential homes. It uses a job-costing system with two direct-cost cate-

gories (direct materials and direct labour) and one indirect-cost pool (assembly support). Direct-

labour-hours is the allocation base for assembly support costs. In December 2022, Peterson budgets

2023 assembly support costs to be SKr 8 000 000 and 2023 direct-labour-hours to be 160 000.

At the end of 2023, Idergard is comparing the costs of several jobs that were started and completed

in 2023.

Mora model

Solna model

Construction period

February–June 2023

May–October 2023

Direct materials

SKr 106 450

SKr 127 604

Direct labour

SKr 36 276

SKr 41 410

Direct-labour-hours

900

1 010

Direct materials and direct labour are paid for on a contract basis. The costs of each are known

when direct materials are used or direct-labour-hours are worked. The 2023 actual assembly

support costs were SKr 6 888 000 while the actual direct-labour-hours were 164 000.

Required

1 Calculate the (a) budgeted and (b) actual indirect-cost rates. Why do they differ?

2 What is the job cost of the Mora model and the Solna model using (a) normal costing and (b)

actual costing?

3 Why might Idergard Construction prefer normal costing over actual costing?

3.18 Job costing, journal entries (30 minutes)

The Editions Sorbonne is wholly owned by the university. It performs the bulk of its work for

other university departments, which pay as though the Editions Sorbonne were an outside business

enterprise. The Editions Sorbonne also publishes and maintains a stock of books for general sale.

A job-costing system is used to cost each job. There are two direct-cost categories (direct materials

and direct manufacturing labour) and one indirect-cost pool (manufacturing overhead, allocated

on the basis of direct-labour costs).

The following data (in €000) pertain to 2023:

Direct materials and supplies purchased on account

€800

Direct materials used

710

Indirect materials issued to various production departments

100

Direct manufacturing labour

1300

Indirect manufacturing labour incurred by various departments

900

Depreciation on building and manufacturing equipment

400

Miscellaneous manufacturing overhead* incurred by various departments

550

(ordinarily would be detailed as repairs, photocopying, utilities, etc.)

Manufacturing overhead allocated at 160% of direct manufacturing labour costs

?

Cost of goods manufactured

4120

Revenues

8000

Cost of goods sold

4020

Stock, 31 December 2022:

Materials control

100

Work-in-progress control

60

Finished goods control

500

* The term ‘manufacturing overhead’ is not used uniformly. Other terms that are often encountered in printing

companies include ‘job overhead’ and ‘shop overhead’.

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Required

1 Present an overview diagram of the job-costing system at the Editions Sorbonne.

2 Prepare general journal entries to summarise 2023 transactions. As your final entry, dispose of

the year-end over- or underallocated manufacturing overhead as a direct write off to Cost of

Goods Sold. Number your entries. Explanations for each entry may be omitted.

3 Show posted T-accounts for all stocks, Cost of Goods Sold, Manufacturing Overhead Control

and Manufacturing Overhead Allocated.

For more details concerning these data, see Exercise 3.19.

3.19 Job costing, journal entries and source documents (continuation of Exercise 3.18)

(20 minutes)

For each journal entry in your answer to Exercise 3.18, (a) indicate the source document that

would most probably authorise the entry and (b) give a description of the entry into the subsidiary

ledgers, if any entry needs to be made there.

***3.20 Job costing, engineering consulting firm** (20–35 minutes)

Solucions SA, an engineering consulting firm, specialises in analysing the structural causes of

major building catastrophes. Its job-costing system in 2023 had a single direct-cost category

(professional labour) and a single indirect-cost pool (general support). The allocation base for

indirect costs is professional labour costs. Actual costs for 2023 were:

Direct costs

Professional labour

€100 million

Indirect costs

General support

190 million

Total costs

€290 million

The following costs were included in the general-support indirect-cost pool:

Technical specialists' costs

€8 million

Telephone/fax machine

6 million

Computer time

37 million

Photocopying

4 million

Total costs

€55 million

The firm’s data-processing capabilities now make it feasible to trace these costs to individual jobs. The

managing partner is considering whether more costs than just professional labour should be traced

to each job as a direct cost. In this way, the firm would be better able to justify billings to clients.

In late 2023, arrangements were made to expand the number of direct-cost categories and to trace

them to seven client engagements. Two of the case records showed the following:

Client case

Client case

304

308

Professional labour

€200 000

€200 000

Technical specialists’ costs

20 000

60 000

Telephone/fax machine

10 000

20 000

Computer time

20 000

40 000

Photocopying

10 000

20 000

Total direct costs

€260 000

€340 000

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Required

1 Present an overview diagram of the 2023 job-costing system. What was the actual indirect-cost

rate per professional labour-euro?

2 Assume that the €55 million of costs included in the 2023 general-support indirect-cost pool

were reclassified as direct costs. The result is a system with five direct-cost categories. Calculate

the revised indirect-cost rate as a percentage of:

a professional labour costs

b total direct costs.

3 Calculate the total costs of jobs 304 and 308 using:

a the 2023 costing system with a single direct-cost category and a single indirect-cost pool

(professional labour costs as the allocation base)

b a costing system with five direct-cost categories and a single indirect-cost pool (professional

labour costs as the allocation base)

c a costing system with five direct-cost categories and a single indirect-cost pool (total direct

cos as the allocation base).

4 Assume that clients are billed at 120% of total job costs (that is, a mark-up on cost of 20%).

Calculate the billings in requirement 3 for jobs 304 and 308 for the (a), (b) and (c) costing

systems.

5 Which method of job costing in requirement 3 do you favour? Explain.

3.21 Job costing, accounting for manufacturing overhead, budgeted rates (25–30 minutes)

Giannacopoulos SA uses a job-costing system at its Korinthos plant. The plant has a Machining

Department and an Assembly Department. Its job-costing system has two direct-cost categories

(direct materials and direct manufacturing labour) and two manufacturing overhead cost pools

(the Machining Department, allocated using actual machine-hours, and the Assembly Depart-

ment, allocated using actual labour cost). The 2023 budget for the plant is as follows:

Machining

Assembly

Department

Department

Manufacturing overhead

€1 800 000

€3 600 000

Direct manufacturing labour cost

€1 400 000

€2 000 000

Direct manufacturing labour-hours

€100 000

€200 000

Machine-hours

50 000

200 000

Required

1 Present an overview diagram of Giannacopoulos's job-costing system. What is the budgeted

overhead rate that should be used in the Machining Department? In the Assembly Department?

2 During the month of February, the cost record for Job 494 shows the following:

Machining

Assembly

Department

Department

Direct material used

€45 000

€70 000

Direct manufacturing labour cost

€14 000

€15 000

Direct manufacturing labour-hours

1 000

1 500

Machine-hours

2 000

1 000

What is the total manufacturing overhead allocated to Job 494?

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Exercises

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3 Balances at the end of 2023 are as follows:

Machining

Assembly

Department

Department

Manufacturing overhead incurred

€2 100 000

€3 700 000

Direct manufacturing labour cost

–

€2 200 000

Machine-hours

55 000

–

Calculate the under- or overallocated manufacturing overhead for each department.

3.22 Overview of general-ledger relationships (30–40 minutes)

Budenmayer BV is a small machine shop that uses highly skilled labour and a job-costing system

(using normal costing). The total debits and credits in certain accounts just before year-end are

as follows:

30 December 2023

Total debits

Total credits

Materials Control

€100 000

€70 000

Work-in-Progress Control

320 000

305 000

Manufacturing Department Overhead Control

85 000

–

Finished Goods Control

325 000

300 000

Cost of Goods Sold

300 000

–

Manufacturing Overhead Allocated

–

90 000

All materials purchased are for direct materials. Note that ‘total debits’ in the stock accounts

would include beginning stock balances, if any.

The preceding accounts do not include the following:

a The manufacturing labour costs recapitulation for the 31 December working day: direct man-

ufacturing labour, €5000 and indirect manufacturing labour, €1000.

b Miscellaneous manufacturing overhead incurred on 30 December and 31 December: €1000.

Additional information

● Manufacturing overhead has been allocated as a percentage of direct manufacturing labour

costs through 30 December.

● Direct materials purchased during 2023 were €85 000.

● There were no returns to suppliers.

● Direct manufacturing labour costs during 2023 totalled €150 000, not including the

31 December working day described previously.

Required

1 Calculate the stock (31 December 2022) of Materials Control, Work-in-Progress Control and

Finished Goods Control. Show T-accounts.

2 Prepare all adjusting and closing journal entries for the preceding accounts. Assume that all

under- or overallocated manufacturing overhead is closed directly to Cost of Goods Sold.

3 Calculate the ending stock (31 December 2023), after adjustments and closing, of Materials

Control, Work-in-Progress Control and Finished Goods Control.

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CHAPTER 4

Process costing

Managerial accountants at companies like Xiaomi (smartphones), Coca-

Cola (soft drinks), BP (oil and gas) and Bayer (pharmaceuticals) use process

Learning objectives

costing because it helps them (1) determine how many units of the prod-

uct the firm has on hand at the end of an accounting reporting period, (2)

After studying this chapter, you

evaluate the units' stages of completion, and (3) assign costs to units pro-

should be able to:

duced and in stock. A process-costing system is a costing system in which

- Recognise when process-costing

the cost of a product or service is obtained by assigning costs to masses

systems are appropriate

of like or similar units. Unit costs are then calculated on an average basis.

Process-costing systems are used in industries that cost like or similar

●

Describe key steps in process

units of products, which are often mass produced. In these industries,

costing

relatively homogeneous products are processed in a very similar manner.

●

Calculate and use equivalent units

Other industries using process costing in their manufacturing area include

●

Demonstrate the weighted-

chemical processing, plastics, brick and tile manufacturing, semiconduc-

average and first-in, first-out

tor chips, and breakfast cereals.

(FIFO) method of process costing

The principal difference between process costing and job costing is the

●

Show how standard costs simplify

extent of averaging used to calculate unit costs of products or services.

process costing

The cost object in a job-costing system is a job that constitutes a distinctly

identifiable product or service. Individual jobs use different quantities of

●

Apply process-costing methods to

manufacturing resources, so it would be incorrect to cost each job at the

cases with transferred-in costs

same average manufacturing cost. In contrast, when like or similar units are mass produced and not processed as individual jobs, process costing averages manufacturing costs over all units produced.

Knowing what products cost is important to consider for stock valuation, pricing decisions and product profitability analysis. Companies also use product costs to measure how well they are doing in managing and reducing costs. For example, Anheuser-Busch InBev SA/NV, which is the world's largest brewer, with more than 400 beer brands and over 183 000 employees globally, makes extensive use of process costing. It compiles information from brewing and packaging operations and tracks beer movement and quality measures. Process-costing information allows the enterprise to prepare and monitor beer loss reports. Organisations that produce similar products can be very complex and use the latest technological innovations. Consider for instance the brewing process of a craft beer company in Germany, which uses the Industrial Internet of Things

(IIOT) technology and data analytics. Technology can help as brewing is a science with the process lasting a few days to several weeks, with temperature affecting the smell and flavour of the end product. Mr Maximilian Sträb, the Marketing and Sales Manager of SONEM, the provider of the technological system, notes that: 'Due to the high sensitivity, multiple processes have to be monitored and optimized within the brewery'. Sebastian Manning, the CEO of the company, adds: 'Based on the molecular acoustics, different fluids can be clearly classified and monitored

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during the entire production process. The captured data set allows, due to its informative content, a

detailed and diverse analysis' (Moxa, 2022).

As we examine process costing in this chapter, we will be concerned only incidentally with con-

trolling and managing costs and evaluating performance. Our primary focus is on determining the cost

of products or services and on stock and cost of goods sold valuation. Operation costing as applied to

batches of similar products is discussed in the appendix to this chapter.

Illustrating process costing

In a process-costing system, the unit cost of a product or service is obtained by assigning total costs

to many identical or similar units. In a manufacturing process-costing setting, each unit is assumed

to receive the same amount of direct materials costs, direct manufacturing labour costs and indirect

manufacturing costs. Unit costs are then calculated by dividing total costs by the number of units.

The principal difference between process costing and job costing is the extent of averaging

used to calculate unit costs of products or services. In a job-costing system, individual jobs use

different quantities of production resources. Thus, it would be incorrect to cost each job at the

same average production cost. In contrast, when identical or similar units of products or services

are mass produced, and not processed as individual jobs, process costing averages production

costs over all units produced.

The easiest way to learn process costing is by example. Consider the following illustration.

Example 4.1

Euro-Défense SA manufactures thousands of components for missiles and military equipment. These

components are assembled in the Assembly Department. Upon completion, the units are immediately

transferred to the Testing Department. We will focus on the Assembly Department process for one of these

components, DG-19. Every effort is made to ensure that all DG-19 units are identical and meet a set of

demanding performance specifications. The process-costing system for DG-19 in the Assembly Depart-

ment has a single direct-cost category (direct materials) and a single indirect-cost category (conversion

costs). Conversion costs are all manufacturing costs other than direct material costs. These include man-

ufacturing labour, indirect materials, energy, plant depreciation, and so on. Direct materials are added at

the beginning of the process in Assembly. Conversion costs are added evenly during Assembly. These facts

are summarised in Exhibit 4.1.

Process-costing systems separate costs into cost categories according to the timing of when

costs are introduced into the process. Often, as in our Euro-Défense example, only two cost clas-

sifications, direct materials and conversion costs, are necessary to assign costs to products. Why?

Because **all** direct materials are added to the process at one time and **all** conversion costs are gen-

erally added to the process uniformly through time. If, however, two different direct materials are

added to the process at different times, two different direct material categories would be needed to

assign these costs to products. Similarly, if manufacturing labour is added to the process at a time

that is different from other conversion costs, an additional cost category (direct manufacturing

labour costs) would be needed to separately assign these costs to products.

We will use the production of the DG-19 component in the Assembly Department to illustrate

process costing in three cases:

1 Process costing with zero opening and zero closing work-in-progress stock of DG-19, that is,

all units are started and fully completed by the end of the accounting period. This case presents

the most basic concepts of process costing and illustrates the key feature of averaging of costs.

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Exhibit 4.1

Allocation of direct material costs and conversion costs to

assembly process

Conversion costs

added evenly

during process

Transfer

Assembly

Testing

Department

Department

Direct materials

added at beginning

of process

2 Process costing with zero opening work-in-progress stock but some closing work-in-progress

stock of DG-19, that is, some units of DG-19 started during the accounting period are incom-

plete at the end of the period. This case builds on the basics and introduces the concept of

equivalent units.

3 Process costing with both some opening and some closing work-in-progress stock of DG-19.

This case adds more detail and describes the effect of weighted-average and first-in, first-out

(FIFO) cost-flow assumptions on cost of units completed and cost of work-in-progress stock.

We start with the simple case and work towards the more detailed and more complex cases.

Case 1: Process costing with no opening or closing

work-in-progress stock

On 1 January 2022, there was no opening stock of DG-19 units in the Assembly Department.

During January 2022, Euro-Défense started, completed assembly of, and transferred out to the

Testing Department, 400 DG-19 units.

Data for the Assembly Department for January 2022 are:

Physical units for January 2022

Work in progress, opening stock (1 January)

0 units

Started during January

400 units

Completed and transferred out during January

400 units

Work in progress, closing stock (31 January)

0 units

Total costs for January 2022

Direct material costs added during January

€32 000

Conversion costs added during January

24 000

Total Assembly Department costs added during January

€56 000

Euro-Défense records direct material and conversion costs in the Assembly Department as

these costs are incurred. By averaging, the assembly costs per unit of DG-19 are €56 000 ÷ 400 units = €140

€56 000 ÷ 400 units = €140 itemised as follows:

Direct material costs per unit (€32 000 ÷ 400)

€80

Conversion costs per unit (€24 000 ÷ 400)

60

Assembly Department costs per unit

€140

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Case 2: Process costing with no opening but a closing work-in-progress stock

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This case shows that in a process-costing system, unit costs can be averaged by dividing total

costs in a given accounting period by total units produced in that period. Because each unit is

identical, we assume all units receive the same amount of direct materials and conversion costs.

This approach can be used by any company that produces a homogeneous product or service

but has no incomplete units when each accounting period ends. This situation frequently occurs

in service-sector organisations. For example, a bank can adopt this process-costing approach to

calculate the unit cost of processing 100 000 similar customer deposits made in a month.

Case 2: Process costing with no opening but a closing

work-in-progress stock

In February 2022, Euro-Défense places another 400 units of DG-19 into production. Because all

units placed into production in January 2022 were completely assembled, there is no opening

stock of partially completed units in the Assembly Department on 1 February 2022. Customer

delays in placing orders for DG-19 prevent the complete assembly of all units started in February.

Only 175 units are completed and transferred out to the Testing Department.

Data for the Assembly Department for February 2022 are:

Physical units for February 2022

Work in progress, opening stock (1 February)

0 units

Started during February

400 units

Completed and transferred out

175 units

Work in progress, closing stock (28 February)

225 units

The 225 partially assembled units as of 28 February 2022 are fully processed with respect to

direct materials. Why? Because all direct materials in the Assembly Department are added at

the beginning of the assembly process. Conversion costs, however, are added evenly during the

assembly process. Based on the work completed relative to the total work required to complete the

DG-19 units still in the process, an Assembly Department supervisor estimates that the partially

assembled units are, on average, 60% complete as to conversion costs.

Total costs for February 2022

Direct material costs added during February

€32 000

Conversion costs added during February

18 600

Total Assembly Department costs added during February

€50 600

The accuracy of the completion percentages depends on the care and skill of the estimator and

the nature of the process. Estimating the degree of completion is usually easier for direct materials

than it is for conversion costs because the quantity of direct materials needed for a completed unit

and the quantity of direct materials for a partially completed unit can be measured more easily. In

contrast, the conversion sequence usually consists of a number of basic operations for a specified

number of hours, days or weeks, for various steps in assembly, testing, and so forth. Thus, the

degree of completion for conversion costs depends on what proportion of the total effort needed

to complete one unit or one batch of production has been devoted to units still in progress. This

estimate is more difficult to make accurately. Because of the difficulties in estimating conver-

sion cost completion percentages, department supervisors and line managers – individuals most

familiar with the process – often make these estimates. Still, in some industries no exact estimate

is possible or, as in the textile industry, vast quantities in progress prohibit the making of costly

physical estimates. In these cases, all work in progress in every department is assumed to be

complete to some reasonable degree (for example, one-third, one-half or two-thirds complete).

The key point to note in Case 2 is that a partially assembled unit is not the same as a fully

assembled unit. Faced with some fully assembled and some partially assembled units, how should

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Euro-Défense calculate (1) the cost of fully assembled units in February 2022, and (2) the cost of

the partially assembled units still in progress at the end of February 2022?

Euro-Défense calculates these costs by using the following five steps:

Step 1: Summarise the flow of physical units of output.

Step 2: Compute output in terms of equivalent units.

Step 3: Compute equivalent-unit costs.

Step 4: Summarise total costs to account for.

Step 5: Assign total costs to units completed and to units in closing work in progress.

Physical units and equivalent units (steps 1 and 2)

Step 1 tracks the physical units of output. Where did the units come from? Where did the units

go? The physical units column of Exhibit 4.2 tracks where the physical units came from – 400

units started, and where they went – 175 units completed and transferred out, and 225 units in

closing stock.

Step 2 focuses on how the output for February should be measured. The output is 175 fully

assembled units plus 225 partially assembled units. Since all 400 physical units are not uniformly

completed, output in step 2 is computed in *equivalent units,* not in physical units.

Equivalent units is a derived amount of output units that takes the quantity of each input (fac-

tor of production) in units completed or in work in progress, and converts it into the amount

of completed output units that could be made with that quantity of input. For example, if 50

physical units of a product in closing work-in-progress stock are 70% complete with respect to

conversion costs, there are 35 (70% × 50) equivalent units of output for conversion costs. That

is, if all the conversion cost input in the 50 units in stock were used to make completed output

units, the company would be able to make 35 completed units of output. Equivalent units are

calculated separately for each input (cost category). Examples of equivalent-unit concepts are

also found in non-manufacturing settings. For instance, universities often convert their part-time

student enrolments into full-time student equivalents.

Exhibit 4.2

Steps 1 and 2: summarise output in physical units and calculate equivalent

units, Assembly Department of Euro-Défense SA, for February 2022

(Step 1)

(Step 2) Equivalent units

Direct

Conversion

Flow of production

Physical units

materials

costs

Work in progress, opening

0

Started during current period

400

To account for

400

Completed and transferred out during current

175

175

175

period

Work in progress, closing*

225

225 × 100%; 225 × 60%

225

135

Accounted for

400

Work done in current period only

400

310

* Degree of completion in this department: direct materials, 100%; conversion costs, 60%.

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Case 2: Process costing with no opening but a closing work-in-progress stock

When calculating equivalent units in step 2, focus on quantities. Disregard euro amounts until

after equivalent units are computed. In the Euro-Défense example, all 400 physical units – the 175

fully assembled ones and the 225 partially assembled ones – are complete in terms of equivalent

units of direct materials. Why? Because all direct materials are added in the Assembly Depart-

ment at the initial stage of the process. Exhibit 4.2 shows output as 400 *equivalent* units for direct

materials because all 400 units are fully complete with respect to direct materials.

The 175 fully assembled units are completely processed with respect to conversion costs. The

partially assembled units in closing work in progress are 60% complete (on average). Therefore,

the conversion costs in the 225 partially assembled units are *equivalent* to conversion costs in

135 (60% of 225) fully assembled units. Hence, Exhibit 4.2 shows output as 310 *equivalent* units

with respect to conversion costs – 175 equivalent units assembled and transferred out and 135

equivalent units in closing work-in-progress stock.

Calculation of product costs (steps 3, 4 and 5)

Exhibit 4.3 shows steps 3, 4 and 5. Together, they are called the *production cost worksheet.* Step

3 calculates equivalent-unit costs by dividing direct materials and conversion costs added during

February by the related quantity of equivalent units of work done in February (as calculated in

Exhibit 4.2).

We can see the importance of using equivalent units in unit-cost calculations by comparing

conversion costs for the months of January and February 2022. Observe that the total conversion

costs of €18 600 for the 400 units worked on during February are less than the conversion costs of

€24 000 for the 400 units worked on in January. However, the conversion costs to fully assemble a

unit are €60 in both January and February. Total conversion costs are lower in February because

fewer equivalent units of conversion costs work were completed in February (310) than were in

January (400). If, however, we had used *physical* units instead of *equivalent* units in the per-unit

Steps 3, 4 and 5: calculate equivalent-unit costs, summarise total costs to

Exhibit 4.3

account for, and assign costs to units completed and to units in closing work in

progress, Assembly Department of Euro-Défense SA, for February 2022

Total production

Direct

Conversion

costs

materials

costs

(Step 3) Costs added during February

€50 600

€32 000

€18 600

Divide by equivalent units of work done in current

period (Exhibit 4.2)

÷400

÷310

Cost per equivalent unit

_____

€80

€60

(Step 4) Total costs to account for

€50 600

(Step 5) Assignment of costs:

Completed and transferred out (175 units)

€24 500

(175* × €80) + (175* × €60)

Work in progress, closing (225 units):

Direct materials

18 000

225† × €80

Conversion costs

8 100

135† × €60

Total work in progress

26 100

Total costs accounted for

€50 600

* Equivalent units completed and transferred out from Exhibit 4.1, step 2.

† Equivalent units in closing work in progress from Exhibit 4.1, step 2.

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calculation, we would have erroneously concluded that conversion costs per unit declined from

€60 in January to €46.50 (€18 600 ÷ 400) in February. This incorrect costing might have prompted

Euro-Défense, for example, to lower the price of DG-19 inappropriately.

Step 4 in Exhibit 4.3 summarises total costs to account for. Because the opening balance of the

work in progress is zero, total costs to account for (that is, the total charges or debits to Work in

Progress – Assembly) consist of the costs added during February – direct materials of €32 000,

and conversion costs of €18 600, for a total of €50 600.

Step 5 in Exhibit 4.3 assigns these costs to units completed and transferred out and to units still

in process at the end of February 2022. *The key idea is to attach euro amounts to the equivalent*

output units for direct materials and conversion costs in (a) units completed, and (b) closing work

in progress calculated in Exhibit 4.2, step 2. To do so, the equivalent output units for each input

are multiplied by the cost per equivalent unit calculated in step 3 of Exhibit 4.3. For example,

the 225 physical units in closing work in progress are completely processed with respect to direct

materials. Therefore, direct materials costs are 225 equivalent units (Exhibit 4.2, step 2) ×€80 (cost

per equivalent of direct materials calculated in step 3), which equals €18 000. In contrast, the 225

physical units are 60% complete with respect to conversion costs. Therefore, the conversion costs

are 135 equivalent units (60% of 225 physical units, Exhibit 4.2, step 2) ×€60 (cost per equivalent

unit of conversion costs calculated in step 3), which equals €8100. The total cost of ending work

in progress equals €26 100 (€18 000 + €8100).

Journal entries

Journal entries in process-costing systems are basically like those made in job-costing systems

with respect to direct materials and conversion costs. The main difference is that, in process

costing, there is often more than one Work-in-Progress account, one for each process – in our

example, Work in Progress – Assembly and Work in Progress – Testing. Euro-Défense purchases

direct materials as needed. These materials are delivered directly to the Assembly Department.

Using euro amounts from Exhibit 4.3, summary journal entries for the month of February at

Euro-Défense are:

1 Work in Progress – Assembly

32 000

Creditors Control

32 000

To record direct materials purchased and used in production

during February

2 Work in Progress – Assembly

18 600

Various accounts

18 600

To record Assembly Department conversion costs for February;

examples include energy, manufacturing supplies, all

manufacturing labour and plant depreciation

3 Work in Progress – Testing

24 500

Work in Progress – Assembly

24 500

To record cost of goods completed and transferred from

Assembly to Testing during February

Exhibit 4.4 shows a general framework for the flow of costs through the T-accounts. Notice

how entry 3 for €24 500 follows the physical transfer of goods from the Assembly to the Testing

Department. The key T-account, Work in Progress – Assembly, shows a closing balance of €26

100, which is the opening balance of Work in Progress – Assembly in March 2022.

Case 3: Process costing with both some opening and some closing work-in-progress stock

Exhibit 4.4

Flow of costs in a process-costing system, Assembly Department of Euro-Défense SA, for February 2022

Creditors

Work in Progress – Assembly

Work in Progress – Testing

1 32 000

1 32 000

Bal. xx

Transferred

2 18 600

3 24 500

3 24 500

out to

Various Accounts

Finished

Bal. 26 100

2 18 600

Goods xx

Finished Goods

xx

Cost of

goods

Sold xx

Cost of Goods Sold

xx

Case 3: Process costing with both some opening and some closing

work-in-progress stock

At the beginning of March 2022, Euro-Défense had 225 partially assembled DG-19 units in the

Assembly Department. During March 2022, Euro-Défense placed another 275 units into produc-

tion. Data for the Assembly Department for March 2022 are:

Physical units for March 2022

Work in progress, opening stock (1 March)

225 units

Direct materials (100% complete)

Conversion costs (60% complete)

Started during March

275 units

Completed and transferred out during March

400 units

Work in progress, closing stock (31 March)

100 units

Direct materials (100% complete)

Conversion costs (50% complete)

Total costs for March 2022

Work in progress, opening stock

Direct materials (225 equivalent units × €80 per unit)

€18 000

Conversion costs (135 equivalent units × €60 per unit)

8 100

€26 100

Direct material costs added during March

19 800

Conversion costs added during March

16 380

Total costs to account for

€62 280

We now have incomplete units in both opening and closing work-in-progress stock to account for.

Our goal is to use the five steps we described earlier to calculate (1) the cost of units completed

and transferred out, and (2) the cost of closing work in progress. To assign costs to each of these

categories, however, we need to choose a stock cost-flow method. We next describe the five-step

approach to process costing using two alternative stock cost-flow methods – the weighted-average

method and the first-in, first-out method. The different assumptions will produce different num-

bers for cost of units completed and for closing work in progress.

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Weighted-average method

The weighted-average process-costing method calculates the equivalent-unit cost of the *work done*

to date (regardless of the period in which it was done) and assigns this cost to equivalent units

completed and transferred out of the process and to equivalent units in closing work-in-progress

stock. The weighted-average cost is the total of all costs entering the Work in Progress account

(regardless of whether it is from opening work in progress or from work started during the period)

divided by total equivalent units of work done to date. We now describe the five-step procedure

introduced in Case 2 using the weighted-average method.

Step 1: Summarise the flow of physical units The physical units column of Exhibit 4.5 shows

where the units came from – 225 units from opening stock and 275 units started during the cur-

rent period – and where they went – 400 units completed and transferred out and 100 units in

closing stock. These data for March were given above.

Step 2: Compute output in terms of equivalent units As we saw in Case 2, even partially assem-

bled units are complete in terms of direct materials because direct materials are introduced at the

beginning of the process. For conversion costs, the fully assembled physical units transferred out

are, of course, fully completed. The Assembly Department supervisor estimates the partially

assembled physical units in March 31 work in progress to be 50% complete (on average).

The equivalent-units columns in Exhibit 4.5 show the equivalent units of work done to date –

equivalent units completed and transferred out and equivalent units in closing work in progress

(500 equivalent units of direct materials and 450 equivalent units of conversion costs). Notice that

the equivalent units of work done to date also equal the sum of the equivalent units in opening stock

(work done in the previous period) and the equivalent units of work done in the current period,

because:

Equivalent units

Equivalent units

Equivalent units

Equivalent units

completed and

in opening

+ of work done in =

+

in closing

transferred out

work in progress

current period

work in progress

in current period

Steps 1 and 2: summarise output in physical units and calculate equivalent

Exhibit 4.5

units, weighted-average method of process costing, Assembly Department of

Euro-Défense SA, for March 2022

(Step 1)

(Step 2) Equivalent units

Physical units

Direct

Conversion

Flow of production

(given p. 97)

materials

costs

Work in progress, opening

225

Started during current period

275

To account for

500

Completed and transferred out during current period

400

400

400

Work in progress, closing*

100

100 × 100%; 100 × 50%

100

50

Accounted for

500

Work done to date

500

450

* Degree of completion in this department: direct materials, 100%; conversion costs, 50%.

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The equivalent-unit calculation in the weighted-average method is concerned only with total

equivalent units of *work done to date* regardless of (1) whether the work was done during the

previous period and is part of opening work in progress, or (2) whether it was done during the

current period. That is, the weighted-average method *merges* equivalent units in opening stock

(work done before March) with equivalent units of work done in the current period. Thus, the

stage of completion of the current-period opening work in progress *per se is irrelevant* and *not*

used in the calculation.

Step 3: Compute equivalent-unit costs Exhibit 4.6, step 3, shows the calculation of equivalent-

unit costs separately for direct materials and conversion costs. The weighted-average cost per

equivalent unit is obtained by dividing the sum of costs for opening work in progress and costs

for work done in the current period by total equivalent units of work done to date. When calcu-

lating the weighted-average conversion cost per equivalent unit in Exhibit 4.6, for example, we

divide total conversion costs, €24 480 (opening work in progress, €8100, plus work done in cur-

rent period, €16 380) by total equivalent units, 450 (equivalent units of conversion costs in open-

ing work in progress and in work done in current period), to get a weighted-average cost per

equivalent unit of €54.40.

Step 4: Summarise total costs to account for The total costs to account for in March 2022 are

described in the example data on page 97 – opening work in progress, €26 100 (direct materials,

€18 000 and conversion costs, €8100) plus €36 180 (direct material costs added during March,

€19 800, and conversion costs, €16 380). The total of these costs is €62 280.

Steps 3, 4 and 5: calculate equivalent-unit costs, summarise total costs to

account for, and assign costs to units completed and to units in closing work in

Exhibit 4.6

progress, weighted-average method of process costing, Assembly Department

of Euro-Défense SA, for March 2022

Total production

Direct

Conversion

costs

materials

costs

(Step 3) Work in progress, opening (given p. 97)

€26 100

€18 000

€8 100

Cost added in current period (given p. 97)

36 180

19 800

16 380

Cost incurred to date

€37 800

€24 480

Divide by equivalent units of

work done to date (Exhibit 4.5)

÷500

÷450

Cost per equivalent unit of work done to date

_____

€75.60

€54.40

(Step 4) Total costs to account for

€62 280

(Step 5) Assignment of costs:

Completed and transferred out (400 units)

52 000

(400* × €75.60) + (400* × €54.40)

Work in progress, closing (100 units):

Direct materials

7 560

100† × €75.60

Conversion costs

2 720

50† × €54.40

Total work in progress

10 280

Total costs accounted for

€62 280

* Equivalent units completed and transferred out from Exhibit 4.5, step 2.

† Equivalent units in closing work in progress from Exhibit 4.5, step 2.

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Step 5: Assign these costs to units completed and to units in closing work in progress The

key point in this step is to cost all work done to date: (1) the cost of units completed and trans-

ferred out of the process, and (2) the cost of closing work in progress. Step 5 in Exhibit 4.6 takes

the equivalent units completed and transferred out and equivalent units in closing work in pro-

gress calculated in Exhibit 4.5 step 2, and attaches euro amounts to them. These euro amounts

are the weighted-average costs per equivalent unit for direct materials and conversion costs cal-

culated in step 3. For example, note that the total cost of the 100 physical units in closing work

in progress consists of:

Direct materials:

100 equivalent units × Weighted-average cost per equivalent unit of

€7 560

€75.60

Conversion costs:

50 equivalent units × Weighted-average cost per equivalent unit of €54.40

2 720

Total costs of closing work in progress

€10 280

The following table summarises the total costs to account for and the €62 280 accounted for in

Exhibit 4.6. The arrows indicate that costs of units completed and transferred out and in closing

work in progress are calculated using average total costs obtained after merging costs of opening

work in progress and costs added in the current period.

Costs accounted for

Costs to account for

calculated at weighted-average cost

Opening work in progress

€ 26 100

Completed and transferred out

€ 52 000

Costs added in current period

36 180

Closing work in progress

10 280

Total costs to account for

€ 62 280

Total costs accounted for

€ 62 280

Before proceeding, please pause and review Exhibits 4.5 and 4.6 carefully to check your under-

standing of the weighted-average method. Note that Exhibit 4.5 deals only with physical and

equivalent units but no costs. Exhibit 4.6 shows the cost amounts.

Using euro amounts from Exhibit 4.6, summary journal entries under the weighted-average

method for the month of March at Euro-Défense SA are:

1 Work in Progress – Assembly

19 800

Creditors Control

19 800

To record direct materials purchased and used in production during

March

2 Work in Progress – Assembly

16 380

Various accounts

16 380

To record Assembly Department conversion costs for March; examples include energy, manufacturing supplies, all manufacturing labour, and plant depreciation

3 Work in Progress – Testing

52 000

Work in Progress – Assembly

52 000

To record cost of goods completed and transferred from Assembly to Testing during March

The key T-account, Work in Progress – Assembly, under the weighted-average method would show the following:

Work in Progress – Assembly

Opening stock, 1 March

26 100

③ Completed and transferred out

52 000

① Direct materials

19 800

to Work in Progress – Testing

② Conversion costs

16 380

Closing stock, 31 March

10 280

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First-in, first-out method

In contrast to the weighted-average method, the first-in, first-out (FIFO) process-costing method

assigns the cost of the previous period’s equivalent units in opening work-in-progress stock to

the first units completed and transferred out of the process, and assigns the cost of equivalent

units worked on during the current period first to complete beginning stock, then to start and

complete new units, and finally to units in closing work-in-progress stock. This method assumes

that the earliest equivalent units in the Work in Progress – Assembly account are completed first.

A distinctive feature of the FIFO process-costing method is that work done on opening stock

before the current period is kept separate from work done in the current period. Costs incurred

in the current period and units produced in the current period are used to calculate costs per

equivalent unit of work done in the current period. In contrast, equivalent-unit and cost-per-

equivalent-unit calculations in the weighted-average method merge the units and costs in opening

stock with units and costs of work done in the current period.

We now describe the five-step procedure introduced in Case 2 using the FIFO method.

Step 1: Summarise the flow of physical units Exhibit 4.7, step 1, traces the flow of physical

units of production. The following observations help explain the physical units calculations.

● The first physical units assumed to be completed and transferred out during the period are the

225 units from the opening work-in-progress stock.

● Of the 275 physical units started, 175 are assumed to be completed. Recall from the March

data given earlier in the chapter (on page xx) that 400 physical units were completed during

March. The FIFO method assumes that the first 225 of these units were from opening stock;

thus 175 (400 – 225) physical units must have been started and completed during March.

● Closing work-in-progress stock consists of 100 physical units – the 275 physical units started

minus the 175 of these physical units completed.

● Note that the physical units 'to account for' equal the physical units 'accounted for' (500 units).

Steps 1 and 2: summarise output in physical units and calculate equivalent

Exhibit 4.7

units, FIFO method of process costing, Assembly Department of Euro-Défense

SA, for March 2022

(Step 2) Equivalent units

(Step 1)

Conversion

Flow of production

Physical units Direct materials

costs

Work in progress, opening (given p. 98)

225

(work done before current period)

Started during current period (given p. 98)

275

To account for

500

Completed and transferred out during current period:

From opening work in progress*

225

225 × (100% − 100%); 225 × (100 − 60%)

0

90

Started and completed

175†

175 × 100%, 175 × 100%

175

175

Work in progress, closing‡ (given p. 98)

100

100 × 100%; 100 × 50%

100

50

Accounted for

500

Work done in current period only

275

315

* Degree of completion in this department: direct materials, 100%; conversion costs, 60%.

† 400 physical units completed and transferred out minus 225 physical units completed and transferred out from opening work-

in-progress stock.

‡ Degree of completion in this department: direct materials, 100%; conversion costs, 50%.

Step 2: Calculate output in terms of equivalent units Exhibit 4.7 also presents the computa-

tions for step 2 under the FIFO method. *The equivalent-unit calculations for each cost category*

focus on the equivalent units of work done in the current period (March) only.

Under the FIFO method, the work done in the current period is assumed to first complete the

225 units in opening work in progress. The equivalent units of work done in March on the opening

work-in-progress stock are calculated by multiplying the 225 physical units *by the percentage of*

work remaining to be done to complete these units: 0% for direct materials, because the opening

work in progress is 100% complete with respect to direct materials, and 40% for conversion

costs, because the opening work in progress is 60% complete with respect to conversion costs.

The results are 0 (0% × 225) equivalent units of work for direct materials and 90 (40% × 225)

equivalent units of work for conversion costs.

Next, the work done in the current period is assumed to start and complete the next 175 units.

The equivalent units of work done on the 175 physical units started and completed are calculated

by multiplying 175 units by 100% for both direct materials and conversion costs, because all work

on these units is done in the current period.

Finally, the work done in the current period is assumed to start but leave incomplete the final

100 units as closing work in progress. The equivalent units of work done on the 100 units of

closing work in progress are calculated by multiplying 100 physical units by 100% for direct

materials (because all direct materials have been added for these units in the current period) and

50% for conversion costs (because 50% of conversion costs work has been done on these units

in the current period).

Step 3: Calculate equivalent-unit costs Exhibit 4.8 shows the step 3 calculation of equivalent-

unit costs *for work done in the current period only* for direct materials and conversion costs. For

example, we divide current-period conversion costs of €16 380 by current-period equivalent units

for conversion costs of 315 to obtain cost per equivalent unit of €52.

Step 4: Summarise total costs to account for The total production costs column in Exhibit 4.8

presents step 4 and summarises the total costs to account for in March 2022 (opening work in pro-

gress and costs added in the current period) of €62 280, as described in the example data (p. 97).

Step 5: Assign costs to units completed and to units in closing work in progress Finally,

Exhibit 4.8 shows the step 5 assignment of costs under the FIFO method. The costs of work done

in the current period are first assigned to the additional work done to complete the opening work

in progress, then to the work done on units started and completed during the current period, and

finally to the closing work in progress . *The easiest way to follow step 5 is to take each of the*

equivalent units calculated in Exhibit 4.7, step 2, and attach euro amounts to them (using the

cost-per-equivalent-unit calculations in step 3). The goal is to determine the total cost of all units

completed from opening stock and from work started and completed in the current period, and

the costs of closing work in progress done in the current period.

Notice that the 400 completed units are of two types: 225 units come from opening stock, and

175 units are started and completed during March. The FIFO method starts by assigning the costs

of the opening work-in-progress stock of €26 100 to the first units completed and transferred

out. This €26 100 is the cost of the 225 equivalent units of direct materials and 135 equivalent

units of conversion costs that comprise opening stock. The work that generated these costs was

done in February, so these units are costed (see data on page xx) at the February prices of €80 for

direct materials and €60 for conversion costs [(225 × €80) + (135 × €60) = €26 100]. As we saw in

step 2, an additional 90 equivalent units of conversion costs are needed to complete these units in the

current period. The current-period conversion costs per equivalent unit is €52, so €4680 (90 × €52)

of additional costs are needed to complete the opening stock. The total production costs for the

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Steps 3, 4 and 5: calculate equivalent-unit costs, summarise total costs to

Exhibit 4.8

account for, and assign costs to units completed and to units in closing

work in progress, FIFO method of process costing, Assembly Department of

Euro-Défense SA, for March 2022

Total

production

Direct

Conversion

costs

materials

costs

Work in progress, opening

(costs of work done

€26 100

before current period)

(Step 3) Costs added in current period (given p. 97)

36 180

€19 800

€16 380

Divide by equivalent units of work done in current period

(Exhibit 4.7)

÷ 275

÷ 315

Cost per equivalent unit of work done in current period

€72

€52

(Step 4) Total costs to account for

€62 280

(Step 5) Assignment of costs:

Completed and transferred out (400 units):

Work in progress, opening (225 units)

€26 100

Direct materials added in current period

0

0 × €72

Conversion costs added in current period

4 680

90 × €52

Total from opening stock

30 780

Started and completed (175 units)

21 700

(175† × €72) + (175† × €52)

Total costs of units completed and transferred out

52 480

Work in progress, closing (100 units):

Direct materials

7 200

100‡ × €72

Conversion costs

2 600

50‡ × €52

Total work in progress, closing

9 800

Total costs accounted for

€62 280

* Equivalent units used to complete opening work in progress from Exhibit 4.7, step 2.

† Equivalent units started and completed from Exhibit 4.7, step 2.

‡ Equivalent units in closing work in progress from Exhibit 4.7, step 2.

units in opening stock are €26 100 + €4680 = €30 780. The 175 units started and completed in

the current period consist of 175 equivalent units of direct materials and 175 equivalent units of

conversion costs. These units are costed at the cost per equivalent unit in the current period (direct

materials, €72 and conversion costs, €52) for a total production cost of €21 700.

Under FIFO, the closing work-in-progress stock comes from units that were started but not

fully completed during the current period. The total cost of the 100 partially assembled physical

units in closing work in progress consists of:

Direct materials:

100 equivalent units × cost per equivalent unit in March of €72

€7 200

Conversion costs:

50 equivalent units × cost per equivalent unit in March of €52

2 600

Total costs of work in progress on 31 March

€9 800

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The following table summarises the total costs to account for and the costs accounted for of

€62 280 in Exhibit 4.8. Notice how under the FIFO method, the layers of opening work in progress

and costs added in the current period are kept separate. The arrows indicate where the costs in

each layer go (that is, to units completed and transferred out or to closing work in progress). Be

sure to include the costs of opening work in progress (€26 100) when calculating the costs of units

completed from opening stock.

Costs accounted for

Costs to account for

calculated on a FIFO basis

Completed and transferred out:

Opening work in progress

€ 26 100

Opening work in progress

€ 26 100

Costs added in current period

36 180

Used to complete opening

work in progress

4 680

Started and completed

21 700

Completed and transferred out

52 480

Closing work in progress

9 800

Total costs to account for

€ 62 280

Total costs accounted for

€ 62 280

Before proceeding, you are advised to pause and review Exhibits 4.7 and 4.8 carefully to check

your understanding of the FIFO method. Note that Exhibit 4.7 deals only with physical and

equivalent units but no costs. Exhibit 4.8 shows the cost amounts.

The journal entries under the FIFO method parallel the journal entries under the weighted-

average method. The only difference is that the entry to record the cost of goods completed and

transferred out would be for €52 480 under the FIFO method instead of for €52 000 under the

weighted-average method.

Only rarely is an application of pure FIFO ever encountered in process costing. As a result, it

should really be called a *modified* or *departmental* FIFO method. Why? Because FIFO is applied

within a department to compile the cost of units transferred *out,* but the units transferred *in*

during a given period usually are carried at a single average unit cost as a matter of conven-

ience. For example, the average cost of units transferred out of the Assembly Department is

€52 480 ÷ 400 units = €131.20 per DG-19 unit. The Assembly Department uses FIFO to dis-

tinguish between monthly batches of production. The succeeding department, Testing, however,

costs these units (that consist of costs incurred in February and March) at one average unit cost

(€131.20 in this illustration). If this averaging were not done, the attempt to track costs on a pure

FIFO basis throughout a series of processes would be unduly cumbersome.

Comparison of weighted-average and FIFO methods

The following table summarises the costs assigned to units completed and to units still in process

under the weighted-average and FIFO process-costing methods for our example:

Weighted average

FIFO

(from Exhibit 4.6)

(from Exhibit 4.8)

Difference

Cost of units completed and

transferred out

€52 000

€52 480

+€480

Work in progress, closing

10 280

9 800

−€480

Total cost accounted for

€62 280

€62 280

The weighted-average closing stock is higher than the FIFO closing stock by €480, or 4.9%

(€480 ÷ €9800). This is a significant difference when aggregated over the many thousands of

products that Euro-Défense makes. The weighted-average method in our example also results in

lower cost of goods sold and hence higher operating income and higher income taxes than does

the FIFO method. Differences in equivalent-unit costs of opening stock and work done during the

current period account for the differences in weighted-average and FIFO costs. Recall from the data

given earlier (on p. 97) that direct materials costs per equivalent unit in opening work-in-progress

stock is €80, and conversion costs per equivalent unit in opening work-in-progress stock is €60.

These costs are greater than the €72 direct materials and €52 conversion costs per equivalent unit

of work done during the current period. This reduction could be due to a decline in the prices of

direct materials and conversion cost inputs or could be a result of Euro-Défense becoming more

efficient.

For the Assembly Department, FIFO assumes that all the higher-cost units from the previous

period in opening work in progress are the first to be completed and transferred out of the process,

and closing work in progress consists of only the lower-cost current-period units. The weighted-

average method, however, smooths out cost per equivalent unit by assuming that more of the low-

er-cost units are completed and transferred out, and some of the higher-cost units are placed in

closing work in progress. Hence, in this example, the weighted-average method results in a lower cost

of units completed and transferred out and a higher closing work-in-progress stock relative to FIFO.

Cost of units completed and, hence, operating income can differ materially between the

weighted-average and FIFO methods when (1) the direct materials or conversion costs per unit

vary significantly from period to period, and (2) the physical stock levels of work in progress are

large in relation to the total number of units transferred out of the process. Thus, as companies

move towards long-term procurement contracts that reduce differences in unit costs from period

to period, and reduce stock levels, the difference in cost of units completed under the weighted –

average and FIFO methods will decrease.

Managers need information from process-costing systems to aid them in pricing and product-

mix decisions and to provide them with feedback about their performance. The major advantage

of FIFO is that it provides managers with information about changes in the costs per unit from

one period to the next. Managers can use this information to evaluate their performance in the

current period compared with a benchmark or compared with their performance in the previous

period. By focusing on work done and the costs of work done during the current period, the FIFO

method provides useful information for these planning and control purposes. The weighted-av-

erage method merges unit costs from different periods and so obscures period- to-period com-

parisons. The major advantages of the weighted-average method, however, are its computational

simplicity and its reporting of a more representative average unit cost when input prices fluctuate

markedly from month to month.

Note that unlike in job-costing systems, activity-based costing (see Chapter 11) has less appli-

cability in process-costing environments. Why? Because products are homogeneous and hence use

resources in a similar way. Furthermore, each process – assembly, testing, and so on – corresponds

to the different (production) activities. Managers reduce the costs of activities by controlling the

costs of individual processes.

Standard-costing method of process costing

As we have mentioned, companies that use process-costing systems produce masses of identical

or similar units of output. Setting standards for quantities of inputs needed to produce output

is often relatively straightforward in such companies. Standard costs per input unit may then be

assigned to these physical standards to develop standard costs per output unit.

The weighted-average and FIFO methods become very complicated when used in process indus-

tries that produce a wide variety of similar products. For example, a steel-rolling mill uses various

steel alloys and produces sheets of various sizes and of various finishes. Both the items of direct mate-

rials and the operations performed are relatively few. But used in various combinations, they yield

such a *wide variety* of products that inaccurate costs for each product result if the *broad* averaging

procedure of actual process costing is used. Similarly, complex conditions are frequently found, for

example, in plants that manufacture rubber products, textiles, ceramics, paints and packaged food

products. The standard-costing method of process costing is especially useful in these situations.

Under the standard-costing method, teams of design and process engineers, operations per-

sonnel, and management accountants determine *separate* standard or equivalent-unit costs on the

basis of the different technical processing specifications for each product. Identifying standard

costs for each product overcomes the disadvantage of costing all products at a single average

amount, as under actual costing.

Computations under standard costing

We again use the Assembly Department of Euro-Défense SA as an example, except this time we

assign standard costs to the process. The same standard costs apply in February and March of 2022:

Direct materials

€74 per unit

Conversion costs

54 per unit

Total standard manufacturing costs

€128 per unit

Data for the Assembly Department are:

Physical units for March 2022

Work in progress, opening stock (1 March)

225 units

Direct materials (100% complete)

Conversion costs (60% complete)

Started during March

275 units

Completed and transferred out during March

400 units

Work in progress, closing stock (31 March)

100 units

Direct materials (100% complete)

Conversion costs (50% complete)

Total costs for March 2022

Work in progress, opening stock as standard costs

Direct materials:

€16 650

225 equivalent units × €74 per unit

Conversion costs:

7 290

€23 940

135 equivalent units × €74 per unit

Actual direct materials costs added during March

19 800

Actual conversion costs added during March

16 380

We illustrate the standard-costing method of process costing using the five-step procedure

introduced earlier in the chapter. Exhibit 4.9 presents steps 1 and 2. These steps are identical to

the steps described for the FIFO method in Exhibit 4.7. Work done in the current period equals

direct materials (275 equivalent units) and conversion costs (315 equivalent units).

Exhibit 4.10 shows the step 3 calculation of equivalent-unit costs. Step 3 is easier under the

standard- costing method than it is under the weighted-average and FIFO methods. Why? Because

the cost per equivalent unit does not have to be calculated, as was done for the weighted-average

and FIFO methods. Instead, the costs per equivalent unit *are* the standard costs: direct materials,

€74, and conversion costs, €54. Using standard costs also simplifies the computations for assign-

ing the total costs to account for to units completed and transferred out and to units in closing

work-in-progress stock.

The total costs to account for in Exhibit 4.10, step 4, that is, the total debits to Work in Progress –

Assembly, differ from the total debits to Work in Progress – Assembly under the actual cost-based

weighted-average and FIFO methods explained earlier in the chapter. Why? Because, *as in all*

standard-costing systems, the debits to the Work-in-Progress account are at standard costs rather

than actual costs. These standard costs total €61 300.

Exhibit 4.10, step 5, assigns total costs to units completed and transferred out and to units

in closing work-in-progress stock, as in the FIFO method. Step 5 attaches euro amounts, using

standard costs, to the equivalent units calculated in Exhibit 4.9. These costs are assigned first to

complete opening work-in-progress stock, then to start and complete new units, and finally to

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Steps 1 and 2: summarise output in physical units and calculate equivalent

Exhibit 4.9

units, use of standard costs in process costing, Assembly Department of

Euro-Défense SA, for March 2022

(Step 1)

(Step 2) Equivalent units

Physical units

Direct

Conversion

Flow of production

materials

costs

Work in progress, opening (given p. 106)

225

Started during current period (given p. 106)

275

To account for

500

Completed and transferred out during current period:

From beginning work in progress*

225 × (100 − 100%); 225 × (100% − 60%)

225

0

90

Started and completed

175†

175 × 100%; 175% − 100%

175

175

Work in progress, closing‡ (given p. 105)

100

100 × 100%; 100% − 50%

100

50

Accounted for

500

Work done in current period only

275

315

* Degree of completion in this department: direct materials, 100%; conversion costs, 60%.

† 400 physical units completed and transferred out minus 225 physical units completed and transferred out from opening

work-in-progress stock.

‡ Degree of completion in this department: direct materials, 100%; conversion costs, 50%.

start new units that are in closing work-in-progress stock. Note how the total costs accounted for

in step 5 of Exhibit 4.10 (€61 300) equal the total costs to account for.

Accounting for variances

Process-costing systems using standard costs usually accumulate actual costs incurred separately

from the stock accounts. The following is an example. The actual costs are recorded in the first

two entries. Recall that Euro-Défense purchases direct materials as needed and that these materials

are delivered directly to the Assembly Department. The total variances are recorded in the next

two entries. The final entry transfers out the completed goods at standard costs.

1 Assembly Department Direct Materials Control (at actual)

19 800

Creditors Control

19 800

To record direct materials purchased and used in production during March. This cost control account is debited with actual costs and immediately credited with standard costs assigned to the units worked on (entry 3 below)

2 Assembly Department Conversion Costs Control (at actual)

16 380

Various accounts

16 380

To record Assembly Department conversion costs for March

Entries 3, 4 and 5 use standard cost euro amounts from Exhibit 4.10.

3 Work in Progress – Assembly (at standard costs)

20 350

Direct Materials Variances

550

Assembly Department Direct Materials Control

19 800

To record actual direct materials used and total direct materials variances

4 Work in Progress – Assembly (at standard costs)

17 010

Conversion Costs Variances

630

Assembly Department Conversion Costs Control

16 380

To record actual conversion costs and total conversion costs variances

5 Work in Progress – Testing (at standard costs)

51 200

Work in Progress – Assembly (at standard costs)

51 200

To record costs of units completed and transferred out at standard cost from Assembly to Testing

Steps 3, 4 and 5: calculate equivalent-unit costs, summarise total costs to account for, and assign costs to units completed and to

Exhibit 4.10

units in closing work in progress, use of standard costs in process costing, Assembly Department of Euro-Défense SA, for March 2022

Total

production

Direct

Conversion

costs

materials

costs

(Step 3) Standard cost per equivalent unit (given p. 106)

€74

€54

Work in progress, opening (given p. 106)

Direct materials, 225 × €74;

Conversion costs, 135 × €54

€23 940

Costs added in current period at standard costs

Direct materials, 275 × €74;

Conversion costs, 315 × €54

37 360

20 350

17 010

(Step 4) Costs to account for

€61 300

(Step 5) Assignment of costs at standard costs:

Completed and transferred out (400 units):

Work in progress, opening (225 units)

€23 940

Direct materials added in current period

0

0* × €74

Conversion costs added in current period 4 860

90* × €54

Total from opening stock

28 800

Started and completed (175 units)

22 400

(175† × €74) + (175† × €54)

Total costs of units transferred out

51 200

Work in progress, closing (100 units):

Direct materials

7 400

100 × €74

Conversion costs

2 700

50 × €54

Total work in progress, closing

10 100

Total costs accounted for

€61 300

Summary of variances for current performance

Costs added in current period at standard prices (see

step 3 above)

€20 350

€17 010

Actual costs incurred (given p. 106)

19 800

16 380

Variance

€550F

€630F

* Equivalent units to complete opening work in progress from Exhibit 4.9, step 2.

† Equivalent units started and completed from Exhibit 4.9, step 2.

‡ Equivalent units in closing work in progress from Exhibit 4.9, step 2.

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Exhibit 4.11

Flow of standard costs in a process-costing system, Assembly Department of Euro-Défense SA, for March 2022

Assembly Department

Work in Progress –

Work in Progress –

Direct Materials Control

Assembly

Testing

1 19 800

3 19 800

Bal. 23 940 5 51 200

5 51 200

Transferred

3

20 350

out to

4

17 010

finished

goods xx

Bal. 10 100

Assembly Department

Conversion Costs

Direct Materials

Control

Variances

Finished Goods

2 16 380

4 16 380

3 550

xx

Cost of

goods

sold xx

Conversion Costs

Creditors

Variances

Cost of Goods Sold

1 19 800

4 630

xx

Various Accounts

2 16 380

Variances arise under the standard-costing method, as in entries 3 and 4 above. Why? Because

the standard costs assigned to products on the basis of work done in the current period do not

equal the actual costs incurred in the current period. Variances can be measured and analysed

in little or great detail for planning and control purposes, as described in Chapters 15 and 16.

Exhibit 4.11 shows how the standard costs flow through the accounts.

Transferred-in costs in process costing

Many process-costing systems have two or more departments or processes in the production

cycle. As units move from department to department, the related costs are also transferred by

monthly journal entries. If standard costs are used, the accounting for such transfers is relatively

simple. However, if the weighted-average or FIFO method is used, the accounting can become

more complex. We now extend our Euro-Défense SA example to the Testing Department. As

the assembly process is completed, the Assembly Department of Euro-Défense immediately

transfers DG-19 units to its Testing Department. Here the units receive additional direct mate-

rials, such as crating and other packing materials to prepare the units for shipment, at the end

of the process. Conversion costs are added evenly during the Testing Department's process. As

units are completed in Testing, they are immediately transferred to Finished Goods. Exhibit 4.12

summarises these facts.

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Exhibit 4.12

Allocation of direct material costs and conversion costs to testing process

Conversion costs

added evenly

during process

Transfer

Assembly

Testing

Finished

Department

Department

Goods

Direct materials

added at end

of process

Concepts in action

Hybrid costing for Adidas customised 3D printed shoes

In 2018, Adidas overtook Nike's Jordan brand to become the second-largest sneaker maker in the United States. Known for its iconic three-stripe logo and partnerships with NBA superstar James Harden and rapper Kanye West, the company is embracing cutting-edge manufacturing and 3D printing to create customized shoes for its customers.

Adidas' Futurecraft 4D running shoes feature a standard 3D-printed midsole. But new versions of the sneakers will feature customised midsoles engineered and printed based on the biomechanical data of each customer. To accomplish this, Adidas computers will

make a three-dimensional scan of a customer's feet and

measure the load and torque in their running stride.

From there, the single-piece customised midsoles will be 3D-printed using digital light synthesis and incorporated

into the knit Futurecraft 4D shoes. The result will be a customized pair of running shoes tailored to each person's

unique feet and running style.

Customised 3D-printed shoes, like the Futurecraft 4D, use a hybrid-costing system. Accounting for the 3D printing

of the midsoles requires job costing, but the similar process used to make the shoes they are stitched into lends itself

to process costing.

Along with athletic shoes, 3D printing is letting people create personalized jewelry, headphones, and mobile phone

cases. Adoption of 3D printing is growing rapidly, and by 2023 the market for 3D printing is expected to eclipse $32

billion.

Sources: Cheng, A. (2018) 'How Adidas plans to bring 3D printing to the masses', Forbes, 22 May (https://www.forbes.com/sites/andriacheng/2018/05/22/

with-adidas-3d-printing-may-finally-see-its-mass-retail-potential/); Flower, I. (2017) 'Is mass customization the future of footwear?' *The Wall Street Journal,*

24 October (https://www.wsj.com/articles/is-mass-customization-the-future-of-footwear-1508850000); Wiener, A. (2017) 'Inside Adidas' robot-powered, on-demand sneaker factory', *Wired,* 29 November

(https://www.wired.com/story/inside-speedfactory-adidas-robot-powered-sneaker-factory/). No author (2017) *3D Printing Market* (Chicago, IL: Markets and Markets).

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Data for the Testing Department for the month of March 2022 are:

Physical units for March 2022

Work in progress, opening stock (March 1)

240 units

Transferred-in costs (100% complete)

Direct materials (0% complete)

Conversion costs (5/8 or 62.5% complete)

Transferred in during March

400 units

Completed during March

440 units

Work in progress, closing stock (March 31)

200 units

Transferred-in costs (100% complete)

Direct materials (0% complete)

Conversion costs (80% complete)

Costs of Testing Department for March 2022

Work in progress, opening stock*

Transferred-in costs

€33 600

(240 equivalent units × €140 Per equivalent units)

Direct materials

0

Conversion costs (150 equivalent units × €120 Per equivalent units)

18 000

€51 600

Transferred-in costs during March

Weighted-average (from Exhibit 4.6)

52 000

FIFO (from Exhibit 4.8)

52 480

Direct material costs added during March

13 200

Conversion costs added during March

48 600

Transferred-in costs (also called previous department costs) are the costs incurred in a previous

department that are carried forward as the product's cost when it moves to a subsequent process

in the production cycle. That is, as the units move from one department to the next, their costs are

transferred with them. Thus, calculations of Testing Department costs consist of transferred-in

costs as well as the direct materials and conversion costs added in Testing.

Transferred-in costs are treated as if they are a separate type of direct material added at the

opening of the process. In other words, when successive departments are involved, transferred

units from one department become all or a part of the direct materials of the next department;

however, they are called transferred-in costs, not direct material costs.

Transferred-in costs and the weighted-average method

To examine the weighted-average process-costing method with transferred-in costs, we use the

five-step procedure described earlier (p. 94) to assign costs of the Testing Department to units

completed and transferred out and to units in closing work in progress. Exhibit 4.13 shows steps

1 and 2. The computations are basically the same as the calculations of equivalent units under the

weighted-average method for the Assembly Department in Exhibit 4.5, except for the addition of

transferred-in costs. The units are fully completed as to transferred-in costs because these costs are

simply carried forward from the previous process. Note, however, that direct materials costs have

a zero degree of completion in both the opening and closing work-in-progress stocks because, in

Testing, direct materials are introduced at the end of the process.

1 *The opening work-in-progress stock is the same under both the weighted-average and FIFO stock methods because we assume costs per equivalent unit to be the same in both January and February. If the cost per equivalent unit had been different in the two months, the work-in-progress stock at the end of February (beginning of March) would be costed differently under the weighted-average and FIFO

*The opening work-in-progress stock is the same under both the weighted-average and FIFO stock methods because

methods. If this were the case, the basic approach to process costing with transferred-in costs would still be the same as described in this we assume costs per equivalent unit to be the same in both January and February. If the cost per equivalent unit had

section, only the opening balances of work in progress would be different.»

been different in the two months, the work-in-progress stock at the end of February (beginning of March) would be

costed differently under the weighted-average and FIFO methods. If this were the case, the basic approach to process

costing with transferred-in costs would still be the same as described in this section, only the opening balances of

work in progress would be different.

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Steps 1 and 2: summarise output in physical units and calculate equivalent

Exhibit 4.13

units, weighted-average method of process costing, Testing Department of

Euro-Défense SA, for March 2022

(Step 2) Equivalent units

(Step 1)

Physical units Transferred- in

Direct

Conversion

Flow of production

(given p. 111)

costs

materials

costs

Work in progress, opening

240

Transferred in during current period

400

To account for

640

Completed and transferred out during current

440

440

440

440

period

Work in progress, closing*

200

200 × 100%; 200 × 0%; 200 × 80%

200

0

160

Accounted for

640

Work done to date

640

440

600

* Degree of completion in this department: transferred-in costs, 100%; direct materials, 0%; conversion costs, 80%.

Exhibit 4.14 describes steps 3, 4 and 5 for the weighted-average method. Note that opening

work in progress and work done in the current period are combined for purposes of computing

equivalent-unit costs for transferred-in costs, direct materials and conversion costs.

Steps 3, 4 and 5: calculate equivalent-unit costs, summarise total costs to

Exhibit 4.14

account for, and assign costs to units completed and to units in closing work in

progress, weighted-average method of process costing, Testing Department of

Euro-Défense SA, for March 2022

Total

production Transferred-

Direct

Conversion

costs

in costs

materials

costs

(Step 3) Work in progress, opening

€51 600

€33 600

€0

€18 000

(given p. 111)

Costs added in current period (given p. 111)

113 800

52 000

13 200

48 600

Costs incurred to date

€85 600

€13 200

€66 600

Divide by equivalent units of work done

to date (Exhibit 4.13)

÷ 640

÷ 440

÷ 600

Equipment-unit costs of

€133.75

€30

€111

work done to date

(Step 4) Total costs to account for

€165 400

(Step 5) Assignment of costs:

Completed and transferred out

€120 890

(440* × €133.75) + (440* × €30) + (440* × €111)

(440 units)

Work in progress, closing (200 units):

Transferred-in costs

26 750

200† × €133.75

Direct materials

0

0† × €30

Conversion costs

17 760

160† × €111

Total work in progress, closing

44 510

Total costs accounted for

€165 400

* Equivalent units completed and transferred out from Exhibit 4.13, step 2.

† Equivalent units in closing work in progress from Exhibit 4.13, step 2.

Using the euro amount from Exhibit 4.14, the journal entry for the transfer out from Testing

to Finished Goods stock is:

Finished Goods Control

120 890

Work in Progress – Testing

120 890

To record cost of goods completed and transferred from Testing to Finished Goods

Entries to the key T-account, Work in Progress – Testing, follow (from Exhibit 4.14).

Work in Progress – Testing

Opening stock, 1 March

51 600

Transferred out

120 890

Transferred-in costs

52 000

Direct materials

13 200

Conversion costs

48 600

Closing stock, 31 March

45 510

Transferred-in costs and the FIFO method

To examine the FIFO process-costing method with transferred-in costs, we again use the five-step

procedure. Exhibit 4.15 shows steps 1 and 2. Other than considering transferred-in costs, the

computations of equivalent units are basically the same as those under the FIFO method for the

Assembly Department shown in Exhibit 4.7.

Exhibit 4.16 describes steps 3, 4 and 5. Note that the costs per equivalent unit for the current

period in step 3 are only calculated on the basis of costs transferred in and work done in the

Steps 1 and 2: summarise output in physical units and calculate equivalent units,

Exhibit 4.15

FIFO method of process costing, Testing Department of Euro-Défense SA, for

March 2022

(Step 1)

(Step 2) Equivalent units

Physical

Transferred- Direct

Conversion

Flow of production

units

in costs

materials

costs

Work in progress, opening (given p. 111)

240

(work done before current period)

Transferred in during current period (given p. 111)

400

To account for

640

Completed and transferred out during current period:

From opening work in progress*

240

240 × (100% − 100%); 240 × (100 − 0%);

240 × (100 − 62.5%)

0

240

90

Started and completed

200†

200 × 100%; 200 100%; 200 × 100%

200

200

200

Work in progress, closing‡ (given p. xxx)

200

200 × 100%; 200 × 0%; 200 × 80%

200

0

160

Accounted for

640

———

———

———

Work done in current period only

400

440

450

* Degree of completion in this department: Transferred-in costs, 100%; direct materials, 0%; conversion costs, 62.5%.

† 440 physical units completed and transferred out minus 240 physical units completed and transferred out from opening

work-in-progress stock.

‡ Degree of completion in this department: transferred-in costs, 100%; direct materials, 0%; conversion costs, 80%.

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Steps 3, 4 and 5: calculate equivalent-unit costs, summarise total costs to

Exhibit 4.16

account for, and assign costs to units completed and to units in closing

work in progress, FIFO method of process costing, Testing Department of

Euro-Défense SA, for March 2022

Total

production Transferred- in

Direct

Conversion

costs

costs

materials

costs

Work in progress, opening

€51 600 (costs of work done before current period)

(given p. 111)

(Step 3) Costs added in current period (given p. 111) 114 280

€52 480

€13 200

€48 600

Divide by equivalent units of work done in

÷ 400

÷ 440

÷ 450

current period (Exhibit 4.15)

Cost per equivalent unit of work done in

€131.20

€30

€108

current period

(Step 4) Total costs to account for

€165 880

(Step 5) Assignment of costs:

Completed and transferred out (440 units):

Work in progress, opening (240 units)

€51 600

Transferred-in costs added in current 0

0† × €131.20

period

Direct materials added in current

7 200

240† × €30

period

Conversion costs added in current

9 720

90† × €108

period

Total from opening stock

68 520

Started and completed (200 units)

53 840 (200† × €131.20) + (200† × €30) + (200† × €108)

Total costs of units completed and 122 360

transferred out

Work in progress, ending (200 units):

Transferred-in costs

26 240 (200† × €131.20)

Direct materials

0

0† × €30

Conversion costs

17 280

160† × €108

Total work in progress, closing

43 520

Total costs accounted for

€165 880

* Equivalent units used to complete opening work in progress from Exhibit 4.15, step 2.

† Equivalent units started and completed from Exhibit 4.15, step 2.

‡ Equivalent units in closing work in progress from Exhibit 4.15, step 2.

current period. In steps 4 and 5, the total costs to account for and accounted for of €165 880 under

the FIFO method differ from the corresponding amounts under the weighted-average method of

€165 400. Why? Because of the different costs of completed units transferred in from the Assembly

Department under the two methods (€52 480 under FIFO and €52 000 under weighted average).

Using the euro amount from Exhibit 4.16, the journal entry for the transfer of completed units

to Finished Goods stock is:

Finished goods Control

122 360

Work in Progress – Testing

122 360

To record cost of goods completed and transferred from Testing to Finished Goods

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Entries to the key T-account, Work in Progress – Testing, follow using information from

Exhibit 4.16.

Work in Progress – Testing

Opening stock, 1 March

51 600

Transferred out

122 360

Transferred-in costs

52 480

Direct materials

13 200

Conversion costs

48 600

Closing stock, 31 March

43 520

Points to remember about transferred-in costs

Here are some points to remember when accounting for transferred-in costs:

● Remember to include transferred-in costs from previous departments in your calculations.

● In calculating costs to be transferred on a FIFO basis, do not overlook the costs assigned at the

opening of the period to units that were in process but are now included in the units transferred.

For example, do not overlook the €51 600 in Exhibit 4.16.

● Unit costs may fluctuate between periods. Therefore, transferred units may contain batches

accumulated at different unit costs. For example, the 400 units transferred in at €52 480 in

Exhibit 4.16 using the FIFO method consist of units that have different unit costs of direct

materials and conversion costs when these units were worked on in the Assembly Depart-

ment (see Exhibit 4.8). Remember, however, that when these units are transferred to the Test-

ing Department, they are costed at *one* average unit cost of €131.20 (€52 480 ÷ 400) as in

Exhibit 4.14.

● Units may be measured in different terms in different departments. Consider each department

separately. For example, unit costs could be based on kilograms in the first department and

litres in the second department. Accordingly, as units are received in the second department,

their measurements must be converted to litres.

Hybrid-costing systems

Product-costing systems do not always fall neatly into the categories of job costing or process costing. A hybrid-costing system blends characteristics from both job-costing systems and process-costing systems. Job-costing and process-costing systems are best viewed as the ends of a continuum (Exhibit 4.17).

Product-costing systems must often be designed to fit the particular characteristics of different production systems. Many production systems are a hybrid – they have some features of custom-order manufacturing and other features of mass-production manufacturing. Manufacturers of a relatively wide variety of closely related standardised products tend to use a hybrid-costing system. Consider Renault, the car manufacturer. Cars may be manufactured in a continuous flow, but individual units may be customised with a special combination of engine size, gears, in-car stereo system, and so on. Companies develop hybrid-costing systems in such situations. The 'Concepts in action' box in this chapter describe a hybrid-costing system at Adidas. The appendix to this chapter explains *operation costing,* a common type of hybrid-costing system.

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Exhibit 4.17

The hybrid-costing systems continuum

Job-costing

Hybrid-costing

Process-costing

systems

systems

systems

Distinct, identifiable

Masses of identical or

units of product

similar units of

or service

product or service

(for example, custom-made

(for example, food or

machines and houses)

chemical processing)

Summary

The following points are linked to the chapter's learning objectives.

1 A process-costing system is used to determine the cost of a product or service when masses of identical or

similar units are produced. Unit costs are computed by first assigning costs to these similar units and then

dividing by the number of these units. Industries using process-costing systems include food, textiles and oil

refining.

2 The five key steps in a process-costing system using equivalent units are (a) summarise the flow of physical units

of output, (b) compute output in terms of equivalent units, (c) compute equivalent-unit costs, (d) summarise total

costs to account for, and (e) assign total costs to units completed and to units in closing work in progress.

3 Equivalent units is a derived amount of output units that takes the quantity of each input in units completed or in

work in progress, and converts it into the amount of completed output units that could be made with that quantity

of input. Equivalent-unit calculations are necessary when all physical units of output are not uniformly completed

during an accounting period. Journal entries in a process-costing system are similar to entries in a job-costing

system. The main difference is that in a process-costing system, there is a separate work-in-progress account for

each department.

4 The weighted-average method of process costing computes unit costs by focusing on the total costs and the

total equivalent units completed to date and assigns this average cost to units completed and to units in closing

work-in-progress stock. The first-in, first-out (FIFO) method of process costing assigns the costs of the open-

ing work-in-progress stock to the first units completed, and assigns the costs of the equivalent units worked on

during the current period first to complete beginning stock, then to start and complete new units, and finally to

units in closing work-in-progress stock.

5 The standard-costing method simplifies process costing because standard costs serve as the costs per equivalent

unit when assigning costs to units completed and to units in closing work-in-progress stock.

6 The weighted-average process-costing method computes transferred-in costs per unit by focusing on total

transferred-in costs and total equivalent transferred-in units completed to date, and assigns this average cost

to units completed and to units in closing work-in-progress stock. The FIFO process-costing method assigns

transferred-in costs in opening work in progress to units completed, and the costs transferred in during the current

period first to complete opening work-in-progress units, then to start and complete new units, and finally to units

in closing work-in-progress stock.

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Appendix

Operation costing

This appendix presents key ideas of operation costing and uses an example to illustrate relevant

calculations and journal entries.

Overview of operation costing

An operation is a standardised method or technique that is performed repetitively regardless of

the distinguishing features of the finished good. Operations are usually conducted within depart-

ments. For instance, a suit maker may have a cutting operation and a hemming operation within

a single department. The term *operation,* however, is often used loosely. It may be a synonym for

a department or a process; for example, some companies may call their finishing department a

finishing process or a finishing operation.

Operation costing is a hybrid-costing system applied to batches of similar products. Each batch

of products is often a variation of a single design and proceeds through a sequence of selected

(though not necessarily the same) activities or operations. Within each operation, all product

units are treated exactly alike, using identical amounts of the operation's resources. Batches are

also termed production runs.

Consider a business that makes suits. Management may select a single basic design for every

suit that the company manufactures. Depending on specifications, batches of suits vary from each

other. One batch may use wool; another batch, cotton. One batch may require special hand stitch-

ing; another batch, machine stitching. Other products that are often manufactured in batches are

semiconductors, textiles and shoes.

An operation-costing system uses work orders that specify the needed direct materials

and step-by-step operations. Product costs are compiled for each work order. Direct mate-

rials that are unique to different work orders are specifically identified with the appropriate

work order as in job-costing systems. The conversion cost for each unit passing through a

given operation is the same regardless of the work order. Why? Because each unit passing

through an operation uses identical amounts of that operation's resources. A single average

conversion cost per unit is calculated as in process costing. For each operation, this amount

is calculated by aggregating conversion costs and dividing by all units passing through that

operation. Our examples assume only two cost categories, direct materials and conversion

costs. Of course, operation costing can have more than two cost categories. The costs in

each category are identified with work orders using job-costing or process-costing methods

as appropriate.

Managers often find operation costing useful in cost management because operation costing

focuses on the physical processes, or operations, of a given production system. For example, in

the manufacturing of clothing, managers are concerned with fabric waste, the number of fabric

layers that can be cut at one time, and so on. Operation costing captures the financial impact

of the control of physical processes. Feedback from an operation-costing system can therefore

provide essential insight into the control of physical processes and the management of opera-

tional costs.

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An illustration of operation costing

Consider Aran Sweaters Ltd, a clothing manufacturer that produces two lines of blazers for

department stores. Wool blazers use better-quality materials and undergo more operations than

do polyester blazers. Let us look at the following operations in 2022:

Work order 423

Work order 424

Direct materials

Wool

Polyester

Satin full lining

Rayon partial lining

Bone buttons

Plastic buttons

Operations

1 Cutting cloth

Use

Use

2 Checking edges

Use

Do not use

3 Sewing body

Use

Use

4 Checking seams

Use

Do not use

5 Machine sewing of collars and lapels

Do not use

Use

6 Hand sewing of collars and lapels

Use

Do not use

Suppose work order 423 is for 50 wool blazers and work order 424 is for 100 polyester blazers.

The following costs are assumed for these two work orders, which were started and completed

in March 2022:

Work order 423

Work order 424

Number of blazers

50

100

Direct material costs

€6 000

€3 000

Conversion costs allocated:

Operation 1

580

1 160

Operation 2

400

–

Operation 3

1 900

3 800

Operation 4

500

–

Operation 5

–

875

Operation 6

700

–

Total manufacturing costs

€10 080

€8 835

As in process costing, all product units in any work order are assumed to consume identical

amounts of conversion costs of a particular operation. Aran Sweaters' operation-costing system

uses a budgeted rate to calculate the conversion costs of each operation. For example, the costs

of operation 1 might be budgeted as follows (amounts assumed):

Operation 1 budgeted

Operation 1 budgeted conversion costs in 2022

conversion cost

= Operation1budgeted product units in 2022

rate in 2022

= €232 000

20 000 units

= €1160 per unit

The budgeted conversion costs of operation 1 include labour, power, repairs, supplies, deprecia-

tion and other overheads of this operation. If some units have not been completed so that all units

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in operation 1 have not received the same amounts of conversion costs, the conversion cost rate

is calculated by dividing budgeted conversion costs by the *equivalent units* of conversion costs.

As goods are manufactured, conversion costs are allocated to the work orders pro-

cessed in operation 1 by multiplying the €11.60 conversion costs per unit by the number

of product units processed. The conversion costs of operation 1 for 50 wool blazers (work

order 423) are €11.60 × 50 = €580, and for 100 polyester blazers (work order 424) are

€11.60 × 100 = €1160. If work order 424 contained 75 units, its total costs in operation

1 would be €870 (€11.60 × 75), 150% rather than 200% of the cost of work order 423. If

equivalent units have been used to calculate the conversion cost rate, costs are allocated to

work orders by multiplying the conversion cost per equivalent unit by the number of equiv-

alent units in the work order. Direct material costs of €6000 for the 50 wool blazers (work

order 423) and €3000 for the 100 polyester blazers (work order 424) are specifically identified

with each order as in a job-costing system. Note that operational unit costs are assumed to

be the same regardless of the work order, but direct material costs vary across orders as the

materials themselves vary.

Journal entries

Actual conversion costs for operation 1 in March 2022 (assumed to be €24 400) are entered into

a Conversion Costs account:

1 Conversion Costs

24 400

Various accounts (such as Wages Payable

24 400

and Provision for Depreciation)

Summary journal entries for assigning costs to the polyester blazers (work order 424) follow.

Entries for the wool blazers would be similar.

Of the €3000 of direct materials for work order 424, €2975 are used in operation 1. The journal

entry for the use of direct materials, which are traced directly to particular batches, for the 100

polyester blazers is:

2 Work in Progress, Operation 1

2975

Materials Stock Control

2975

The allocation of conversion costs to products in operation costing uses the budgeted rate €11.60

times the 100 units processed, or €1160.

3 Work in Progress, Operation 1

1160

Conversion Costs Allocated

1160

The transfer of the polyester blazers from operation 1 to operation 3 (recall that the polyester

blazers do not go through operation 2) would be entered in the journal as follows:

4 Work in Progress, Operation 3

4135

Work in Progress, Operation 1

4135

After posting, Work in Progress, Operation 1 account appears as follows:

Work in Progress, Operation 1

2 Direct materials

2975

4 Transferred to Operation

34 135

3 Conversion costs

1160

allocated

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The costs of the blazers are transferred through the pertinent operations and then to Finished

Goods in the usual manner. Costs are added throughout the year in the Conversion Costs and

Conversion Costs Allocated accounts. Any over- or underallocation of conversion costs is dis-

posed of in the same way as over- or underallocated manufacturing overhead in a job-costing

system.

Reference

Moxa-Europe (2022), ‘Smart edge turnkey solution for optimizing brewing processes’ (https://moxa-europe.

com/lp/case-study-ait-sonem/).

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CHAPTER 4

Assessment material

Review questions

4.1

Give three examples of industries that often use process-costing systems.

4.2

In process costing, why are costs often divided into two main classifications?

4.3

What problems might arise in estimating the degree of completion of an aircraft blade in a

machining shop?

4.4

Describe the distinctive characteristic of weighted-average computations in assigning costs to

units completed and closing work in progress.

4.5

Describe the distinctive characteristic of FIFO computations in assigning costs to units completed

and closing work in progress.

4.6

Identify a major advantage of the FIFO method for purposes of planning and control.

4.7

Identify the main difference between journal entries in process costing and those in job costing.

4.8

Why should the accountant distinguish between transferred-in costs and additional direct material

costs for a particular department?

4.9

‘Previous department costs are those incurred in the preceding accounting period.’ Do you agree?

Explain.

4.10 ‘There’s no reason for me to get excited about the choice between the weighted-average and FIFO

methods in my process-costing system. I have long-term contracts with my materials suppliers

at fixed prices.’ State the conditions under which you would (a) agree and (b) disagree with this

statement, made by an accountant. Explain.

Exercises

Intermediate level

4.11 No opening stock (25 minutes)

Europe Electronics SNC manufactures microchips in large quantities. Each microchip undergoes

assembly and testing. The total assembly costs during January 2022 were:

Direct materials used

€720 000

Conversion costs

760 000

Total manufacturing costs

€1 480 000

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Required

1 Assume there was no opening stock on 1 January 2022. During January, 10 000 microchips were

placed into production and all 10 000 microchips were fully completed at the end of January.

What is the unit cost of an assembled microchip in January 2022?

2 Assume that during February 10 000 microchips were placed into production. Further assume

the same total assembly costs for January are also incurred in February, but only 9000 micro-

chips are fully completed at the end of February. All direct materials had been added to the

remaining 1000 microchips. However, on average, these remaining 1000 microchips were only

50% complete as to conversion costs. (a) What are the equivalent units for direct materials and

conversion costs and their respective equivalent-unit costs for February? (b) What is the unit

cost of an assembled microchip in February?

3 Explain the difference in your answers to requirements 1 and 2.

***4.12 Journal entries** (continuation of Exercise 4.11) (20 minutes)

Refer to requirement 2 of Exercise 4.11.

Required

Prepare summary journal entries for the use of direct materials and conversion costs. Also prepare

a journal entry to transfer out the cost of goods completed. Show the postings to the Work in

Progress account.

4.13 Equivalent units and equivalent-unit costs (25 minutes)

Consider the following data for the satellite Assembly Division of Aéro-France:

Physical units

(satellites)

Direct materials Conversion costs

Opening work in progress (1 May)*

8

€4 968 000

€928 000

Started in May

50

Completed during May

46

Closing work in progress (31 May)†

12

Costs added during May

€32 200 000

€13 920 000

* Degree of completion: direct materials, 90%; conversion costs, 40%.

† Degree of completion: direct materials, 60%; conversion costs, 30%.

Required

1 Calculate equivalent units of work done in the current period for direct materials and conver-

sion costs. Show physical units in the first column.

2 Calculate cost per equivalent unit of opening work in progress and of work done in the current

period for direct materials and conversion costs.

***4.14 Equivalent-unit computations, benchmarking, ethics** (20–25 minutes)

Radhika Khrishna is the corporate accountant of Manchester Suits plc. Manchester Suits has

20 plants worldwide that manufacture basic suits for retail stores. Each plant uses a process-

costing system. At the end of each month, each plant manager submits a production report and a

production-cost report. The production report includes the plant manager's estimate of the per-

centage of completion of the closing work in progress as to direct materials and conversion costs.

Khrishna uses these estimates to calculate the equivalent units of work done in each plant and the

cost per equivalent unit of work done for both direct materials and conversion costs in each month.

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Plants are ranked from 1 to 20, in terms of (a) cost per equivalent unit of direct materials and (b)

cost per equivalent unit of conversion costs. Each month Khrishna publishes a report that she calls

‘Benchmarking for Efficiency Gains at Manchester Suits’. The top three ranked plants on each

category receive a bonus and are written up as the best in their class in the company newsletter.

Khrishna has been pleased with the success of her benchmarking programme. However, she has

heard some disturbing news. She has received some unsigned letters stating that two plant man-

agers have been manipulating their monthly estimates of percentage of completion in an attempt

to become best in class.

Required

1 How and why might plant managers ‘manipulate’ their monthly estimates of percentage of

completion?

2 Khrishna’s first reaction is to contact each plant accountant and discuss the problem raised by

the unsigned letters. Is that a good idea?

3 Assume that the plant accountant’s primary reporting responsibility is to the plant manager

and that each plant accountant receives the telephone call from Khrishna, mentioned in require-

ment 2. What is the ethical responsibility of each plant accountant (a) to Radhika Khrishna

and (b) to Manchester Suits in relation to the equivalent-unit information each plant provides

for the 'Benchmarking for Efficiency' report?

4 How might Khrishna gain some insight into whether the equivalent-unit figures provided by

particular plants are being manipulated?

4.15 Process Costing (From ACCA Financial Information for Management, Part 1, June 2004)

(40 minutes)

Duddon Ltd makes a product that has to pass through two manufacturing processes, I and II. All

the material is input at the start of process I. No losses occur in process I but there is a normal

loss in process II equal to 7% of the input into that process. Losses have no realisable value.

Process I is operated only in the first part of every month, followed by process II in the second

part of the month. All completed production from process I is transferred into process II in the

same month. There is no work in progress in process II.

Information for last month for each process is as follows:

Process I

Opening work in progress

200 units (40% complete for conversion costs)

valued in total at £16 500

Input into the process

1900 units with a material cost of £133 000

Conversion costs incurred

£93 500

Closing work in progress

50% complete for conversion costs

Process II

Transfer from process I

1800 units

Conversion costs incurred

£78 450

1650 completed units were transferred to the Finished Goods warehouse.

Required

1 Calculate for process I:

a the value of the closing work in progress; and

b the total value of the units transferred to process II.

Chapter 4 Process costing

2 Prepare the process II account for last month.

3 Identify TWO main differences between process costing and job costing.

Advanced level

***4.16 Transferred-in costs, equivalent-unit costs, working backwards** (30 minutes)

Le Roi du Plastique Sarl has two processes – extrusion and thermo-assembly. Consider the June

2022 data for physical units in the thermo-assembly process of Le Roi du Plastique: opening work

in progress, 15 000 units; transferred in from the Extruding Department during September, 9000;

closing work in progress, 5000. Direct materials are added when the process in the Thermo-as-

sembly Department is 80% complete. Conversion costs are added evenly during the process. Le

Roi du Plastique uses the weighted-average process-costing method. The following information

is available.

Transferred-

Direct

Conversion

in costs

materials

costs

Opening work in progress at cost

€90 000

–

€45 000

Cost per equivalent unit of opening

€6

–

€5

work in progress

Costs added in current period

€58 500

€57 000

€57 200

Cost per equivalent unit of work done in

€6.50

€3

€5.20

current period

Required

1 For each cost element, calculate equivalent units of (a) opening work in progress and (b) work

done in the current period.

2 For each cost element, calculate the equivalent units in closing work in progress.

3 (a) For each cost element, calculate the percentage of completion of opening work-in-progress

stock and (b) for each cost element, calculate the percentage of completion of closing work-

in-progress stock.

4.17 Transferred-in costs, weighted-average method (35–40 minutes)

Telemark-Kjemi AS manufactures an industrial solvent in two departments – mixing and cook-

ing. This question focuses on the Cooking Department. During June 2022, 90 tonnes of solvent

were completed and transferred out from the Cooking Department. Direct materials are added

at one point in time during the process. Conversion costs are added uniformly during the process.

Telemark-Kjemi uses the weighted-average process-costing method. The following information

about the actual costs for June 2022 is available.

Transferred-in costs

Direct materials

Conversion costs

Equivalent

Total

Equivalent

Total

Equivalent Total

tonnes

costs

tonnes

costs

tonnes

costs

Work in progress,

40

NOK 40 000

0

NOK 0

30

NOK 18

1 June

000

Work done in June

80

NOK 87 200

90

NOK 36 000

75

NOK 49

725

Completed in June

?

?

?

?

?

?

Work in progress,

?

?

?

?

?

?

30 June

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Exercises

125

Required

1 Calculate the equivalent tonnes of solvent completed and transferred out and in closing work

in progress for each cost element.

2 Calculate cost per equivalent unit for opening work in progress and work done in current period.

3 Summarise total costs to account for and assign these costs to units completed (and transferred

out) and to units in closing work in progress using the weighted-average method.

4.18 Transferred-in costs, FIFO method (35–40 minutes)

Refer to the information in Exercise 4.17. Suppose that Telemark-Kjemi uses the FIFO method

instead of the weighted-average method in all its departments. The only changes under the FIFO

method are that the total transferred-in cost of opening work in progress is NOK 39 200 and that

the cost of work done in the current period is NOK 85 600.

Required

Do Exercise 4.17 using the FIFO method.

4.19 Transferred-in costs, standard-costing method (35–40 minutes)

Refer to the information in Exercise 4.17. Suppose Telemark-Kjemi determines standard costs

of NKr 1050 per (equivalent) tonne of transferred-in costs, NOK 390 per (equivalent) tonne of

direct materials and NOK 640 per (equivalent) tonne of conversion costs for both opening work

in progress and work done in the current period.

Required

Do Exercise 4.17 using the standard-costing method.

4.20 Weighted-average method (25 minutes)

Euro-Défense is a manufacturer of military equipment. Its Tourcoing plant manufactures the

Déca-Pite missile under contract to the French government and friendly countries. All Déca-Pites

go through an identical manufacturing process. Every effort is made to ensure that all Déca-Pites

are identical and meet many demanding performance specifications. The product-costing system

at the Tourcoing plant has a single direct-cost category (direct materials) and a single indirect-cost

category (conversion costs). Each Déca-Pite passes through two departments – the Assembly

Department and the Testing Department. Direct materials are added at the opening of the pro-

cess in Assembly. Conversion costs are added evenly throughout the two departments. When the

Assembly Department finishes work on each Déca-Pite, it is immediately transferred to Testing.

Euro-Défense uses the weighted-average method of process costing. Data for the Assembly

Department for October 2022 are:

Direct

Conversion

Physical units (missiles)

materials

costs

Work in progress, 1 October*

20

€460 000

€120 000

Started during October

80

Completed during October

90

Work in progress, 31 October†

10

Costs added during October

€2 000 000

€935 000

* Degree of completion: direct materials, ?%; conversion costs, 60%.

† Degree of completion: direct materials, ?%; conversion costs, 70%.

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Required

1 For each cost element, calculate equivalent units of work done in October 2022 in the Assembly

Department. Show physical units in the first column.

2 For each cost element, calculate cost per equivalent unit of opening work in progress and of

work done in October 2022.

3 Summarise the total Assembly Department costs for October 2022 and assign these costs to

units completed (and transferred out) and to units in closing work in progress using the weight-

ed-average method.

4 Prepare a set of summarised journal entries for all October 2022 transactions affecting Work in

Progress – Assembly. Set up a T-account for Work in Progress – Assembly and post the entries to it.

4.21 FIFO method (continuation of Exercise 4.20) (20 minutes)

Required

Do Exercise 4.20 using the FIFO method of process costing. Explain any difference between the

cost of work completed and transferred out and cost of closing work in progress in the Assembly

Department under the weighted-average method and the FIFO method.

4.22 Weighted-average method (25 minutes)

Sligo Toys Ltd manufactures one type of wooden toy figure. It buys wood as its direct material

for the Forming Department of its Ballinode plant. The toys are transferred to the Finishing

Department, where they are hand-shaped and metal is added to them.

Sligo Toys uses the weighted-average method of process costing. Consider the following data for

the Forming Department in April 2022:

Physical units

Direct

Conversion

(missiles)

materials

costs

Work in progress, 1 April*

300

€7 500

€2 125

Started during April

2 200

Completed during April

2 000

Work in progress, 30 April†

500

Costs added during April

€70 000

€42 500

* Degree of completion: direct materials, 100%; conversion costs, 40%.

† Degree of completion: direct materials, 100%; conversion costs, 25%.

Required

1 Summarise the total Forming Department costs for April 2022, and assign these costs to units

completed (and transferred out) and to units in closing work in progress using the weighted-

average method.

2 Prepare a set of summarised journal entries for all April transactions affecting Work in Progress –

Forming. Set up a T-account for Work in Progress – Forming and post the entries to it.

4.23 FIFO computations (continuation of Exercise 4.22) (20 minutes)

Required

Do Exercise 4.22 (1) using FIFO and four decimal places for unit costs. Explain any difference

between the cost of work completed and transferred out and cost of closing work in progress in

the Forming Department under the weighted-average method and the FIFO method.

4.24 Transferred-in costs, weighted-average (related to Exercises 4.22 and 4.23) (30 minutes)

Sligo Toys Ltd manufactures wooden toy figures at its Ballinode plant. It has two departments –

the Forming Department and the Finishing Department. (Exercises 4.22 and 4.23 focused on the

Forming Department.) Consider now the Finishing Department, which processes the formed toys

through hand-shaping and the addition of metal. For simplicity here, suppose all additional direct

materials are added at the end of the process. Conversion costs are added evenly duringFinishing

operations.

Sligo Toys uses the weighted-average method of process costing. The following is a summary of

the April 2022 operations in the Finishing Department:

Physical units Transferred- in

Direct

Conversion

(toys)

costs

materials

costs

Work in progress, 1 April*

500

€17 750

€0

€7 250

Transferred-in during April

2 000

Completed during April

2 100

Work in progress, 30 April†

400

Costs added during April

€104 000

€23 100

€38 400

* Degree of completion: transferred-in costs, 100%; direct materials, 0%; conversion costs, 60%.

† Degree of completion: transferred-in costs, 100%; direct materials, 0%; conversion costs, 30%.

Required

1 Summarise the total Finishing Department costs for April 2022, and assign these costs to units

completed (and transferred out) and to units in closing work in progress using the weighted-

average method.

2 Prepare journal entries for April transfers from the Forming Department to the Finishing

Department and from the Finishing Department to Finished Goods.

4.25 Transferred-in costs, FIFO costing (continuation of Exercise 4.24) (30 minutes)

Required

1 Using the FIFO process-costing method, do the requirements of Exercise 4.24. The transferred-

in costs from the Forming Department for the April opening work in progress are €17 520.

During April, the costs transferred in are €103 566. All other data are unchanged.

2 Explain any difference between the cost of work completed and transferred out and cost of

closing work in progress in the Finishing Department under the weighted-average method and

the FIFO method.

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CHAPTER 5

Cost al ocation

Cost allocation is an inescapable problem in nearly every organisation. How should the airline costs of a trip to attend job interviews from

Learning objectives

London to Dubai to Tunis and then return to London be allocated among the prospective employers in Dubai and Tunis? How should university

After studying this chapter, you

costs be allocated among undergraduate, graduate and research degrees?

should be able to:

How should the costs of expensive medical equipment, facilities and staff

-

Describe how a costing system can

be allocated in a medical centre? How should manufacturing overhead be

have multiple cost objects

allocated to individual products in a multiple-product company such as Heinz?

-

Outline four purposes for

Finding answers to cost-allocation questions is difficult. The answers

allocating costs to cost objects

are seldom entirely right or clearly wrong. But cost allocation is of real

●

Discuss key decisions faced when

importance for most enterprises. While the allocation may not affect

collecting costs in indirect-cost

the firm’s profit as a whole, if the allocation is not performed properly,

pools

it can make the profitability of some departments and projects (and

●

Describe how the single-rate

their managers) look better or worse than they should. In other cases,

cost-allocation method differs

the allocations can affect the decisions of managers and the prices

from the dual-rate method

paid by consumers. Lock and Dimond (2021) believe that in large

●

Explain how the choice of

organisations, there may be 30–50% of total costs being allocated, that budgeted versus actual allocation

is, moved from one cost object to another. Most of these are the costs of rates changes the risks that

corporate functions like IT, Finance, HR, and so on. Often these are not managers face

allocated once only but rather allocated and re-allocated (on average 4.2 times) before being charged eventually to a business unit. According

- Distinguish between direct

to consultants, ‘the process of cost allocation divides organisations as allocation, step-down and

business units seek to protect their profitability by avoiding corporate reciprocal methods of allocating

charges’ (Deloitte, 2022). Regardless of the work you do, you will support department costs

undoubtedly be faced with many cost-allocation questions in your career.

- Distinguish between the

We first concentrate on the allocation of costs to departments and later,

incremental and stand-alone cost-

we’ll look at the allocation of costs to individual products, services,

allocation methods

customers or jobs. Chapter 6 considers costing issues which arise when

●

Outline the consequences of the

two or more products are simultaneously produced with each other and

inappropriate use of an allocation

where joint costs are allocated to products and services.

base

●

Describe why managers may

find cost hierarchy-based reports

useful in their decisions

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Purposes of cost allocation

The indirect costs of a particular cost object are costs that are related to that cost object but

cannot be traced to it in an economically feasible or cost-effective way.

Indirect costs often comprise a sizeable percentage of the costs assigned to cost objects such as

products, distribution channels and customers. Exhibit 5.1 illustrates four purposes for allocating

indirect costs to such cost objects:

1 to provide information for managerial decisions

2 to motivate managers and employees

3 to justify costs or calculate reimbursement

4 to measure income and assets for reporting to external parties.

The allocation of one particular cost need not satisfy all purposes simultaneously. Consider the

salary of an aerospace scientist in a central research department of Aérospatiale. This salary cost

may be allocated as part of central research costs to satisfy purpose 1 (managerial decisions); it

may or may not be allocated to satisfy purpose 2 (motivation); it may or may not be allocated to a

government contract to justify a cost to be reimbursed to satisfy purpose 3 (cost reimbursement);

and it must not be allocated (under generally accepted accounting principles) to stock to satisfy

purpose 4 (income and asset measurement).

Different costs are appropriate for different purposes. Consider product costs of the following

business functions in the value chain:

Research

and

Design

Production

Customer

Marketing

Distribution

Development

service

Exhibit 5.1

Purposes of cost allocation

Purpose

Illustrations

1 To provide

● To decide whether to add a new airline flight

information for

● To decide whether to make a component part of a television set or

managerial decisions

to purchase it from another manufacturer

● To decide on the selling price for a customised product or service

2 To motivate managers

● To encourage the design of products that are simpler to

and employees

manufacture or less costly to service

● To encourage sales representatives to push high-margin products

or services

3 To justify costs or

● To cost products at a ‘fair’ price, often done with government

calculate reimbursement

defence contracts

● To compute reimbursement for a consulting firm that is paid a

percentage of the cost savings resulting from the implementation

of its recommendations

4 To measure income

●

To communicate financial information to shareholders,

and assets for meeting

bondholders and other stakeholders. (In financial reporting

external regulatory and

statements, ‘inventoriable’ costs include manufacturing costs but

legal reporting obligations

exclude research and development (R&D), marketing, distribution

and customer-service costs.)

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The same combination of costs in these six business functions typically will not satisfy each of the

four purposes in Exhibit 5.1. For the managerial-decision purpose (for example, product pricing),

the costs in all six functions should be included. For the motivation purpose, costs from more

than one function are often included to emphasise to managers how costs in different functions

are related to each other. For example, many Japanese and German companies require product

designers to incorporate costs further down the chain than design (such as distribution and cus-

tomer service, as well as manufacturing) into their product-cost estimates. The aim is to focus

attention on how different product-design options affect the total costs of the organisation. For

the cost-reimbursement purpose, the particular contract will often stipulate whether all six of the

business functions or only a subset of them are to be reimbursed. For instance, for the purpose

of income and asset measurement for reporting to external parties, inventoriable costs in the

preparation of financial reports usually include only manufacturing costs (and product-design

costs in some cases). In most European countries, R&D costs can be capitalised (over up to five

years) although there are countries (such as Germany and the UK) where research costs must be

written off in the accounting period in which they are incurred. So you can see that cost allocation

is a matter of judgement rather than pure economic logic.

Cost allocation and costing systems

We will use Fontaine Informatique to illustrate how costs incurred in different parts of an organ-

isation can be assigned and then reassigned when costing products, services, customers or con-

tracts. Fontaine Informatique has two manufacturing divisions. The Microcomputer Division

manufactures its Roseau, Roseau Portable and Super Roseau products. The Roseau and Roseau

Portable are assembled at its Antwerp, Mataró and Longvic plants. The Super Roseau is assem-

bled at its Tourcoing plant. The Peripheral Equipment Division manufactures printers, cables and

other items used with its computer products. It has plants in Antwerp and Rotterdam.

Exhibit 5.2 presents an overview of the costing system at the Antwerp assembly plant of the

Microcomputer Division. This plant assembles the Roseau line and the Roseau Portable line.

The area within the box in Exhibit 5.2 shows a costing system overview for the Model A version

of the Roseau. Fontaine Informatique has manufacturing plants located in France, Belgium, the

Netherlands and Spain. It has marketing operations in more than 20 countries. Every month it

consolidates accounting information from each of its operations to use in its planning and con-

trol decisions. A detailed costing overview of this company-wide system would be sizably more

complex than that in Exhibit 5.2.

The costing system for the Antwerp plant portrayed in Exhibit 5.2 highlights two impor-

tant points. First, it highlights how there are multiple cost objects in most costing systems.

Examples at the Antwerp plant include the Plant Maintenance Department, the Roseau Assem-

bly Department, the Roseau Portable Assembly Department and the separate products in the

Roseau Assembly Department – for example, Roseau Models A, B and C. Note, however, that

Exhibit 5.2 presents only a small subset of the separate cost objects at the Antwerp plant. Other

examples include the Procurement Department, the Energy Department and the various Roseau

Portable products.

Exhibit 5.2 also highlights how an individual cost item can be simultaneously a direct cost

of one cost object and an indirect cost of another cost object. Consider the salary of the Plant

Maintenance Department manager. This salary is a direct cost traced to the Plant Maintenance

Department. Fontaine Informatique then allocates the costs of this department to the two Assem-

bly Departments at the Antwerp plant using units produced as the allocation base. In turn, the

costs of the two Assembly Departments are allocated to individual products, such as the Roseau

Model A, using assembly machine-hours as the allocation base. Thus, the salary of the Plant

Maintenance Department manager is both an indirect cost of each computer assembled at the

plant and a direct cost of the Plant Maintenance Department.

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Exhibit 5.2

Cost tracing and cost allocation at the Antwerp assembly plant of Fontaine Informatique

Plant Maintenance

Dept.

Manager’s

salary

Antwerp Plant

Maintenance Department

Roseau

Roseau Portable

Assembly Dept.

Assembly Dept.

Manager’s

Cost-allocation base:

Manager’s

salary

production units

salary

Roseau Assembly

Roseau Portable

Department

Assembly Department

Cost-allocation base:

assembly machine-hours

Cost object:

Indirect costs

Roseau

Roseau

Roseau

Model B

Model C

Model A

Direct costs

Direct

Direct

materials

manufacturing

labour

Indirect-cost pools and cost allocation

The indirect costs of products assembled at the manufacturing plants of Fontaine Informatique

include (1) costs incurred at corporate headquarters and (2) costs incurred at the manufacturing

plants. Exhibit 5.3 illustrates cost pools at both levels (1) and (2).

Choices related to indirect costs

Fontaine Informatique has several key choices to make when accumulating and subsequently

allocating the indirect costs to products of the Microcomputer Division:

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Exhibit 5.3

Indirect-cost pools (when the cost object is an individual

product) of Fontaine Informatique

Corporate headquaters

Corporate executive salaries

Payroll Department

Central Computer Facility Department

Personnel Department

Level 1

Accounting Department

Research and Development

Treasury Department

Government Relations Department

Legal Department

Investor Relations Department

Marketing Department

Public Relations Department

Indirect costs of

Indirect costs of

products assembled in each

products assembled in each

Microcomputer

Peripheral Equipment

manufacturing plant

manufacturing plant

Level 2

Indirect labour

Indirect materials

Machinery and equipment-related costs

Plant-leasing costs

Energy costs

Product development

Process development

● Which cost categories from corporate headquarters and the other divisions should be included

in the indirect costs of the Microcomputer Division? Should all of the corporate headquarters

cost pools in Exhibit 5.3 be allocated, or should only a subset of them be allocated? For exam-

ple, some companies exclude corporate public relations from any corporate cost allocations

to the divisions; division managers have little say in corporate public relations decisions and

would object to allocations as ‘taxation without representation’.

● How many cost pools should be used when allocating corporate costs to the Microcomputer

Division? A cost pool is a grouping of individual cost items. One extreme is to aggregate all cor-

porate costs into a single cost pool. The other extreme is to have numerous individual corporate

cost pools. The concept of homogeneity (described in the following section) is important in

making this decision.

● Which allocation base should be used for each of the corporate cost pools when allocating

corporate costs to the Microcomputer Division? Examples include the following:

Cost pool	**Possible allocation bases**
Corporate executive salaries	Sales; assets employed; operating profit
Treasury Department	Sales; assets employed; estimated time or usage
Legal Department	Estimated time or usage; sales; assets employed
Marketing Department	Sales; number of sales personnel

Payroll Department

Number of employees; payroll euros

Personnel Department

Number of employees; payroll euros; number of new

employees

●

Which allocation base should be used when allocating the indirect-cost pools at each manufac-

turing plant to the products assembled in those plants? Examples include number of parts assem-

bled in each product, direct manufacturing labour-hours, machining-hours and testing-hours.

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These allocation bases for both corporate and plant indirect costs are illustrative only. Managers'

choices of allocation bases depend on the purpose served by the cost allocation (see Exhibit 5.1),

the criteria used to guide the cost allocation (see Exhibit 5.2) and the costs of implementing the

different allocation bases.

Determining cost pools

A homogeneous cost pool is one in which all the activities whose costs are included in the pool

have the same or a similar cause-and-effect relationship or benefits-received relationship between

the cost allocator and the costs of the activity. Why is homogeneity important? Because using

homogeneous indirect-cost pools enables more accurate product, service and customer costs to

be obtained. A consequence of using a homogeneous cost pool is that the cost allocations using

that pool will be the same as would be made if costs of each individual activity in that pool were

allocated separately. The greater the degree of homogeneity, the fewer cost pools required to

explain accurately the differences in how products use resources of the organisation.

Assume that Fontaine Informatique wishes to use the cause-and-effect criterion (that is, iden-

tify the variable or variables that cause resources to be consumed) to guide cost-allocation deci-

sions. The company should aggregate only those cost pools that have the same cause-and-effect

relationship to the cost object. For example, if the number of employees in a division is the cause

for incurring both corporate Payroll Department costs and corporate Personnel Department costs,

the payroll cost pool and the personnel cost pool could be aggregated before determining the

combined payroll and personnel cost rate per unit of the allocation base. That is, the combined

rate per unit of the allocation base is the same as the sum of the rates if the individual cost pools

were allocated separately.

A variety of factors may prompt managers to consider recognising multiple cost pools where

a single cost pool is currently being used. One factor is the views of line managers and person-

nel. For example, do they believe important differences exist in how costs are driven or how

products use the facilities not currently being recognised using a single cost pool? A second

factor is changes made in plant layout, general operations and so on, such that all products do

not use the facility in an equivalent way. A third factor is changes in the diversity of products

(or services) produced or in the way those products use the resources in the cost pool. Improve-

ments in information and communication technology continuously expand the ability to develop

multiple cost pools.

Allocating costs from one department to another

In many cases, the costs of a department will include costs allocated from other departments.

Three key issues that arise when allocating costs from one department to another are (1) whether

to use a single-rate method or a dual-rate method, (2) whether to use budgeted rates or actual

rates, and (3) whether to use budgeted quantities or actual quantities.

Single-rate and dual-rate methods

A single-rate cost-allocation method pools all costs in one cost pool and allocates them to cost

objects using the same rate per unit of the single allocation base. There is no distinction between

costs in the cost pool in terms of cost variability (such as fixed costs versus variable costs). A

dual-rate cost-allocation method first classifies costs in one cost pool into two subpools (typically

into a variable-cost subpool and a fixed-cost subpool). Each subpool has a different allocation

rate or a different allocation base.

Consider the Central Computer Department at the corporate headquarters of Fontaine Infor-

matique (shown in Exhibit 5.3). For simplicity, assume that the only users of this facility are the

Microcomputer Division and the Peripheral Equipment Division. The following data apply to

the coming budget year:

Fixed costs of operating the facility

€300 000 per year

Total capacity available

1 500 hours

Budgeted long-term usage (quantity) in hours

Microcomputer Division

800

Peripheral Equipment Division

400

Total

1 200

Budgeted variable costs per hour in the

1000–1500-hour relevant range

€200 per hour used

Under the single-rate method, the costs of the Central Computer Department (assuming budgeted

usage is the allocation base and budgeted rates are used) would be allocated as follows:

Total cost pool: €300 000 + (1200 budgeted hours) × €200)

€540 000 per year

Budgeted usage

1 200 hours

Budgeted total rate per hour rate: €540 000 ÷ 1200 hours

€450 per hour used

Allocation rate for Microcomputer Division

€450 per hour used

Allocation rate for Peripheral Equipment Division

€450 per hour used

The rate of €450 per hour differs sizably from the €200 budgeted variable cost per hour. The €450

rate includes an allocated amount of €250 per hour (€300 000 ÷ 1200 hours) for the fixed costs

of operating the facility. These fixed costs will be incurred whether the computer runs its 1500-

hour capacity, its 1200-hour budgeted usage, or even, say, only 600 hours' usage.

Using the €450 per hour single-rate method (combined with the budgeted usage allocation

base) transforms what is a fixed cost to the Central Computer Department (and to Fontaine

Informatique) into a variable cost to users of that facility. This approach could lead internal users

to purchase computer time outside the company. Consider an external supplier that charges less

than €450 per hour but more than €200 per hour. A division of Fontaine Informatique that uses

this supplier rather than the Central Computer Department may decrease its own division costs,

but the overall costs to Fontaine Informatique are increased. For example, suppose the Microcom-

puter Division uses an external supplier that charges €360 per hour when the Central Computer

Department has excess capacity. In the short run, Fontaine Informatique incurs an extra €160 per

hour because this external supplier is used (€360 external purchase price per hour minus the €200

internal variable costs per hour) instead of its own Central Computer Department.

When the dual-rate method is used, allocation bases for each different subcost pool must be

chosen. Assume that the budgeted rates are used. The allocation quantities chosen are budgeted

usage for fixed costs and actual usage for variable costs. The total budgeted usage of 1200 hours

comprises 800 hours for the Microcomputer Division and 400 hours for the Peripheral Equipment

Division. The costs allocated to the Microcomputer Division would be as follows:

Fixed-cost function:

(800 hours ÷ 1200 hours) × €300 000

€200 000

per year

Variable-cost function

€200

per hour used

The costs allocated to the Peripheral Equipment Division would be:

Fixed-cost function:

(400 hours ÷ 1200 hours) × €300 000

€100 000

per year

Variable-cost function

€200

per hour used

Assume now that during the coming year the Microcomputer Division actually uses 900 hours

but the Peripheral Equipment Division uses only 300 hours. The costs allocated to these two

divisions would be computed as follows:

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Under the single-rate method

Microcomputer Division

900 × €450 = €405 000

Peripheral Equipment Division

300 × €450 = €135 000

Under the dual-rate method

Microcomputer Division

€200 000 + (900 × €200) = €380 000

Peripheral Equipment Division

€100 000 + (300 × €200) = €160 000

One obvious benefit of using the single-rate method is the low cost of implementation. It avoids

the often expensive analysis necessary to classify the individual cost items of a department into

fixed and variable categories. However, a single-rate method may lead divisions to take actions

that appear to be in their own best interest but are not in the best interest of the organisation as

a whole.

An important benefit of the dual-rate method is that it signals to division managers how

variable costs and fixed costs behave differently. This important information could steer division

managers into making decisions that benefit the corporation as well as each division. For exam-

ple, it would signal that using a third-party computer supplier who charges more than €200 per

hour could result in Fontaine Informatique's being worse off than if it had used its own Central

Computer Department, which has a variable cost of €200 per hour.

Budgeted versus actual rates

The decision whether to use budgeted cost rates or actual cost rates affects the level of uncertainty

that user departments face. Budgeted rates let the user departments know the cost rates they will

be charged in advance. Users are then better equipped to determine the amount of the service to

request and, if the option exists, whether to use the internal department source or an external

supplier. In contrast, when actual rates are used, the user department will not know the rates

charged until the end of the period.

Budgeted rates also help motivate the manager of the support department (for example, the

Central Computer Department) to improve efficiency. During the budget period, the support

department, not the user departments, bears the risk of any unfavourable cost variances. Why?

Because the user department does not pay for any costs that exceed the budgeted rates. The man-

ager of the support department would probably view this as a disadvantage of using budgeted

rates, especially when unfavourable cost variances occur because of price increases outside the

department's control.

Some organisations recognise that it may not always be best to impose all the risks of variances

from budgeted amounts completely on the support department (as when costs are allocated using

budgeted rates) or completely on the user departments (as when costs are allocated using actual

rates). For example, the two departments may agree to share the risk (through an explicit formula)

of a large, uncontrollable increase in the price of materials used by the support department.

Budgeted versus actual usage allocation bases

The choice between actual usage and budgeted usage for allocating department fixed costs can

also affect a manager's behaviour. Consider the budget of €300 000 fixed costs at the Central

Computer Department of Fontaine Informatique. Assume that actual and budgeted fixed costs

are equal. Assume also that the actual usage by the Microcomputer Division is always equal to

the budgeted usage. We now look at the effect on allocating the €300 000 in total fixed costs when

actual usage by the Peripheral Equipment Division equals (case 1), is greater than (case 2) and is

less than (case 3) the budgeted usage. Recall that the budgeted usage is 800 hours for the Micro-

computer Division and 400 hours for the Peripheral Equipment Division. Exhibit 5.4 presents the

allocation of total fixed costs of €300 000 to each division for these three cases.

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Exhibit 5.4

Effect of variations in actual usage on departmental cost allocations

Budgeted usage as

Actual usage as

Actual usage

allocation base

allocation base

Peripheral

Peripheral

Peripheral

Microcomputer Equipment Microcomputer Equipment Microcomputer

Equipment

Case

Division

Division

Division

Division

Division

Division

1

800 hours

400 hours

€200 000*

€100 000†

€200 000*

€100 000†

2

800 hours

700 hours

€200 000*

€100 000†

€160 000‡

€140 000‖

3

800 hours

200 hours

€200 000*

€100 000†

€240 000§

€60 000#

*

800

× €300 000

× €300 000

× €300 000

800 + 400

†

400

800 + 400

‡

700

800 + 700

§

800

× €300 000

‖

700

× €300 000

#

200

× €300 000

800 + 200

800 + 700

800 + 200

In case 1, the fixed-cost allocation equals the expected amount. In case 2, the fixed-cost allocation

is €40 000 less to the Microcomputer Division than expected (€160 000 vs €200 000). In case 3, the

fixed-cost allocation is €40 000 more than expected (€240 000 vs €200 000). Consider case 3. Why

is there an increase of €40 000 even though the Microcomputer Division's actual and budgeted

usage are exactly equal? Because the fixed costs are spread over fewer hours of usage. Variations in

usage in another division will affect the fixed costs allocated to the Microcomputer Division when

fixed costs are allocated on the basis of actual usage. When actual usage is the allocation base, user

divisions will not know how much cost is allocated to them until the end of the budget period.

When budgeted usage is the allocation base, user divisions will know their allocated costs in

advance. This information helps the user divisions with both short-run and long-run planning.

The main justification given for the use of budgeted usage to allocate fixed costs relates to long-

range planning. Organisations commit to infrastructure costs (such as the fixed costs of a support

department) on the basis of a long-range planning horizon; the use of budgeted usage to allocate

these fixed costs is consistent with this long-range horizon.

If fixed costs are allocated on the basis of estimated long-run use, some managers may be tempted

to underestimate their planned usage. In this way, they will bear a lower fraction of the total costs

(assuming all other managers do not similarly underestimate). Some organisations offer rewards in

the form of salary increases and promotions to managers who make accurate forecasts of long-range

usage. (This is the ‘carrot’ approach.) Alternatively, some organisations impose cost penalties for

underpredicting long-range usage. For instance, a higher cost rate may be charged after a division

exceeds its budgeted usage. (This is the ‘stick’ approach.) It is often the case that a business unit

within a large enterprise establishes a final budget for the following year which looks a lot like the

one its managers proposed at the beginning of the budget-setting process and which is not much

different from the actual performance for the previous year. The reason for this is that managers often

get ‘anchored’. Lovallo and Sibony (2014) explain that ‘anchoring’ is a well-known psychological bias

whereby one piece of information sticks in one’s mind and influences interpretation of subsequent

information, even if one is unaware of it. They state that ‘In the case of budgeting, getting stuck in

the same numbers from year to year is almost unavoidable.’ In 2017, Richard Thaler won the Nobel

Prize in economics for showing how heavily economic decisions are influenced by cognitive biases.

His ‘theory of mental accounting’ suggests that people making financial decisions really only look at

the narrow effect of individual decisions, rather than the whole effect (Vitasek, 2017). So executives

who think they are rational actors who maximise utility should be treated with suspicion!

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Allocating costs of support departments

Operating departments and support departments

Many organisations distinguish between operating departments and support departments. An

operating department (also called a production department) adds value to a product or service

that is observable by a customer. A support department (also called a service department) provides

the services that maintain other internal departments (operating departments and other support

departments) in the organisation. Support departments at Fontaine Informatique include the

Legal Department and the Personnel Department at corporate headquarters.

Support departments create special accounting problems when they provide reciprocal support

to each other as well as support to operating departments. An example of reciprocal support

at Fontaine Informatique would be the Legal Department's providing services to the Personnel

Department (such as advice on compliance with employment law) and the Personnel Department's

providing support to the Legal Department (such as advice about the hiring of solicitors and secre-

taries). To obtain accurate product, service and customer costs at Fontaine Informatique requires

inclusion of support department costs as well as operating department costs. More accurate sup-

port department cost allocations results in more accurate product, service and customer costs.

Be cautious here for several reasons. First, organisations differ in the departments located at the

corporate and division levels. Some departments located at corporate headquarters of Fontaine

Informatique (for example, R&D) are located at the division level in other organisations. Second,

organisations differ in their definitions of *operating department and support department.* Always

try to ascertain the precise meaning of these terms when analysing data that include allocations

of operating department costs and support department costs. Third, organisations differ in the

percentage of total support costs allocated using the methods described in this section. Some

companies allocate all support department costs using one of the methods outlined below. Other

companies only allocate *indirect* support department costs using these methods, with all *direct*

support costs traced to the appropriate operating department.

Support department cost-allocation methods

We now examine three methods of allocating the costs of support departments: *direct, step-down*

and *reciprocal.* To focus on concepts, we use the single-rate method to allocate the costs of each

support department.

Consider Honnigsvåg, AS, which manufactures engines used in electric power generating

plants. Honnigsvåg has two support departments (Plant Maintenance and Information Systems)

and two operating departments (Machining and Assembly) in its manufacturing facility. Costs are

accumulated in each department for planning and control purposes. For stock costing, however,

the support department costs of Honnigsvåg must be allocated to the operating departments.

The data for our example are listed in Exhibit 5.5. The percentages in this table can be illustrated

by reference to the Plant Maintenance Department. This support department provides a total

of 8000 hours of support work: 20% (1600 ÷ 8000) goes to the Information Systems support

department; 30% (2400 ÷ 8000) to the Machining Department; and 50% (4000 ÷ 8000) to the

Assembly Department.

Direct allocation method

The direct allocation method (often called the direct method) is the most widely used method

of allocating support department costs. This method allocates each support department's

costs directly to the operating departments. Exhibit 5.6 illustrates this method using the data

in Exhibit 5.5. Note how this method ignores both the 1600 hours of support time rendered by

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Exhibit 5.5

Data for allocating support department costs at Honnigsvåg for 2022

Support departments

Operating departments

Plant

Information

Maintenance

Systems

Machining Assembly

Total

Budgeted manufacturing overhead costs

before any interdepartment cost

allocations

€600 000

€116 000

€400 000

€200 000

€1 316 000

Support work furnished

By Plant Maintenance

Budgeted labour-hours

–

1600

2400

4000

8000

Percentage

–

20%

30%

50%

100%

By Information Systems

Budgeted computer time

200

–

1 600

200

2 000

Percentage

10%

–

80%

10%

100%

Exhibit 5.6

Direct method of allocating support department costs at Honnigsvåg for 2022

Support Departments

Operating Departments

Plant Maintenance

€225 000

Machinery

€600 000

Department

€375 000

€103 111

Information Systems

Assembly

€116 000

Department

€12 889

Support departments

Operating departments

Plant

Information

Maintenance

Systems

Machining

Assembly

Total

Budgeted manufacturing overhead

costs before any interdepartment cost

allocations

€600 000

€116 000

€400 000

€200 000

€1 316 000

Allocation of Plant Maintenance □□3 □

□ ,5□□□ *

(600 000)

225 000

375 000

□□□ 8 8□□

€0

Allocation of Information Systems □□

□†

(116 000)

103 111

12 889

□ 8 □

, 1□□

□□ 9 9 □□

€0

Total budgeted manufacturing overhead of

€728 111

€587 889

€1 316 000

operating departments

* Base is (2400 + 4000), or 6400hours; 2400 ÷ 6400

3

= ; 4000 ÷ 6400

5

= .

8

8

†

8

1

Base is (1600 + 200), or 1800 hours;1600 ÷ 1800 = ; 200 ÷ 1800 = .

9

9

the Plant Maintenance Department to the Information Systems Department and the 200 hours

of support time rendered by Information Systems to Plant Maintenance. The base used to allo-

cate Plant Maintenance is the budgeted total maintenance labour-hours worked in the operating

departments: 2400 + 4000 = 6400 hours. This amount excludes the 1600 hours of support time

provided by Plant Maintenance to Information Systems. Similarly, the base used for allocation of

Information Systems costs is 1600 + 200 = 1800 hours of computer time, which excludes the

200 hours of support time provided by Information Systems to Plant Maintenance.

The benefit of the direct method is its simplicity. There is no need to predict the usage of sup-

port department resources by other support departments.

Step-down allocation method

Some organisations use the step-down allocation method (sometimes called the step allocation

method or sequential allocation method), which allows for *partial* recognition of the services ren-

dered by support departments to other support departments. This method requires the sup-

port departments to be ranked (sequenced) in the order in which the step-down allocation is

to proceed. The costs in the first-ranked support department are allocated to the other support

departments and to the operating departments. The costs in the second-ranked department are

allocated to those support departments not yet allocated and to the operating departments. This

procedure is followed until the costs in the last-ranked support department have been allocated to

the operating departments. Two ways to determine the sequence to allocate support department

costs are as follows:

Approach A Rank support departments on the percentage of the support department's total

support provided to other support departments. The support department with the highest per-

centage is allocated first. The support department with the lowest percentage is allocated last. In

our Honnigsvåg example, the chosen order would be:

Percentage of total service

provided to other support departments

1 Plant Maintenance

20%

2 Information Systems

10%

Approach B Rank support departments on the total euros of service provided to other support

departments. In our Honnigsvåg example, the chosen order would be:

Euro amount of total service

provided to other support departments

1 Plant Maintenance (0.20 × €600 000)

€120 000

2 Information Systems (0.10 × €116 000)

€11 600

Exhibit 5.7 shows the step-down method where the Plant Maintenance cost of €600 000

is allocated first; €120 000 is allocated to Information Systems (20% of €600 000); €180 000

to Machining (30% of €600 000); and €300 000 to Assembly (50% of €600 000). The costs

in Information Systems now total €236 000 (€116 000 + €120 000 from the first-round allo-

cation). This €236 000 amount is then allocated among the two operating departments:

€209 778 (8 × €236 000) to Machining and €26 222 (1 × €236 000) to Assembly.

9

9

Under the step-down method, once a support department's costs have been allocated, no sub-

sequent support department costs are allocated or circulated back to it. Thus, once the Plant

Maintenance Department costs are allocated, they receive no further allocation from other (lower-

ranked) support departments.

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Exhibit 5.7

Step-down method of allocating support department costs at Honnigsvåg for

2022

Support Departments			
Operating Departments			
Plant Maintenance			

€180 000

Machinery

€600 000

Department

€209 778

€300 000

€120 000

Information Systems

Assembly

(€120 000 + €116 000)

Department

= €236

€26 222

000

Support departments

Operating departments

Plant

Information

Maintenance

Systems

Machining Assembly

Total

Budgeted manufacturing overhead costs

€600 000

€116 000

€400 000

€200 000

€1 316 000

before any interdepartment cost allocations

Allocation of Plant Maintenance (2 , 3 , 5) *

10 10 10

(600 000)

120 000

180 000

300 000

€0

236 000

Allocation of Information Systems □□8 □ †

(236 000)

209 778

26 222

□ , 1□□□

□□□ 9 9□□

€0

Total budgeted manufacturing overhead of

€789 778

€526 222

€1 316 000

operating departments

* Base is (1600 + 2400 + 4000),or 8000 hours; 1600 ÷ 8000

2

=

; 2400 ÷ 8000

3

=

; 4000 ÷ 8000

5

=

.

10

10

10

† Base is (1600 + 200),or 1800 hours; 1600 ÷ 1800

8

= ; 200 ÷ 1800

1

= .

9

9

Reciprocal allocation method

The reciprocal allocation method allocates costs by explicitly including the mutual services pro-

vided among all support departments. Theoretically, the direct method and the step-down method

are less accurate when support departments provide services to one another reciprocally. For

example, the Plant Maintenance Department maintains all the computer equipment in the Infor-

mation Systems Department. Similarly, Information Systems provides database support for Plant

Maintenance. The reciprocal allocation method enables us to incorporate interdepartmental

relationships *fully* into the support department cost allocations. That is, Plant Maintenance is

allocated to Information Systems and Information Systems is allocated to Plant Maintenance;

each is allocated to the operating departments as well. Implementing the reciprocal allocation

method requires three steps.

Step 1 Express support department costs and reciprocal relationships in linear equation form.

Let PM be the *complete reciprocated costs* of Plant Maintenance and let IS be the complete

reciprocated costs of Information Systems. We then express the data in Exhibit 5.5 as follows:

PM = €600 000 + 0.1IS

(1)

IS = €116 000 + 0.2PM

(2)

The 0.1IS term in equation (1) is the percentage of the Information Systems work used by Plant

Maintenance. The 0.2PM term in equation (2) is the percentage of the Plant Maintenance work

used by Information Systems.

By complete reciprocated cost in equations (1) and (2), we mean the actual costs incurred by a

support department plus a part of the costs of the other support departments that provide service

to it. This complete reciprocated costs figure is sometimes called the artificial costs of the support

department; it is always larger than the actual costs.

Step 2 Solve the set of simultaneous equations to obtain the complete reciprocated costs of

each support department. Where there are two support departments, the following substitution

approach can be used. Substituting equation (2) into equation (1),

PM = €600 000 + [0. (

1 €116 000 + 0.2PM)]

= €600 000 + €11 600 + 0.02PM

0.98PM = €611 600

∴ PM = €624 082

Substituting into equation (2),

IS = €116 000 + 0.2(€624 082)

= €240 816

Where there are more than two support departments with reciprocal relationships, computer

programs can be used to calculate the complete reciprocated costs of each support department.

Step 3 Allocate the complete reciprocated costs of each support department to all other depart-

ments (both support and operating departments) on the basis of the usage proportions (based on

total units of service provided to all departments). Consider the Information Systems Department,

which has a complete reciprocated cost of €240 816. This amount would be allocated as follows:

To Plant Maintenance (1 × €240 816)

€24 082

10

To Machining (8 × €240 816)

192 653

10

To Assembly (1 × €240 816)

24 082

10

Total

€240 817

Exhibit 5.8 presents summary data pertaining to the reciprocal method.

One source of confusion to some managers using the reciprocal cost-allocation method is why

the complete reciprocated costs of the support departments, €864 898 (€624 082 and €240 816 in

Exhibit 5.8), exceed their budgeted amount of €716 000 (€600 000 and €116 000 in Exhibit 5.5).

The excess of €148 898 (€24 082 for Plant Maintenance and €124 816 for Information Systems)

is the total costs that are allocated among support departments. The total costs allocated to the

operating departments under the reciprocal allocation method are still only €716 000.

Overview of methods

Assume that the total budgeted overhead costs of each operating department in the example in

Exhibits 5.6 to 5.8 are allocated to individual products on the basis of budgeted machine-hours

for the Machining Department (4000 hours) and budgeted direct labour-hours for the Assembly

Department (3000 hours). The budgeted overhead allocation rates associated with each support

department allocation method (rounded to the nearest euro) are set out in Exhibit 5.9.

These differences in budgeted overhead rates with alternative support department cost -

allocation methods can be important to managers. For example, consider a cost-reimbursement

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Chapter 5 Cost allocation

Exhibit 5.8

Reciprocal method of allocating support department costs at Honnigsvåg

for 2022

Support Departments

Operating Departments

Plant Maintenance

€187 225

Machinery

€24 082 + €600 000

Department

= €624 082

€24

€312 041

082

€124 816

€192 652

Information Systems

Assembly

(€124 816 + €116 000)

=

Department

€240 816

€24 082

Support departments

Operating departments

Plant

Information

Maintenance

Systems

Machining

Assembly

Total

Budgeted manufacturing overhead

€600 000

€116 000

€400 000

€200 000

€1 316 000

costs before any interdepartment

cost allocations

Allocation of Plant Maintenance

(624 082)

124 816

187 225

312 041

□□

□ *

□ 1

□

, 8 , 1 □□

□□10 10 10 □□

Allocation of Information Systems

24 082

(240 816)

192 652

24 082

□□

□ †

□ 1

□

, 8 , 1 □□

□□10 10 10 □□

€0

€0

Total budgeted manufacturing

€779 877

€536 123

€1 316 000

overhead of operating departments

* Base is(1600 + 2400 + 4000),or 8000hours;1600 ÷ 8000

2

=

;2400 ÷ 8000

3

=

;4000 ÷ 8000

5

=

.

10

10

10

† Base is(200 + 1600 + 200),or 2000hours;200 ÷ 2000

1

=

;1600 ÷ 2000

8

=

;200 ÷ 2000

1

=

.

10

10

10

Exhibit 5.9

The budgeted overhead allocation rates associated with each support department allocation method

Total budgeted overhead

costs after allocation of all

Budgeted overhead rate per hour

support department costs

for product-costing purposes

Support department

Machining

Assembly

cost-allocation method

Machining

Assembly

(4000 machine-hours) (3000 labour-hours)

Direct

€728 111

€587 889

€182

€196

Step-down

789 778

526 222

197

175

Reciprocal

779 877

536 123

195

179

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contract that uses 100 machine-hours and 15 assembly labour-hours. The support department

costs allocated to this contract would be:

Direct

€21 140

(€195 × 100 + €179 × 15)

Step-down

22 325

(€197 × 100 + €175 × 15)

Reciprocal

22 185

(€195 × 100 + €179 × 15)

Use of the step-down method would result in the highest cost reimbursement to the contractor.

The reciprocal method, while conceptually preferable, is not widely used. The advantage of

the direct and step-down methods is that they are relatively simple to calculate and understand.

However, with the ready availability of computer software to solve sets of simultaneous equations,

the extra costs of using the reciprocal method will, in most cases, be minimal. The more likely

obstacles to the reciprocal method's being widely adopted are: (1) many managers find it difficult

to understand, and (2) the numbers obtained by using the reciprocal method differ little (in some

cases) from those obtained by using the direct or step-down method. In the UK, the direct method

is the most widespread.

Allocating common costs

We next consider two methods used to allocate common costs. A common cost is a cost of operat-

ing a facility, operation, activity or other cost object that is shared by two or more users. Consider

Emma O'Shea, a third-year undergraduate student in Galway who has been invited to an interview

with an employer in Moscow. The round-trip Galway–Moscow airfare costs €1200. A week prior

to leaving, O'Shea is also invited to an interview with an employer in Prague. The round-trip

Galway–Prague airfare costs €800. O'Shea decides to combine the two recruiting steps into a

Galway–Moscow–Prague trip that will cost €1500 in airfare. The €1500 is a common cost that

benefits both employers. Two methods for allocating this common cost between the two potential

employers are now discussed: the stand-alone method and the incremental method.

Stand-alone cost-allocation method

The stand-alone cost-allocation method uses information pertaining to each cost object as a sep-

arate operating entity to determine the cost-allocation weights. For the airfare common cost of

€1500, information about the separate (stand-alone) return airfares (€1200 and €800) is used to

determine the allocation weights:

Moscow employer:

€1200

× €1500 = 0.60 × €1500 = €900

€1200 + €800

Prague employer:

€800

× €1500 = 0.40 × €1500 = €600

€800 + €1200

Advocates of this method often emphasise an equity or fairness rationale. That is, fairness occurs

because each employer bears a proportionate share of total costs in relation to their individual

stand-alone costs.

Incremental cost-allocation method

The incremental cost-allocation method ranks the individual cost objects and then uses this rank-

ing to allocate costs among those cost objects. The first-ranked cost object is termed the *primary*

party and is allocated costs up to its cost as a stand-alone entity. The second-ranked cost object

is termed the *incremental party* and is allocated the additional cost that arises from there being

two users instead of only the primary user. If there are more than two parties, the non-primary

parties will need to be ranked.

Consider Emma O'Shea and her €1500 airfare cost. Assume that the Moscow employer is

viewed as the primary party. O'Shea's rationale was that she had already committed to go to

Moscow. The cost allocations would then be:

Party	**Costs allocated**	**Costs remaining to be allocated to other parties**
Moscow (primary)	€1200	€300(€1500 − €1200)
Prague (incremental)	300	0

The Moscow employer is allocated the full Galway–Moscow airfare. The non-allocated part of the

total airfare is allocated to the Prague employer. Had the Prague employer been chosen as the primary

party, the cost allocations would have been Prague, €800 (the stand-alone Galway–Prague return

airfare) and Moscow, €700(€1500 − €800). Where there are more than two parties, this method

requires them to be ranked and the common costs allocated to those parties in the ranked sequence.

Under the incremental method, the primary party typically receives the highest allocation of

the common costs. Not surprisingly, most users in common cost situations propose themselves

as the incremental party. In some cases, the incremental party is a newly formed ‘organisation’

such as a new product line or a new sales territory. Chances for its short-term survival may be

enhanced if it bears a relatively low allocation of common costs.

A caution is appropriate here as regards O’Shea’s cost-allocation options. Her chosen method

must be acceptable to each prospective employer. Indeed, some prospective employers may have

guidelines that recruiting candidates must follow. For example, the Moscow employer may have a

policy that the maximum reimbursable airfare is a seven-day advance booking price in economy

class. If this amount is less than the amount that O'Shea would receive under (say) the stand-alone

method, then the employer's upper limit guideline would govern how much could be allocated

to that interviewer. O'Shea should obtain approval before she purchases her ticket as to which

cost-allocation method(s) each potential employer views as acceptable.

Cost-allocation bases and cost hierarchies

Companies make changes in their costing systems at varying degrees of regularity. The prompts

to these changes vary. In some cases, it is a change in the operations (for example, an increase

in automation or a change in the products manufactured). It can also be a change in informa-

tion- gathering technology. Another prompt is a change in the products or services offered by

competitors (for example, a competitor separately selling as individual products items that were

previously sold as a bundle for a single price).

As companies change from labour-paced to machine-paced operations, they increase their

use of machine-hours-related allocation bases. In labour-paced operations, worker dexterity and

productivity determine the speed of production. Machines function as tools that aid production

workers. Direct manufacturing labour costs or direct manufacturing labour-hours may still cap-

ture cause-and-effect relationships here, even if operations are highly automated. In contrast, in

machine-paced operations, machines conduct most (or all) phases of production, such as move-

ment of materials to the production line, assembly and other activities on the production line and

shipment of finished goods to the delivery bay areas. Machine operators in such environments

may simultaneously operate more than one machine. Workers focus their efforts on supervising

the production line and general troubleshooting rather than on operating the machines. Computer

specialists and industrial engineers guide the speed of production. In machine-paced operations,

machine-hours will probably better capture cause-and-effect relationships than the direct labour-

hours allocation base.

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Consequences of an inappropriate allocation base

Cost figures play a key role in many important decisions. If these figures result from alloca-

tion bases that fail to capture cause-and-effect relationships, managers may make decisions

that conflict with maximising long-run company net income. Consider the use of direct man-

ufacturing labour costs as an allocation base in machine-paced manufacturing settings. In this

environment, indirect-cost rates of 500% of direct manufacturing labour costs (or more) may

be encountered. Thus, every €1 of indirect manufacturing labour costs has a €6 impact (€1 in

direct costs + 500% per €1 in indirect costs) on reported product costs. Possible negative con-

sequences include the following points:

1 Product managers may make excessive use of external suppliers for parts that have a high direct

manufacturing labour content.

2 Manufacturing managers may pay excessive attention to controlling direct manufacturing

labour-hours relative to the attention paid to controlling the more costly categories of materials

and machining. By eliminating €1 of direct manufacturing labour costs when the indirect-cost

rate is 500% of these costs, €6 of reported product cost can be eliminated. When the indi-

rect-cost rate is 500% of these costs, managers can control much of the accounting amounts

allocated to products by controlling direct labour use. However, this action does not control

the larger materials and machining costs actually incurred.

3 Managers may attempt to classify shop-floor personnel as indirect labour rather than as direct

labour. As a result, part of these labour costs will be allocated (inappropriately) to other

products.

4 Products may be under- or overcosted. The danger then arises that a company will push to

gain market share on products that it believes are profitable when in fact they are unprofitable.

Similarly, the company may neglect products that are profitable because it believes they are

unprofitable.

Cost drivers and allocation bases

When a cause-and-effect criterion is used, the chosen allocation bases are cost drivers. Because a

change in the level of a cost driver causes a change in the total cost of a related cost object, the

use of cost drivers as allocation bases increases the accuracy of reported product costs. However,

not all chosen cost-allocation bases are cost drivers. Consider the following reasons for using

bases that are not cost drivers.

1 Improving the accuracy of individual product costs may be less important to a company than

other goals. Think about the goal of restraining the growth in headcount (the number of

employees on a company's payroll). Several Japanese companies use direct manufacturing

labour-hours as the cost-allocation base, while acknowledging that such labour-hours are not

the most important driver of their manufacturing overhead costs. The purpose of this choice

is to send a clear signal to all managers that reduction in headcount is a key goal.

Managers may also prefer direct manufacturing labour-hours as an allocation base so as

to promote increased levels of automation. Using this allocation base, product designers are

motivated to decrease the direct manufacturing labour content of the products they design.

Management may view increased automation as a strategic necessity to remain competitive

in the long run.

2 Information about cost-driver variables may not be reliably measured on an ongoing basis. For

example, managers often view the number of machine set-ups as a driver of indirect manufac-

turing costs, but some companies do not systematically record this information.

3 Accounting systems with many indirect-cost pools and allocation bases are more expensive to

use than systems with few cost pools and allocation bases. The investment required to develop

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and implement a system with many indirect-cost pools – and to educate users about it – can be

sizeable. Unfortunately, some firms place a low priority on investments in their internal account-

ing systems, given that the benefits from such investments are frequently difficult to quantify.

Cost assignment and cost hierarchies

One extreme approach to cost assignment is to fully assign every cost to each individual unit of

a product or service. There is growing interest in *cost hierarchy* systems that stop short of this

full assignment of costs. A cost hierarchy is a categorisation of costs into different cost pools on

the basis of either different classes of cost drivers or different degrees of difficulty in determining

cause-and-effect relationships. Not all costs in a cost hierarchy are driven by unit-level product or

unit-level service-related variables. Four levels of costs in the product-based cost hierarchy are: (1)

output unit-level costs, (2) batch-level costs, (3) product-sustaining costs, and (4) facility- sustaining

costs. Activity-based costing systems (see Chapter 11) often differentiate these four levels.

Is the product-costing system broken?

A student knows when a smartphone no longer works. A driver knows when a motor vehicle no

longer starts. The failure of many products is easy to detect and sometimes, so is the cause. The

breakdown of a product-costing system is less easy. But an enterprise's environment can send sig-

nals about the inadequacy of a costing system in use. Some firms receive, over time, many signals

which collectively flag the need for a rigorous review of the accounting system. The following

four questions can be posed:

1 Can managers easily explain changes in profit margins from one period to the next?

2 Can managers easily explain why their bids for business are successful or unsuccessful?

3 Does the costing system have a small number of cost pools, and are the items in each cost pool

heterogeneous?

4 Are competitors pricing their high-volume products at prices substantially lower than our cost

figures for similar products?

No to questions 1 and 2 and yes to questions 3 and 4 are warning responses to the overall question

of whether a product-costing system is broken. An individual company that gives such red-flag

responses to all four of these questions should quickly examine whether its existing costing system

needs to be changed.

Summary

The following points are linked to the chapter's learning objectives.

1 A *cost object* is anything for which a separate measurement of costs is desired. Costing systems in organisations

have multiple cost objects (departments, products, services and customers), meaning many individual costs are

allocated and reallocated several times before becoming an indirect cost of a specific cost object.

2 The four purposes of cost allocation are to provide information for economic decisions, to motivate managers and

employees, to justify costs or calculate reimbursement and to measure income and assets for meeting external

regulatory and legal reporting obligations. Different cost allocations may be appropriate depending on the specific

purpose.

3 A cost pool is a grouping of individual cost items. Two key decisions related to indirect-cost pools are the number

of indirect-cost pools and the allowability of individual cost items to be included in those cost pools.

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4 A single-rate cost-allocation method pools all costs in one cost pool and allocates them to cost objects using the

same rate per unit of the single allocation base. In the dual-rate method, costs are grouped in two separate cost

pools, each of which has a different allocation rate and which may have a different allocation base.

5 When cost allocations are made using budgeted rates, managers of divisions to which costs are allocated face no

uncertainty about the rates to be used in that period. In contrast, when actual rates are used for cost allocation,

managers do not know the rates to be used until the end of the accounting period.

6 The three main methods of allocating support department costs to operating departments are the direct, step-down

and reciprocal. The direct method ignores any reciprocal support among support departments. The step-down

method allows for partial recognition while the reciprocal method provides full recognition of support among

support departments.

7 Common costs are the costs of operating a facility, operation or activity area that are shared by two or more users.

The stand-alone cost-allocation method uses information pertaining to each operating entity to determine how

to allocate the common costs. The incremental cost-allocation method ranks cost objects and allocates common

costs first to the primary cost object and then to the other remaining (incremental) cost objects.

8 The use of an inappropriate cost allocation base can cause products to be manufactured less efficiently, manage-

ment to be misfocused and products to be mispriced in the marketplace.

9 There is growing interest in cost hierarchies, which are categorisations of costs into different cost pools based on

either different classes of cost drivers or different degrees of difficulty in determining cause-and-effect relationships.

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CHAPTER 5

Assessment material

Review questions

5.1

Why might the classification of a cost as a direct cost or an indirect cost of a cost object change

over time?

5.2

How can an individual cost item, such as the salary of a plant security guard, be both a direct

cost and an indirect cost at the same time?

5.3

A given cost may be allocated for one or more purposes. List four purposes.

5.4

How do cost–benefit considerations affect choices by a company about the allocation of indirect

costs to products, services or customers?

5.5

Distinguish among the three methods of allocating the costs of service departments to production

departments.

5.6

Distinguish between two methods of allocating common costs.

5.7

Different costs for different purposes means that a cost allocated for one purpose is not allocated

for another purpose. Do you agree?

5.8

Why is the distinction between labour-paced and machine-paced operations important when

selecting indirect-cost allocation bases?

5.9

Describe two consequences of using direct manufacturing labour-hours as an allocation base in

a machine-paced work environment.

Exercises

Basic level

5.10 Alternative allocation bases for a professional services firm (15 minutes)

Germinal et Associés provides tax advice to multinational firms. Germinal charges clients for (a)

direct professional time (at an hourly rate) and (b) support services (at 30% of the direct profes-

sional costs billed). The three professionals in Germinal and their rates per hour are:

Professional

Billing rate per hour

Thérèse Raquin

€500

Jeanne Rozerot

120

Claude Bernard

80

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Germinal has just prepared the May 2022 bills for two clients. The hours spent on each client are

as follows:

Hours per client

Professional

Fortune Plassans

Au Bonheur des Dames

Raquin

15

2

Rozerot

3

8

Bernard

22

30

Total

40

40

Required

1 What amounts did Germinal bill to Fortune Plassans and Au Bonheur des Dames for May 2022?

2 Suppose support services were billed at €50 per labour-hour (instead of 30% of labour costs).

How would this change affect the amounts Germinal billed to the two clients for May 2022?

Comment on the differences between the amounts billed in requirements 1 and 2.

3 How would you determine whether labour costs or labour-hours is the more appropriate allo-

cation base for Germinal's support services?

***5.11 Cost allocation, use of a separate machining cost pool category** (10 minutes)

Azu-Cena Ltda is a manufacturer of motorcycles. Production and cost data for 2022 are as follows:

500 cc model

1000 cc model

Units produced

10 000

20 000

Direct manufacturing labour-hours per unit

2

4

Machine-hours per unit

8

8

A single cost pool is used for manufacturing overhead. For 2022, manufacturing overhead was

€6.4 million. Azu-Cena allocates manufacturing overhead costs to products on the basis of direct

manufacturing labour-hours per unit.

Azu-Cena's accountant now proposes that two separate pools be used for manufacturing overhead costs:

● Machining cost pool (€3.6 million in 2022)

● General plant overhead cost pool (€2.8 million in 2022).

Machining costs are to be allocated using machine-hours per unit. General plant overhead costs

are to be allocated using direct manufacturing labour-hours per unit.

Required

1 Calculate the overhead costs allocated per unit to each model of motorcycle in 2022 using the

current single-cost-pool approach of Azu-Cena.

2 Calculate the machining costs and general plant overhead costs allocated per unit to each model

of motorcycle assuming that the accountant's proposal for two separate cost pools is used in

2022.

3 What benefits might arise from the accountant's proposal for separate pools for machining

costs and general plant costs?

5.12 Cost allocation with a non-financial variable, retailing (15–20 minutes)

Jyvaskyla Oy is a retail chain of supermarkets. For many years, it has used gross margin (selling

price minus cost of goods sold) to guide it in deciding on which products to emphasise or de-em-

phasise. And, for many years, it has not allocated any costs to products. It changed its internal

reporting system recently and goods-handling costs are now allocated to individual products on

the basis of cubic volume. (Most products are delivered to the shelves in cartons. A detailed study

showed that cubic volume was the major driver of Jyvaskyla's goods-handling costs. These costs

make up over 30% of non-cost-of-goods-sold costs of Jyvaskyla.) The following data focus on

four products in April 2022:

Product	**Revenue per carton**	**Cost of goods purchased per carton**	**Volume (cubic metres)**
Breakfast cereal	€82	€56	

24

Dairy product

64

52

12

Paper towels

36

26

24

Toothpaste

100

74

12

Each supermarket has a weekly report on product contribution:

Revenue

€

R

Cost of goods sold

C

Gross margin (GM)

R – C

Goods-handling costs

D

Product contribution (PC)

€ GM – D

The April 2022 goods-handling cost allocation rate is €0.50 per cubic metre.

Required

1 Calculate the gross margin for each of the four products. Rank these four products using their

gross margin percentage.

2 Calculate the product contribution for each of the four products. Rank these four products

using the product contribution to revenue percentage.

3 Compare your ranking in requirement 2 with that in requirement 1. How is the requirement 2

analysis useful to Jyvaskyla management?

Intermediate level

5.13 Cost allocation in centres, alternative allocation criteria (15–20 minutes)

Brian McGarrigle went to Les Arcs for his annual winter vacation. Unfortunately, he suffered

a broken ankle while skiing and had to spend two days at the Hôpital de Grasse. McGarrigle's

insurance company received a €4800 bill for his two-day stay. One item that caught McGarrigle's

eye was an €11.52 charge for a roll of cotton wool. McGarrigle was a salesman for Boots and

knew that the cost to the centre of the roll of cotton wool would be in the €2.20 to €3.00 range.

He asked for a breakdown of how the €11.52 charge was derived. The accounting office of the

centre sent him the following information:

a Invoiced cost of cotton wool roll

€2.40

b Processing of paperwork for purchase

0.60

c Supplies room management fee

0.70

d Operating-room and patient-room handling charge

1.60

e Administrative centre costs

1.10

f

University teaching-related recoupment

0.60

g Malpractice insurance costs

1.20

h Cost of treating uninsured patients

2.72

i

Profit component

0.60

Total

€11.52

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McGarrigle believes the overhead charge is excessive. He comments, ‘There was nothing I could

do about it. When they come in and dab your stitches, it’s not as if you can say, “Keep your cotton

wool. I’ve brought my own.”’

Required

1 Calculate the overhead rate Hôpital de Grasse charged on the cotton wool.

2 What criteria might Hôpital de Grasse use to justify allocation of each of the overhead items

b to i in the preceding list? Examine each item separately and use the allocation criteria listed

in Exhibit 5.2 in your answer.

3 What should McGarrigle do about the €11.52 charge for the cotton wool?

***5.14 Single-rate versus dual-rate cost-allocation methods** (15–20 minutes)

Alxenor SA has a power plant designed and built to serve its three factories. Data for 2022 are as follows:

Usage in kilowatt-hours

Factory

Budget

Actual

Kifisia

100 000

80 000

Iraklion

60 000

120 000

Chalandri

40 000

40 000

Actual fixed costs of the power plant were €1 million in 2022; actual variable costs, €2 million.

Required

1 Calculate the amount of power costs that would be allocated to Iraklion using a single-rate

method.

2 Calculate the amount of power costs that would be allocated to Iraklion using a dual-rate

method.

5.15 Single-rate versus dual-rate allocation methods, support department (20 minutes)

The Fredensborg power plant that services all manufacturing departments of Fabri-Danmark

AS has a budget for the coming year. This budget has been expressed in the following terms on a

monthly basis:

Needed at practical

Average expected

Manufacturing

capacity production level*

monthly usage

departments

(kilowatt-hours)

(kilowatt-hours)

Roskilde

10 000

8 000

Køge

20 000

9 000

Nysted

12 000

7 000

Ålborg

8 000

6 000

Totals

50 000

30 000

* This factor was the most influential in planning the size of the power plant.

The expected monthly costs for operating the department during the budget year are DKr 15 000:

DKr 6000 variable and DKr 9000 fixed.

Required

1 Assume that a single cost pool is used for the power plant costs. What Danish krone amounts

will be allocated to each manufacturing department? Use (a) practical capacity and (b) average

expected monthly usage as the allocation bases.

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2 Assume a dual-rate method; separate cost pools for the variable and fixed costs are used.

Variable costs are allocated on the basis of expected monthly usage. Fixed costs are allocated

on the basis of practical capacity. What Danish krone amounts will be allocated to each man-

ufacturing department? Why might you prefer the dual-rate method?

5.16 Allocation of common costs (20–30 minutes)

Rolf, Ilse and Ulrich are members of the Frankfurt Fire Brigade. They share an apartment that has a

lounge with the latest wide-screen TV. Ulrich owns the apartment, its furniture and the wide-screen

TV. He can subscribe to a cable television company that has the following packages available:

Package

Rate per month

A Basic news

€32

B Premium movies

25

C Premium sport

30

D Basic news and premium movies

50

E Basic news and premium sport

54

F Premium movies and premium sport

48

G Basic news, premium movies and premium sport

70

Rolf is a TV news addict, has average interest in movies and no interest in sport (‘they are overpaid

dummies'). Ilse is a movie buff, likes sport and avoids the news ('it's all depressing anyway'). Ulrich

is a sports fan, has average interest in news and no interest in movies ('I always fall asleep before

the end'). They all agree that the purchase of the €70 total package is a 'win-win-win' situation.

Each works on a different eight-hour shift at the fire station, so conflicts in viewing are

minimal.

Required

1 What criteria might be used to guide the choice about how to allocate the €70 monthly cable

fee among Rolf, Ilse and Ulrich?

2 Outline two methods of allocating the €70 among Rolf, Ilse and Ulrich.

5.17 Allocation of travel costs (20 minutes)

Catherine MacDougall, a third-year undergraduate student at a university near Edinburgh,

received an invitation to visit a prospective employer in Nice. A few days later, she received an

invitation from a prospective employer in Copenhagen. She decided to combine her visits, travel-

ling from Edinburgh to Nice, Nice to Copenhagen and Copenhagen to Edinburgh.

MacDougall received job offers from both companies. Upon her return, she decided to accept

the offer in Copenhagen. She was puzzled about how to allocate her travel costs between the two

employers. She gathered the following data:

Regular round-trip fares with no stopovers

Edinburgh to Nice

£1400

Edinburgh to Copenhagen

£1100

MacDougall paid £1800 for her three-leg flight (Edinburgh to Nice, Nice to Copenhagen, Copen-

hagen to Edinburgh). In addition, she paid £30 for a taxi from her home to Edinburgh Airport

and another £30 for a taxi from Edinburgh Airport to her home when she returned.

Required

1 How should MacDougall allocate the £1800 airfare between the employers in Nice and Copen-

hagen? Show the actual amounts you would allocate and give reasons for your allocations.

2 Repeat requirement 1 for the £60 taxi fares at the Edinburgh end of her travels.

Exercises

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5.18 Support department cost allocation; direct and step-down methods (30 minutes)

Olympiakos SA provides outsourcing services and advice to both government and corporate cli-

ents. For costing purposes, Olympiakos classifies its departments into two support departments

(Administrative/Human Resources and Information Systems) and two operating departments

(Government Consulting and Corporate Consulting). For the first quarter of 2022, Olympiakos

incurs the following costs in its four departments:

Administrative/Human Resources (A/HR)

€600 000

Information Systems (IS)

€2 400 000

Government Consulting (GOVT)

€8 756 000

Corporate Consulting (CORP)

€12 452 000

The actual level of support relationships among the four departments for the first quarter of 2022

was:

Used by

A/HR

IS

GOVT

CORP

Supplied

A/HR

–

25%

40%

35%

by

IS

10%

–

30%

60%

The Administrative/Human Resource support percentages are based on headcount. The Infor-

mation Systems support percentages are based on actual hours of computer time used.

Required

1 Allocate the two support department costs to the two operating departments using the follow-

ing methods:

a Direct method

b Step-down method (allocate Administrative/Human Resources first)

c Step-down method (allocate Information Systems first).

2 Compare and explain differences in the support department costs allocated to each operating

department.

3 What criteria could determine the sequence for allocating support departments using the step-

down method? What criterion should Olympiakos use if government consulting jobs require

the step-down method?

5.19 Manufacturing cost allocation, use of a conversion cost pool category, automation

(20–30 minutes)

Euro-Medi Plc manufactures a wide range of medical instruments. Two testing instruments (101

and 201) are produced at its highly automated Limerick plant. Data for December 2022 are as

follows:

Instrument 101

Instrument 201

Direct materials

€100 000

€300 000

Direct manufacturing labour

€20 000

€10 000

Units produced

5 000

20 000

Actual direct labour-hours

1 000

500

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Manufacturing overhead is allocated to each instrument product on the basis of actual direct manu-

facturing labour-hours per unit for that month. Manufacturing overhead cost for December 2022 is

€270 000. The production line at the Limerick plant is a machine-paced one. Direct manufacturing

labour is made up of costs paid to workers minimising machine problems rather than actually operating

the machines. The machines in this plant are operated by computer specialists and industrial engineers.

Required

1 Calculate the cost per unit in December 2022 for instrument 101 and instrument 201 under the

existing cost accounting system.

2 The accountant at Euro-Medi proposes combining direct manufacturing labour costs and man-

ufacturing overhead costs into a single conversion costs pool. These conversion costs would be

allocated to each unit of product on the basis of direct materials costs. Calculate the cost per

unit in December 2022 for instrument 101 and instrument 201 under the accountant's proposal.

3 What are the benefits of combining direct manufacturing labour costs and manufacturing

overhead costs into a single conversion costs pool?

5.20 Segment reporting and cost hierarchies (20 minutes)

Koala Ltd has only two divisions: A and B. The following data apply to Division A.

Fixed costs controllable outside division

€100 000

Net revenues

1 500 000

Variable marketing and administrative expenses

200 000

Total traceable costs

1 000 000

Total variable costs

600 000

Required

1 Prepare a segment report for Division A that differentiates between the performance of the

manager and the performance of the division.

2 Division B's net revenue is €3 million and its contribution margin is €1.2 million. The segment

margin (contribution by division of Division B) is €700 000.

a Determine fixed costs traceable to Division B.

b Determine variable costs of Division B.

3 Koala's corporate costs unallocated to divisions are €400 000. Determine Koala's income.

5.21 Departmental cost allocation, university computer-service centre (20–30 minutes)

A computer-service centre of Madrid University serves two major users, the department of

Engineering and the department of Humanities and Sciences (H&S).

Required

1 When the computer equipment was initially installed, the procedure for cost allocation was

straightforward. The actual monthly costs were compiled and divided between the two depart-

ments on the basis of the computer time used by each. In October, the costs were €100 000.

H&S used 100 hours and Engineering used 100 hours. How much cost should be allocated to

each department? Suppose costs were €110 000 because of various inefficiencies in the opera-

tion of the computer centre. How much cost would then be allocated? Does such an allocation

seem justified? If not, what improvement would you suggest?

2 Use the same approach as in requirement 1. The actual cost-behaviour pattern of the computer

centre was €80 000 fixed cost per month plus €100 variable cost per hour used. In November,

H&S used 50 hours and Engineering used 100 hours. How much cost would be allocated to

each department? Use a single-rate method.

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3 As the computer-service centre developed, a committee was formed that included representatives

of H&S and Engineering. This committee determined the size and composition of the centre's

equipment. The committee based its planning on the long-run average utilisation of 180 monthly

hours for H&S and 120 monthly hours for Engineering. Suppose the €80 000 fixed costs are allo-

cated through a budgeted monthly lump sum based on long-run average utilisation. Variable costs

are allocated through a budgeted unit rate of €100 per hour. How much cost should be allocated to

each department? What are the advantages of this dual-rate allocation method over other methods?

4 What are the likely behavioural effects of lump-sum allocations of fixed costs? For example,

if you were the representative of H&S on the facility planning committee, what would your

biases be in predicting long-run usage? How would top management counteract the bias?

Advanced level

***5.22 Cost allocation for all cost categories in the value chain, different costs for different pur-**

poses (30–40 minutes)

Laser Tecnologia Srl develops, assembles and sells two product lines:

● Product Line A (laser scanning systems)

● Product Line B (laser cutting tools).

Product Line A is sold exclusively to the Italian Department of Defence under a cost-plus reim-

bursement contract. Product Line B is sold to commercial organisations.

Laser Tecnologia classifies costs in each of its six value-chain business functions into two cost

pools: direct product-line costs (separately traced to Product Line A or B) and indirect prod-

uct-line costs. The indirect product-line costs are grouped into a single cost pool for each of the

six functions of the value-chain cost structure:

Value-chain indirect

product-line cost function

Base for allocating indirect costs to each product line

1 R&D

Hours of R&D time identifiable with each product line

2 Product design

Number of new products

3 Production

Hours of machine assembly time

4 Marketing

Number of salespeople

5 Distribution

Number of shipments

6 Customer service

Number of customer visits

Summary data in 2022 are:

Product

Product

Line A:

Line B:

Total

Product

Product

Product

direct

direct

indirect

allocation

Line A

Line B

costs

costs

costs

base for

units of

units of

(millions)

(millions)

(millions)

indirect costs allocation base allocation base

R&D

€10.0

€5.0

€20.0

R&D time

6000 hours

2000 hours

Product design

2.0

3.0

6.0

New products 8 new

4 new products

products

Production

15.0

13.0

24.0

Machine-hours 70 000

50 000

machine-

machine-hours

hours

Marketing

6.0

5.0

7.0

Salespeople

25 people

45 people

Distribution

2.0

3.0

2.0

Shipments

600 shipments 1400 shipments

Customer

5.0

3.0

1.0

Customer

1000 visits

4000 visits

service

visits

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Chapter 5 Cost allocation

Required

1 For product pricing on its Product Line B, Laser Tecnologia sets a preliminary selling price

of 140% of full cost (made up of both direct costs and the allocated indirect costs for all six

of the value-chain cost categories). What is the average full cost per unit of the 2000 units of

Product Line B produced in 2022?

2 For motivating managers, Laser Tecnologia separately classifies costs into three groups:

- upstream (R&D and product design)
- manufacturing
- downstream (marketing, distribution and customer service).

Calculate the costs (direct and indirect) in each of these three groups for Product Lines A and B.

3 For the purpose of income and asset measurement for reporting to external parties, inventori-

able costs under generally accepted accounting principles for Laser Tecnologia include manu-

facturing costs and product-design costs (both direct and indirect costs of each category). At

the end of 2022, what is the average inventoriable cost for the 300 units of Product Line B on

hand? (Assume zero opening stock.)

4 The Department of Defence purchases all Product Line A units assembled by Laser Tecnologia.

Laser is reimbursed 120% of allowable costs. Allowable cost is defined to include all direct and

indirect costs in the R&D, product design, manufacturing, distribution and customer-service

functions. Laser Tecnologia employs a marketing staff that makes many visits to government

officials, but the Department of Defence will not reimburse Laser for any marketing costs.

What is the 2022 allowable cost for Product Line A?

5 ‘Differences in the costs appropriated for different decisions, such as pricing and cost reim-

bursement, are so great that firms should have multiple accounting systems rather than a single

accounting system.’ Do you agree?

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CHAPTER 6

Cost al ocation: joint-cost situations

Rather than emphasise costing either for single-product companies or for companies in which individual products are separately produced,

Learning objectives

we now consider costing for the more complex case where two or more products are simultaneously produced with each other. Costs incurred

After studying this chapter, you

in this more complex case are termed joint costs. A joint cost is the

should be able to:

cost of a single process that yields multiple products simultaneously.

●

Identify the split-off point(s) in a

Although joint costs sometimes pose problems of allocation, it may be

joint-cost situation

possible to trace resources consumption to ultimate cost objects such as individual products or organisational units. This can be useful in making

●

Distinguish between joint

certain types of managerial decision. This chapter examines methods for

products and by-products

allocating joint costs to products and services.

- Provide several reasons for allocating joint costs to individual products
- Explain alternative methods of allocating joint costs
- Identify the criterion used to support market-based joint-cost allocation methods
- Describe the irrelevance of joint costs in deciding to sell or further process
- Distinguish alternative methods of

accounting for by-products

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Chapter 6 Cost allocation: joint-cost situations

Meaning of joint products and by-products terms

Consider a single process that yields two or more products (or services) simultaneously. The dis-

tillation of coal, for example, gives us coke, gas and other products. The cost of this distillation

process would be called a joint cost. Joint costs are thus the costs of a production process that

yields multiple products simultaneously. The juncture in the process when one or more products

in a joint-cost setting become separately identifiable is called the split-off point. An example is

the point where coal becomes coke, gas and other products. Separable costs are costs incurred

beyond the split-off point that are assignable to one or more individual products. At or beyond

the split-off point, decisions relating to sale or further processing of individual products can be

made independently of decisions about other products.

Various terms have arisen in conjunction with production processes. A product is any output

that has a positive sales value (or an output that enables an organisation to avoid incurring costs).

Joint products all have relatively high sales value but are not separately identifiable as individual

products until the split-off point. When a single process yielding two or more products yields only

one product with a relatively high sales value, that product is termed a main product. A by-product

has a low sales value compared with the sales value of the main or joint product(s). Scrap has a

minimal sales value. The classification of products as main, joint, by-product or scrap can change

over time, especially for products (such as tin) whose market price can increase or decrease by, say,

30% or more in any one year.

Exhibit 6.1 shows the relationship between the terms defined in the preceding paragraph. Be

careful. These distinctions are not firm in practice. The variety of terminology and accounting

practice is bewildering. Always gain an understanding of the terms used by the particular organ-

isation with which you are dealing.

Industries abound in which single processes simultaneously yield two or more products.

Exhibit 6.2 presents examples of joint-cost situations in diverse industries. In each example in

Exhibit 6.2, no individual product can be produced without the accompanying products appear-

ing, although sometimes the proportions can be varied. A poultry farm cannot kill a turkey wing;

it has to kill a whole turkey, which yields breast, drumsticks, giblets, feather meal and poultry meal

in addition to wings. In this example, the focus is on building up costs of individual products as

disassembly occurs. This focus contrasts with prior chapters that emphasise building up costs of

individual products as assembly occurs.

In some joint-cost settings, the number of outputs produced exceeds the number of products.

This situation can occur where an output, produced as an inherent part of the joint production

process, is recycled without any value being added by its production. For example, the offshore

Exhibit 6.1

Joint products, main product, by-product and scrap

Joint products*

Main product†

By-product

Scrap

High

Low

Minimal

Relative sales value

* If multiple products have relatively high sales values

† If only one product has a relatively high sales value

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Exhibit 6.2

Examples of joint-cost situations

Industry

Separable products at the split-off point

Agriculture

Lamb

Lamb cuts, offal, hides, bones, fat

Raw milk

Cream, liquid skim

Turkeys

Breast, wings, drumsticks, giblets, feather meal, poultry meal

Mining industries

Coal

Coke, gas, benzol, tar, ammonia

Copper ore

Copper, silver, lead, zinc

Petroleum

Crude oil, gas, raw liquefied petroleum gas

Salt

Hydrogen, chlorine, caustic soda

Chemical industries

Raw liquefied petroleum gas

Butane, ethane, propane

Semiconductor industry

Fabrication of silicon-wafer chips

Memory chips of different quality (as to capacity), speed, life

expectancy and temperature tolerance

processing of hydrocarbons to yield oil and gas also yields water as an output, which is recycled

back into the sea. Similarly, the processing of mineral ore to yield gold and silver also yields dirt

as an output, which is recycled back into the ground. The water and dirt in these examples typ-

ically are not classified as products, but they are outputs. No entries are made in the accounting

system to record their processing. The physical quantity of these outputs can be large relative to

the physical quantity of outputs that are recorded in the accounting system as products. It is only

those outputs that have a positive sales value that are typically labelled products.

Why allocate joint costs?

There are many contexts that require the allocation of joint costs to individual products or ser-

vices (see Bhimani and Bromwich 2010, chapter 2 for a detailed explanation). Examples include:

● Stock-costing and cost-of-goods-sold computations for external financial statements and

reports for income tax authorities.

● Stock-costing and cost-of-goods-sold computations for internal financial reporting. Such

reports are used in division profitability analysis when determining compensation for division

managers.

● Cost reimbursement under contracts when only a portion of a business's products or services

is sold or delivered to a single customer (such as a government agency).

● Customer profitability analysis where individual customers purchase varying combinations of

joint products or by-products as well as other products of the company.

● Insurance settlement computations when damage claims made by businesses with joint prod-

ucts, main products or by-products are based on cost information.

● Rate regulation when one or more of the jointly produced products or services are subject to

price regulation.

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Approaches to allocating joint costs

There are two basic approaches to allocating joint costs:

1 Allocate costs using market-based data (for example, revenues). Three methods that can be

used in applying this approach are:

a the sales value at split-off method

b the estimated net realisable value (NRV) method

c the constant gross-margin percentage NRV method.

2 Allocate costs using physical measure-based data such as weight or volume.

We have previously emphasised both the cause-and-effect and benefits-received criteria for guid-

ing cost-allocation decisions. In joint-cost settings, it is not feasible to use the cause-and-effect

criterion to guide individual product-cost allocations. Joint costs, by definition, cannot be the

subject of cause-and-effect analysis at the individual product level. The cause-and-effect relation-

ship exists only at the joint process level. The benefits-received criterion leads to a preference for

methods under approach 1. Revenues, in general, are a better indicator of benefits received than

are physical measures such as weight or volume.

In the simplest situation, the joint products are sold at the split-off point without further pro-

cessing. We use this case first (Example 6.1) to illustrate the sales value at split-off method and

the physical measures method using volume as the metric. Then we consider situations involv-

ing further processing beyond the split-off point (Example 6.2) to illustrate the estimated NRV

method and the constant gross-margin percentage NRV method.

To highlight each joint-cost example, we make extensive use of exhibits in this chapter. We use

the following notation:

Joint product or main product

By-product or scrap

To enable comparisons across the methods, we report for each method individual gross-margin

percentages for individual products.

Example 6.1

Farmers' Dairy purchases raw milk from individual farms and processes it up to the split-off point, where

two products (cream and liquid skim) are obtained. These two products are sold to an independent

company, which markets and distributes them to supermarkets and other retail outlets.

Exhibit 6.3 presents an overview of the basic relationships in this example. Summary data for

May 2022 are as follows:

● Raw milk processed: 440 litres (440 litres of raw milk yield 400 litres of good product with a

40-litre shrinkage):

Production Sales

Cream

100 litres

80 litres at €2 per litre

Liquid skim 300 litres

120 litres at €1 per litre

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Exhibit 6.3

Farmers' Dairy: Example 6.1 overview

Joint costs

Cream

Raw milk

Processing

€400

Liquid

skim

Split-off

point

● Stocks:

Opening stock

Closing stock

Raw milk

0 litre

0 litre

Cream

0 litre

20 litres

Liquid skim

0 litre

180 litres

● Cost of purchasing 440 litres of raw milk and processing it up to the split-off point to yield

100 litres of cream and 300 litres of liquid skim: €400.

How much of the joint costs of €400 should be allocated to the closing stock of 20 litres of cream

and 180 litres of liquid skim? The joint production costs of €400 cannot be uniquely identified

with or traced to either product. Why? Because the products themselves were not separated before

the split-off point. The joint-cost-allocation methods we now discuss can be used for costing the

stock of cream and liquid skim as well as determining cost of goods sold.

Sales value at split-off method

The sales value at split-off method allocates joint costs on the basis of the relative sales value at the

split-off point of the total production in the accounting period of each product. In Exhibit 6.4,

the sales value at split-off of the May 2022 production is €200 for cream and €300 for liquid

skim. We then assign a weighting to each product, which is a percentage of total sales value. Using

this weighting, we allocate the joint costs to the individual products, as shown in Exhibit 6.4.

Note that this method uses the sales value of the *entire production* of the accounting period.

The joint costs were incurred on all units produced and not just those sold. Exhibit 6.5 pre-

sents the product-line income statement, using the sales value at split-off method of joint-cost

allocation. Use of this method has enabled us to obtain individual product costs and gross

margins. Both cream and liquid skim have gross-margin percentages of 20%. The equality of

the gross-margin percentages for the two products is a mechanical result reached with the sales

value at split-off method when there are no beginning stocks and all products are sold at the

split-off point.

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Exhibit 6.4

Allocation of joint costs using the sales value at split-off method

Cream

Liquid skim

Total

1 Sales value at split-off point (cream,

€200

€300

€500

100 litres × €2; liquid skim, 300 litres × €1)

2 Weighting (€200 ÷ €500; €300 ÷ €500)

0.40

0.60

3 Joint costs allocated (cream, 0.40 × €400;

€160

€240

€400

liquid skim, 0.60 × €400)

4 Joint production costs per litre (cream,

€1.60

€0.80

€160 ÷ 100 litres; liquid skim, €240 ÷ 300 litres)

Exhibit 6.5

Farmers' Dairy product-line income statement for May 2022:

joint costs allocated using sales value at split-off method

Cream

Liquid skim

Total

Sales (cream, 80 litres × €2;

€160

€120

€280

liquid skim, 120 litres × €1)

Joint costs

Production costs (cream, 0.4 × €400;

160

240

400

liquid skim, 0.6 × €400)

Deduct ending stock (cream, 20 litres × €1.60;

32

144

176

liquid skim, 180 litres × €0.80)

Cost of goods sold

128

96

224

Gross margin

€32

€24

€56

Gross-margin percentage

20%

20%

20%

The sales value at split-off point method exemplifies the benefits-received criterion of cost

allocation. Costs are allocated to products in proportion to their ability to contribute revenue.

This method is both straightforward and intuitive. The cost-allocation base (sales value at split-

off) is expressed in terms of a common denominator (euros) that is systematically recorded in the

accounting system and well understood by all parties.

Concepts in action

Big Data joint products and by-products create new business

opportunities

Forward-thinking companies are using their data to create

new products and business lines as a byproduct of their operations. For some companies, the value of big data is so significant that it is a joint product, not a byproduct.

UnitedHealth, for example, has built a business by reusing the information contained in the insurance claim forms it processes. These aggregated data allow pharmaceutical companies to see how their products are used, how effective they are, and how well they are competing with rival drugs.

Similarly, Toyota created a new business that leverages the GPS navigation devices it installs in cars sold in Japan.

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It captures the speed and position of cars and sells traffic data to municipal planning departments and corporate delivery fleets at prices that start at $2,000 a month.

Cargill developed a new digital product line to supplement its business of selling crop seeds to farmers. By analyzing its large database of information on how its seeds performed in various types of soil and weather conditions, it built

software that gives customized advice to farmers looking to increase their crop yields.

Companies are increasingly leveraging their data to find product enhancements that increase revenue, build ser-

vices that broaden their customer relationships, and even create new businesses that capitalize on the large quantities

of data they are collecting to serve new customers.

Source: Alan Lewis and Dan McKone (2016) *Edge Strategy: A New Mindset for Profitable Growth* (Boston, MA: Harvard Business School Press).

Physical measure method

The physical measure method allocates joint costs on the basis of their relative proportions at

the split-off point, using a common physical measure such as weight or volume of the total pro-

duction of each product. In Example 6.1, the €400 joint costs produced 100 litres of cream and

300 litres of liquid skim. Joint costs using these quantities are allocated as shown in Exhibit 6.6.

Exhibit 6.7 presents the product-line income statement using this method of joint-cost alloca-

tion. The gross-margin percentages are 50% for cream and 0% for liquid skim.

The physical weights used for allocating joint costs may have no relationship to the revenue- pro-

ducing power of the individual products. Using the benefits-received criterion, the physical measure

method is less preferred than the sales value at split-off method. Consider a mine that extracts

Exhibit 6.6

Allocation of joint costs using the physical measure method

Cream

Liquid skim

Total

1 Physical measure of production (litres)

25

75

100

2 Weighting (100 liters ÷ 400 litres;

0.25

0.75

300 liters ÷ 400 litres)

3 Joint costs allocated (cream, 0.25 × €400;

€100

€300

€400

liquid skim, 0.75 × €400)

4 Joint production costs per litre (cream, €100 ÷ 100

€1

€1

litres; liquid skim, €300 ÷ 300 litres)

Exhibit 6.7

Farmers' Dairy product-line income statement for May 2022:

joint costs allocated using the physical measure method

Cream

Liquid skim

Total

Sales (cream, 80 litres × €2; liquid skim, 120 litres × €1)

€160

€120

€280

Joint costs

Production costs (cream, 0.25 × €400;

100

300

400

liquid skim, 0.75 × €400)

Deduct closing stock (cream, 20 litres × €1;

20

180

200

liquid skim, 180 litres × €1)

Cost of goods sold

80

120

200

Gross margin

€80

€0

€80

Gross-margin percentage

50%

0%

28.6%

ore containing gold, silver and lead. Use of a common physical measure (tonnes) would result in

almost all the costs being allocated to the product that weighs the most – lead, which has the lowest

revenue-producing power. As a second example, if the joint cost of a pig were assigned to its various

products on the basis of weight, loin pork chops would have the same cost per kilogram as pigs' trot-

ters, lard, bacon, bones and so forth. In a product-line income statement, the pork products that have

a high sales value per kilogram (for example, loin pork chops) would show a fabulous 'profit', and

products that have a low sales value per kilogram (for example, bones) would show consistent losses.

Obtaining comparable physical measures for all products is not always straightforward. Con-

sider oil and gas joint-cost settings, where oil is a liquid and gas is a vapour. Use of a physical

measure, such as barrels, will require technical assistance from chemical engineers on how to con-

vert the vapour into a measure additive with barrels of oil. Technical personnel outside account-

ing may be required when using some physical measures in joint-cost-allocation situations.

Example 6.2

Assume the same situation as in Example 6.1 except that both cream and liquid skim can be processed further:

● Cream → Butter cream: 100 litres of cream are further processed to yield 80 litres of butter cream at

additional processing (separable) costs of €280. Butter cream is sold for €6.25 per litre.

● Liquid skim → Condensed milk: 300 litres of liquid skim are further processed to yield 200 litres of

condensed milk at additional processing costs of €520. Condensed milk is sold for €5.5 per litre.

Sales during the accounting period were 48 litres of butter cream and 180 litres of condensed

milk. Exhibit 6.8 presents an overview of the basic relationships. Stock information is as follows:

Opening stock Closing stock

Raw milk

0 litres

0 litres

Cream

0 litres

0 litres

Liquid skim

0 litres

0 litres

Butter cream

0 litres

32 litres

Condensed milk

0 litres

20 litres

Example 6.2 will be used to illustrate the estimated net realisable value (NRV) method and the

constant gross-margin percentage NRV method.

Exhibit 6.8

Farmers' Dairy: Example 6.2 overview

Joint costs

Separable costs

Cream

Processing

Butter

€280

cream

Raw milk

Processing

€400

Liquid

Processing

Condensed

skim

€520

milk

Split-off

point

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Estimated net realisable value method

The estimated net realisable value (NRV) method allocates joint costs on the basis of the relative

estimated net realisable value (expected final sales value in the ordinary course of business minus

the expected separable costs of production and marketing of the total production of the period).

Joint costs would be allocated as shown in Exhibit 6.9.

Exhibit 6.10 presents the product-line income statement using the estimated NRV method. The

gross-margin percentages are 22.0% for butter cream and 26.4% for condensed milk.

Estimating the net realisable value of each product at the split-off point requires information

about the subsequent processing steps to be taken (and their expected separable costs). (The esti-

mated NRV method is clear-cut when there is only one split-off point. When there are multiple

split-off points, however, additional allocations may be required if processes subsequent to the

Exhibit 6.9

Allocation of joint costs using the estimated NRV method

Butter

Condensed

cream

milk

Total

1

Expected final sales value of production

€500

€1100

€1600

(butter cream, 80 litres × €6.25; condensed

milk, 200 litres × €5.5)

2

Deduct expected separable costs to complete

280

520

800

and sell

3 Estimated NRV at split-off point

€220

€580

€800

4 Weighting (€220 ÷ €800; €580 ÷ €800)

0.275

0.725

5 Joint costs allocated (butter cream,

€110

€290

€400

0.275 × €400; condensed milk, 0.725 × €400)

6 Production costs per litre [butter cream

€4.875

€4.05

(€110 + €280), 80 litres condensed milk

(€290 + €520), 200 litres]

Exhibit 6.10

Farmers' Dairy product-line income statement for May 2022:

joint costs allocated using the estimated NRV method

Butter

Condensed

cream

milk

Total

Sales (butter cream, 48 litres × €6.25;

€300

€990

€1290

condensed milk, 180 litres × €5.5)

Cost of goods sold

Joint costs (butter cream, 0.275 × €400;

110

290

400

condensed milk, 0.725 × €400)

Separable processing costs

280

520

800

Cost of goods available for sale

390

810

1200

Deduct closing stock (butter cream,

156

81

237

32 litres × €4.875; condensed milk,

20 litres × €4.05)

Cost of goods sold

234

729

963

Gross margin

€66

€261

€327

Gross-margin percentage

22.0%

26.4%

25.3%

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initial split-off point remerge with each other to create a second joint-cost situation.) In some

plants, such as in petrochemicals, there may be many possible subsequent steps. Companies may

frequently change further processing to exploit fluctuations in the separable costs of each pro-

cessing stage or in the selling prices of individual products. Under the estimated NRV method,

each such change would affect the joint-cost-allocation percentages. (In practice, a set of standard

subsequent steps is assumed at the start of the accounting period when using the estimated NRV

method.)

The sales value at split-off method is less complex than the estimated NRV method as it does

not require knowledge of the subsequent steps in processing. However, it is not always feasible to

use the sales value at split-off method. Why? Because there may not be any market prices at the

split-off point for one or more individual products. Market prices may not first appear until after

processing beyond the split-off point has occurred.

Constant gross-margin percentage NRV method

The constant gross-margin percentage NRV method allocates joint costs in such a way that the

overall gross-margin percentage is identical for all the individual products. This method entails

three steps:

1 Calculate the overall gross-margin percentage.

2 Use the overall gross-margin percentage and deduct the gross margin from the final sales values

to obtain the total costs that each product should bear.

3 Deduct the expected separable costs from the total costs to obtain the joint-cost allocation.

Exhibit 6.11 presents these three steps for allocating the €400 joint costs between butter cream

and condensed milk. To determine the joint-cost allocation, Exhibit 6.11 uses the expected final

sales value of the *total production* of the period (€1600) and *not* the actual sales of the period.

The joint costs allocated to each product need not always be positive under this method. Some

Exhibit 6.11

Farmers' Dairy for May 2022: joint costs allocated using constant

gross-margin percentage NRV method

Butter

Condensed

cream

milk

Total

Step 1

Expected final sales value of production:

€1600

(80 litres × €6.25) + (200 litres × €5.5)

Deduct joint and separable costs

1200

(€400 + €280 + €520)

Gross margin

€400

Gross-margin percentage (€400 ÷ €1600)

25%

Step 2

Expected final sales value of production (butter cream,

€500

€1100

€1600

80 litres × €6.25; condensed milk, 200 litres × €5.5)

Deduct gross margin, using overall gross-margin

125

275

400

percentage (25%)

Cost of goods sold

375

825

1200

Step 3

Deduct separable costs to complete and sell

280

520

800

Joint costs allocated

€95

€305

€400

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Approaches to allocating joint costs

Farmers' Dairy product-line income statement for May 2022:

Exhibit 6.12

joint costs allocated using constant gross-margin percentage

NRV method

Butter

Condensed

cream

milk

Total

Sales (butter cream, 48 litres × €6.25;

€300.0

€990.0

€1290.0

condensed milk, 180 litres × €5.5)

Cost of goods sold

Joint costs (from Exhibit 6.11)

95.0

305.0

400.0

Separable costs to complete and sell

280.0

520.0

800.0

Cost of goods available for sale

375.0

825.0

1200.0

Deduct closing stock (butter cream,

150.0

82.5

232.5

32 litres × €4.6875*; condensed milk,

20 litres × €4.125†)

Cost of goods sold

225.0

742.5

967.5

Gross margin

€75.0

€247.5

€322.5

Gross-margin percentage

25%

25%

25%

* 375 ÷ 80 litres = €4.6875.

† 825 ÷ 200 litres = €4.125.

products may receive negative allocations of joint costs to bring their gross-margin percentages

up to the overall company average. The overall gross-margin percentage is 25%. A product-line

income statement for the constant gross-margin percentage NRV method is presented in

Exhibit 6.12.

The tenuous assumption underlying the constant gross-margin percentage NRV method is that

all the products have the same ratio of cost to sales value. A constant ratio of cost to sales value

across products is rarely seen in companies that produce multiple products but have no joint costs.

The main advantage of this method, however, is that it is easy to implement.

Comparison of methods

Which method of allocating joint costs should be chosen? Because the costs are joint in nature,

managers cannot use the cause-and-effect criterion in making this choice. Managers cannot be

sure what causes what cost when examining joint costs. The benefits-received criterion leads to a

preference for the sales value at split-off point method (or other related revenue or market-based

methods). Additional benefits of this method include:

1 No anticipation of subsequent management decisions. The sales value at split-off method does

not presuppose an exact number of subsequent steps undertaken for further processing.

2 Availability of a meaningful common denominator to calculate the weighing factors. The

denominator of the sales value at split-off method (euros) is a meaningful one. In contrast,

the physical measure method may lack a meaningful common denominator for all the

separable products (for example, when some products are liquids and other products are

solids).

3 Simplicity. The sales value at split-off method is simple. In contrast, the estimated NRV method

can be very complex in operations with multiple products and multiple split-off points. The

total sales value at split-off is unaffected by any change in the production process after the

split-off point.

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The purpose of the joint-cost allocation is important. Consider rate regulation. Market-based

measures are difficult to use in this context. It is circular to use selling prices as a basis for setting

prices (rates) and at the same time use selling prices to allocate the costs on which prices (rates) are

based. Physical measures represent one joint-cost-allocation approach available in rate regulation.

Concepts in action

Chicken processing: costing on the disassembly line

Chicken processing operations provide many examples

where joint and by-product costing issues can arise. Each chicken is killed and then ‘disassembled’ into many products. Every effort is made to obtain revenue from each disassembled item.

White breast meat, the highest revenue-generating product, is obtained from the front end of the bird. Dark meat is obtained from the back end. Other edible products include chicken wings, giblets and kidneys. There are many non-edible products, including feathers and blood, the head, feet and intestines. The non-edible products have a diverse set of uses. Examples include poultry feathers (used in bedding and sporting goods); poultry leftover parts such as bones, beaks and feet (ground into livestock pellets and fertiliser); and poultry fat (used in animal feed and pet food).

Poultry companies use individual product-cost information for several purposes. One purpose is in customer profitability analysis. Customers (such as supermarkets and fast-food restaurants) differ greatly in the mix of products purchased. Individual product-cost data enable companies to determine differences in individual customer profitability. A subset of products is placed into frozen storage, which creates a demand for individual product-cost

information for stock valuation.

Companies differ in how they cost individual products. Some companies classify white breast meat as the single

main product in their costing system. All other products are then classified as by-products. Market selling prices of

the many by-products are used to reduce the chicken processing costs that are allocated to the main product. The

white breast meat is often further processed into many individual products (such as trimmed chicken and marinated

chicken). The separable cost of this further processing is added to the cost per kilogram of deboned white breast meat

to obtain the cost of further processed products.

Other companies might classify any product sold to a retail outlet as a joint product. Such products include breast

fillets, half breasts, drumsticks, thighs and whole legs. All other products are classified as by-products. Revenue from

by-products is offset against the chicken processing cost and is allocated among the joint products. The average selling

prices of products sold to retail outlets are used to allocate the net chicken processing cost among the individual joint

products. The distribution costs of transporting the chicken products from the processing plants to retail outlets are

not taken into account when determining the joint-cost-allocation weights.

No allocation of joint costs

All of the preceding methods of allocating joint costs to individual products are subject to criti-

cism. As a result, some companies refrain from joint-cost allocation entirely. Instead, they carry

all stocks at estimated NRV. Income on each product is recognised when production is completed.

Industries that use variations of this approach include meat packing, canning and mining.

Accountants ordinarily criticise carrying stocks at estimated NRV. Why? Because income is

recognised *before* sales are made. Partly in response to this criticism, some companies using

this no-allocation approach carry their stocks at estimated NRV minus a normal profit margin.

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Exhibit 6.13

Farmers' Dairy product-line income statement for May 2022:

no allocation of joint costs

Butter

Condensed

cream

milk

Total

Produced and sold (butter cream, 48 litres × €6.25;

€300

€990

€1290

condensed milk, 180 litres × €5.5)

Produced but not sold (butter cream, 32 litres × €6.25;

200

110

310

condensed milk, 20 litres × €5.5)

Total sales value of production

500

€1100

1600

Separable costs

280

520

800

Contribution to joint costs and operating profit

€220

€580

800

Joint costs

400

Gross margin

€400

Gross-margin percentage

25%

Exhibit 6.13 presents the product-line income statement with no allocation of joint costs for

Example 6.2. The separable costs are assigned first, which highlights for managers the cause-and-

effect relationship between individual products and the costs incurred on them. The joint costs

are not allocated to butter cream and condensed milk as individual products.

Irrelevance of joint costs for decision making

No technique for allocating joint-product costs should guide management decisions regarding

whether a product should be sold at the split-off point or processed beyond split-off. When a

product is an inevitable result of a joint process, the decision to process further should not be

influenced either by the size of the total joint costs or by the portion of the joint costs allocated

to particular products. Ultimately, all joint-cost allocations to products are, to a degree, arbitrary.

Sell or process further

The decision to incur additional costs beyond split-off should be based on the incremental oper-

ating profit attainable beyond the split-off point. Example 6.2 assumed that it was profitable

for both cream and liquid skim to be further processed into butter cream and condensed milk,

respectively. The incremental analysis for these decisions to process further is as follows:

Further processing cream into butter cream

Incremental revenue (€500 – €200)

€300

Incremental processing costs

280

Incremental operating profit

€20

Further processing liquid skim into condensed milk

Incremental revenue (€1100 – €300)

€800

Incremental processing costs

520

Incremental operating profit

€280

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Chapter 6 Cost allocation: joint-cost situations

Example 6.3

Atilla-Parfums jointly processes a speciality chemical that yields two perfumes: 50 ml of Chimène and

150 ml of Nicomède. The sales values per millilitre at split-off are €6 for Chimène and €4 for Nicomède.

The joint costs incurred up to the split-off point are €880. The manager has the option of further processing

150 ml of Nicomède to yield 100 ml of Psyché. The total additional costs of converting Nicomède into

Psyché would be €160 and the selling price per millilitre of Psyché would be €8. Exhibit 6.14 summarises

the relationships in this example.

Exhibit 6.14

Atilla-parfums: Example 6.3 overview

Joint costs

Separable costs

Chimène

Speciality

chemical

Processing

€880

Nicomède

Processing

Psyché

€160

Split-off

point

The amount of joint costs incurred up to split-off (€400) – and how it is allocated – is irrelevant

in deciding whether to process further cream or liquid skim. Why? Because the joint costs of €400

are the same whether or not further processing is done.

Many manufacturing companies constantly face the decision of whether to process further a

joint product. Meat products may be sold as cut or may be smoked, cured, frozen, canned, and

so forth. Petroleum refiners are perpetually trying to adjust to the most profitable product mix.

The refining process necessitates separating all products from crude oil, even though only two or

three may have high revenue potential. The refiner must decide what combination of processes to

use to get the most profitable mix of crude oil, gas, butane, ethane, propane and the like.

In designing reports for managers' decisions of this nature, the accountant must concentrate

on incremental costs rather than on how historical joint costs are to be allocated among various

products. The only relevant items are incremental revenue and incremental costs. This next exam-

ple illustrates the importance of the incremental-cost viewpoint.

The correct approach in deciding whether to further process Nicomède into Psyché is to com-

pare the incremental revenue with the incremental costs, if all other factors such as invested capital

and the time period are held constant:

Incremental revenue of Psyché (100 × €8) – (150 × €4)

€200

Incremental costs of Psyché, further processing

160

Incremental operating profit from converting Nicomède into Psyché

€40

The following is a total income computation of each alternative. The revenues reported for each

product are Chimène (50 ml at €6 per ml = €300), Nicomède (150 ml at €4 per ml = €600) and

Psyché (100 ml at €8 per ml = €800).

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Alternative 1:

Alternative 2:

Sell Chimène

Sell Chimène

and Nicomède

and Psyché

Difference

Total revenues

(€300 + €600) €900

(€300 + €800) €1100

€200

Total processing costs

880

(€880 + €160) 1040

160

Operating profit

€20

€60

€40

As we can see from our example, it is profitable to extend processing and to incur additional

costs on a joint product as long as the incremental revenue exceeds incremental costs.

Conventional methods of joint-cost allocation may mislead managers who rely on unit-cost

data to guide their sell-or-further-process decisions. For example, the physical measure method

(millilitres in our example) would allocate the €880 joint costs as follows:

Millilitres

Allocation of

Product

produced

Weighting

joint costs

Chimène

50

50 ÷ 200 = 0.25

0.25 × €880 = €220

Nicomède

150

150 ÷ 200 = 0.75

0.75 × €880 = 660

200

€880

The resulting product-line income statement for the alternative of selling Chimène and Psyché

would erroneously imply that the company would suffer a loss by selling Psyché:

Chimène

Psyché

Revenues

€300

€800

Costs

Joint costs allocated

220

660

Separable costs

–

160

Cost of goods sold

220

820

Operating profit

€80

€(20)

Accounting for by-products

Processes that yield joint products often also yield what are frequently referred to as by-products –

products that have relatively low sales value compared with the sales value of the main or

joint product(s). We now discuss accounting for by-products. To simplify the discussion, consider

a two-product example consisting of a main product and a by-product.

Example 6.4

Deen's Grossierderij BV processes meat from slaughterhouses. One of its departments cuts lamb shoulders

and generates two products:

● shoulder meat (the main product) – sold for €60 per pack

● hock meat (the by-product) – sold for €4 per pack.

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Exhibit 6.15

Deen's Grossierderij BV: Example 6.4 overview

Joint costs

Shoulder

meat

Lamb

shoulders

Processing

25000

Hock

meat

Split-off

point

Both products are sold at the split-off point without further processing, as Exhibit 6.15 shows.

Data (number of packs) for this department in July 2022 are as follows:

Production

Sales

Opening stock

Closing stock

Shoulder meat

500

400

0

100

Hock meat

100

30

0

Total manufacturing costs of these products were €25 000.

Accounting methods for by-products address two major questions:

1 When are by-products first recognised in the general ledger? The two basic choices are (a) at

the time of production, or (b) at the time of sale.

2 Where do by-product revenues appear in the income statement? The two basic choices are (a)

as a cost reduction of the main or joint product(s), or (b) as a separate item of revenue or other

income.

Combining these two questions and choices gives four possible ways of accounting for by- products

(Exhibit 6.16).

Exhibit 6.16

Four ways to account for by-products

By-product

When by-products

Where by-product

Where by-product

accounting

are recognised in in

revenues appear in

stocks appear on

method

general ledger

income statement

balance sheet

A

Production

Reduction of cost

By-product stock

B

Production

Revenue or other

reported at

income item

(unrealised)

selling prices

C

Sale

Reduction of cost

By-product stock

D

Sale

Revenue or other

not recognised

income item

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Accounting for by-products

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Exhibit 6.17 presents the income statement figures and stock figures that Deen's Grossi-

erderij would report under each method. Methods A and B recognise the by-product stock

at the time of production. Note, however, that by-product stocks are reported on the balance

sheet at selling prices rather than at a cost amount. One variation of methods A and B is to

report by-product stocks at selling price minus a 'normal profit margin'. This variation avoids

including unrealised gains as an offset to cost of goods sold in the period of production. One

version of method A deducts the estimated NRV of the by-product(s) from the joint costs

before the remainder is allocated to individual joint products. Another version of method A

deducts the estimated NRV of the by-product(s) from the total production costs (joint costs

plus separable costs).

Methods C and D are rationalised in practice primarily on grounds of the relative insignifi-

cance of by-products. By-products are sometimes viewed as incidental. Methods C and D permit

managers to ‘manage’ reported earnings by timing when they sell by-products. Managers may

stockpile by-products so that they have flexibility to give revenue a ‘boost’ when most propitious

for them.

Exhibit 6.17

Deen’s Grossierderij BV income statement for July 2022

By-product accounting method

A

B

C

D

When by-products are recognised

At production At production

At sale

At sale

in general ledger

Where by-product revenues

Reduction of

Revenue Reduction Revenue

appear in income statements

cost

item

of cost

item

Revenues

Main product: shoulder meat

€24 000

€24 000

€24 000 €24 000

(400 × €60)

By-product: hock meat (30 × €4)

–

120

– 120

Total revenue

24 000

24 120

24 000 24 120

Cost of goods sold

Total manufacturing costs

25 000

25 000

25 000

25 000

Deduct by-product net revenue (30 × €4)

120

–

120 –

Net manufacturing costs

24 880

25 000

24 880 25 000

Deduct main product stock*

4 976

5 000

4 976

5 000

Deduct by-product stock (70 × €4)

280

280

Total cost of goods sold

19 624

19 720

19 904 20 000

Gross margin

€4 376

€4 400

€4 096 €4 120

Gross-margin percentage

18.23%

18.24%

17.07% 17.08%

Inventoriable costs (end of period)

Main product: shoulder meat

€4 976

€5 000

€4 976

€5 000

By-product: hock meat†

280

280

0

0

* (100 ÷ 500) × net manufacturing costs.

† Shown at selling prices.

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Deen’s Grossierderij uses method B in its accounting system. This method highlights how each

saleable product contributes to its total revenues. Over time, the revenues contributed by individ-

ual products can vary. Method B enables managers to track these changing contributions easily.

Summary

The following points are linked to the chapter's learning objectives.

1 A joint cost is the cost of a single process that yields multiple products. The split-off point is the juncture in the

process when the products become separately identifiable.

2 Joint products have relatively high sales value and are not separately identifiable as individual products until the

split-off point. A by-product has a low sales value compared with the sales value of a joint product. Individual

products can change from being a by-product or a joint product when their market prices move sizably in one

direction.

3 The purposes for allocating joint costs to products include stock costing for external financial reporting, internal

financial reporting, cost reimbursement under contracts, customer profitability analysis, insurance settlements and

rate regulation.

4 The accounting methods available for allocating joint costs include using market selling price (either sales value

at split-off or estimated net realisable value) or using a physical measure. Choosing not to allocate is also an

option.

5 The benefits-received criterion leads to a preference for revenue or market-based methods such as the sales

value at split-off point method. Additional pros of this method include not anticipating subsequent management

decisions on further processing, using a meaningful common denominator and being simple.

6 The incremental-cost analysis emphasised elsewhere in this book applies equally to joint-cost situations. No

techniques for allocating joint-product costs should guide decisions about whether a product should be sold at

the split-off point or processed beyond split-off because joint costs are irrelevant.

7 By-product accounting is an area where there is much inconsistency in practice and where some methods used are

justified on the basis of expediency rather than theoretical soundness. By-products can be recognised at production

or at the point of sale. By-product revenues can appear as a separate revenue item or an offset to other costs.

References and further reading

Bhimani, A. and Bromwich, M. (2010) *Management Accounting: Retrospect and Prospect* (Oxford: CIMA/

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CHAPTER 6

Assessment material

Review questions

6.1

What is a joint cost?

6.2

Define separable costs.

6.3

Give two examples of industries in which joint costs are found. For each example, what are the

individual products at or beyond the split-off point?

6.4

Why might the number of products in a joint-cost setting differ from the number of outputs? Give

an example.

6.5

Provide three reasons for allocating joint costs to individual products or services.

6.6

Give two limitations of the physical measure method of joint-cost allocation.

6.7

Which joint-cost-allocation method is supported by the cause-and-effect criterion for choosing

among allocation methods?

6.8

'Managers must decide whether a product should be sold at split-off or processed further. The

sales value at split-off method of joint-cost allocation is the best method for generating the infor-

mation managers need.' Do you agree? Why?

6.9

'Managers should consider only additional revenues and separable costs when making decisions

about selling now or processing further.' Do you agree? Why?

6.10 Describe an accounting method that would eliminate some key inconsistencies that often arise in

by-product reporting.

Exercises

Basic level

6.11 Matching terms with definitions (10 minutes)

Terms

a Split-off point

b Joint cost

c Separable cost

d By-product

e Joint product

f Product

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Definitions

1 Product with low sales value compared with the sales value of the main or joint product(s).

2 Any output that has a positive sales value.

3 Junction in the process when one or more products in a joint-cost setting become separately

identifiable.

4 Cost of a single process that yields multiple products simultaneously.

5 Cost incurred beyond the split-off point that are assignable to one or more individual products.

6 Product that is one of two or more products with relatively high sales value but not separately

identifiable until the split-off point.

Required

Match each term with its appropriate definition.

6.12 Estimated net realisable value method (10 minutes)

Miljø-Såpe AS produces two joint products, cooking oil and soap oil, from a single vegetable oil

refining process. In July 2022, the joint costs of this process were NOK 24 000 000. Separable pro-

cessing costs beyond the split-off point were cooking oil, NOK 30 000 000; and soap oil, NOK 7

500 000. Cooking oil sells for NOK 50 per drum. Soap oil sells for NOK 25 per drum. Miljø-Såpe

produced and sold 1 000 000 drums of cooking oil and 500 000 drums of soap oil. There are no

beginning or ending stocks of cooking oil or soap oil.

Required

Allocate the NOK 24 000 000 joint costs using the estimated NRV method.

Intermediate level

***6.13 Joint-cost allocation, insurance settlement** (20–30 minutes)

Galinha-Esquina SA grows and processes chickens. Each chicken is disassembled into five main

parts. Information pertaining to production in July 2022 is as follows:

Parts	**Kilograms of product production line**	**Wholesale selling price per kilogram at end of**
Breast	100	€1.10
Wings	20	0.40
Thighs	40	0.70
Bones	80	0.20
Feathers	10	

0.10

Joint costs of production in July 2022 were €100.

A special shipment of 20 kg of breasts and 10 kg of wings has been destroyed in a fire. Galinha-

Esquina's insurance policy provides for reimbursement for the cost of the items destroyed. The

insurance company permits Galinha-Esquina to use a joint-cost-allocation method. The split-off

point is assumed to be at the end of the production line.

Required

1 Calculate the cost of the special shipment destroyed using (a) the sales value at split-off point

method, and (b) the physical measure method using kilograms of finished product.

2 Which joint-cost-allocation method would you recommend that Galinha-Esquina use?

***6.14 Accounting for a main product and a by-product** (30 minutes)

Claude Deux-Bussy is the owner and operator of Boissons Barbe-Bleue Sarl, a bulk soft-drink

producer. A single production process yields two bulk soft drinks, Pelléas (the main product) and

Mélisande (the by-product). Both products are fully processed at the split-off point and there are

no separable costs.

Summary data for September 2022 are as follows:

● Cost of soft-drink operations = €120 000

● Production and sales data

Production

Sales

Selling price

(litres)

(litres)

per litre

Main product (Pelléas)

40 000

32 000

€20.00

By-product (Mélisande)

8 000

5 600

2.00

There were no opening stocks on 1 September 2022. The following is an overview of operations:

Required

1 What is the gross margin for Boissons Barbe-Bleue under methods A, B, C and D of by-product

accounting described in this chapter (on p. 172)?

2 What are the stock amounts reported in the balance sheet on 30 September 2022 for Pelléas and

Mélisande under each of the four methods of by-product accounting cited in requirement 1?

3 Which method would you recommend Boissons Barbe-Bleue to use? Explain.

6.15 Joint costs and by-products (W. Crum, adapted) (35–45 minutes)

Pohjanmaan Oy processes an ore in Department 1, out of which come three products, L, W and

X. Product L is processed further through Department 2. Product W is sold without further pro-

cessing. Product X is considered a by-product and is processed further through Department 3.

Costs in Department 1 are €800 000 in total; Department 2 costs are €100 000; and Department

3 costs are €50 000. Processing 600 000 kg in Department 1 results in 50 000 kg of product L, 300

000 kg of product W and 100 000 kg of product X.

Product L sells for €10 per kg. Product W sells for €2 per kg. Product X sells for €3 per kg. The

company wants to make a gross margin of 10% of sales on product X and also allow 25% for

marketing costs on product X.

Required

1 Calculate unit costs per kilogram for products L, W and X, treating X as a by-product. Use the

estimated NRV method for allocating joint costs. Deduct the estimated NRV of the by-product

produced from the joint cost of products L and W.

2 Calculate unit costs per kilogram for products L, W and X, treating all three as joint products

and allocating costs by the estimated NRV method.

6.16 Estimated net realisable value method, by-products (CMA, adapted) (30 minutes)

Flori-Dante Srl grows, processes, packages and sells three joint apple products: (a) sliced apples

that are used in frozen pies, (b) apple sauce, and (c) apple juice. The apple peel, processed as

animal feed, is treated as a by-product. Flori-Dante uses the estimated NRV method to allocate

costs of the joint process to its joint products. The by-product is inventoried at its selling price

when produced; the net realisable value of the by-product is used to reduce the joint production

costs before the split-off point. Details of Flori-Dante production process are presented here:

● The apples are washed and the peel is removed in the Cutting Department. The apples are then

cored and trimmed for slicing. The three joint products and the by-product are recognisable

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after processing in the Cutting Department. Each product is then transferred to a separate

department for final processing.

● The trimmed apples are forwarded to the Slicing Department, where they are sliced and frozen.

Any juice generated during the slicing operation is frozen with the apple slices.

● The pieces of apple trimmed from the fruit are processed into apple sauce in the Crushing

Department. The juice generated during this operation is used in the apple sauce.

● The core and any surplus apple pieces generated from the Cutting Department are pulverised

into a liquid in the Juicing Department. There is a loss equal to 8% of the weight of the good

output produced in this department.

● The peel is chopped into animal feed and packaged in the Feed Department. It can be kept in

cold storage until needed.

A total of 270 000 kg of apples were entered into the Cutting Department during November.

The following schedule shows the costs incurred in each department, the proportion by weight

transferred to the four final processing departments and the selling price of each end-product.

Processing data and costs November 2022

Proportion of

product by weight

Selling price per

transferred to

kilogram of final

Department

Costs incurred

departments

product

Cutting

€60 000

Slicing

11 280

33%

€0.80

Crushing

8 550

30

0.55

Juicing

3 000

27

0.40

Feed

700

10

0.10

Total

€83 530

100%

Required

1 Flori-Dante uses the estimated NRV method to determine stock cost of its joint products;

by-products are reported on the balance sheet at their selling price when produced. For the

month of November 2022, calculate the following:

a The output for apple slices, apple sauce, apple juice and animal feed, in kilograms.

b The estimated NRV at the split-off point for each of the three joint products.

c The amount of the cost of the Cutting Department assigned to each of the three joint

products and the amount assigned to the by-product in accordance with corporate policy.

d The gross margins in euros for each of the three joint products.

2 Comment on the significance to management of the gross-margin monetary information by

joint product for planning and control purposes, as opposed to stock-costing purposes.

6.17

Joint product/by-product distinctions, ethics (continuation of Exercise 6.16) (20–30 minutes)

Flori-Dante classifies animal feed as a by-product. The by-product is inventoried at its selling

price when produced; the net realisable value of the product is used to reduce the joint production

costs before the split-off point. Prior to 2022, Flori-Dante classified both apple juice and animal

feed as by-products. These by-products were not recognised in the accounting system until sold.

Revenues from their sale were treated as a revenue item at the time of sale.

Flori-Dante uses a ‘management by objectives’ basis to compensate its managers. Every six

months, managers are given ‘stretch’ operating-income to revenue ratio targets. They receive no

bonus if the target is not met and a fixed amount if the target is met or exceeded.

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Required

1 Assume that Flori-Dante managers aim to maximise their bonuses over time. What by-product

method (the pre-2022 method or the 2022 method) would the manager prefer?

2 How might an accountant gain insight into whether the manager of the Apple Products

division is ‘abusing’ the accounting system in an effort to maximise his bonus?

3 Describe an accounting system for Flori-Dante that would reduce ‘gaming’ behaviour by

managers with respect to accounting rules for by-products.

6.18 Processing cost issues (From ACCA Financial Information for Management, Part 1, June 2007)

(25 minutes)

A company simultaneously produces three products (X, Y and Z) from a single process. X and

Y are processed further before they can be sold; Z is a by-product that is sold immediately for $6

per unit without incurring any further costs. The sales prices of X and Y after further processing

are $50 per unit and $60 per unit respectively. Data for October are as follows:

$

Joint production costs that produced 2500 units of X, 3500

140 000

units of Y and 3000 units of Z

Further processing costs for 2500 units of X

24 000

Further processing costs for 3500 units of Y

46 000

Joint costs are apportioned using the final sales value method.

Required

Calculate the total cost of the production of X for October.

Advanced level

***6.19 Net realisable value cost-allocation method, further process decision** (20–30 minutes)

Langholmen-Sverige AB crushes and refines mineral ore into three products in a joint-cost

operation. Costs and production for 2022 were as follows:

● Department 1, at initial joint costs of SKr 420 000, produces 20 000 kg of Vadstena, 60 000 kg

of Vättervik and 100 000 kg of Birgitta.

● Department 2 processes Vadstena further at a cost of SKr 100 000.

● Department 3 processes Vättervik further at a cost of SKr 200 000.

Results for 2022 are:

● Vadstena: 20 000 kg completed; 19 000 kg sold for SKr 20 per kg; closing stock, 1000 kg.

● Vättervik: 60 000 kg completed; 59 000 kg sold for SKr 6 per kg; closing stock, 1000 kg.

● Birgitta: 100 000 kg completed; 99 000 kg sold for SKr 1 per kg; closing stock, 1000 kg; Birgitta

required no further processing.

Required

1 Use the estimated NRV method to allocate the joint costs of the three products. Calculate the

total costs and unit costs of closing stock.

2 Calculate the individual gross-margin percentages of the three products.

3 Suppose Langholmen-Sverige receives an offer to sell all of its Vätervik product for a price of

SKr 2 per kg at the split-off point before going through Department 3, just as it comes off

the production line in Department 1. Using last year's figures, would Langholmen-Sverige be

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better off by selling Vätervik that way or processing it through Department 3 and selling it?

Show computations to support your answer. Disregard all other factors not mentioned in the

problem.

6.20 Alternative joint-cost-allocation methods, further process decision (40 minutes)

Jerónimos Ltda produces two products, turpentine and methanol (wood alcohol), by a joint

process. Joint costs amount to €120 000 per batch of output. Each batch totals 40 000 litres:

25% methanol and 75% turpentine. Both products are processed further without gain or loss in

volume. Separable processing costs include: methanol, €0.75 per litre, and turpentine, €0.5 per

litre. Methanol sells for €5.25 per litre; turpentine sells for €3.5 per litre.

Required

1 What joint costs per batch should be allocated to the turpentine and methanol, assuming that

joint costs are allocated on a physical measure (number of litres at split-off point) basis?

2 If joint costs are to be assigned on an estimated NRV basis, what amounts of joint cost should

be assigned to the turpentine and to the methanol?

3 Prepare product-line income statements per batch for requirements 1 and 2. Assume no opening

or closing stocks.

4 The company has discovered an additional process by which the methanol can be made into

a pleasant tasting alcoholic beverage. The new selling price would be €15 per litre. Additional

processing would increase separable costs by €2.25 per litre (in addition to the €0.75 separable

cost required to yield methanol). The company would have to pay excise taxes of 20% on the

new selling price. Assuming no other changes in cost, what is the joint cost applicable to the

methanol (using the estimated NRV method)? Should the company use the new process?

6.21 Alternative methods of joint-cost allocation, product-mix decisions (40 minutes)

Schmidsendl GmbH buys crude vegetable oil. Refining this oil results in four products at the split-

off point: A, B, C and D. Product C is fully processed at the split-off point. Products A, B and D

can be individually further refined into Super A, Super B and Super D. In the most recent month

(December), the output at the split-off point was:

Product A

300 000 litres

Product B

100 000 litres

Product C

50 000 litres

Product D

50 000 litres

The joint costs of purchasing the crude vegetable oil and processing it were €100 000.

Schmidsendl had no beginning or ending stocks. Sales of product C in December were €50 000.

Total output of products A, B and D was further refined and then sold. Data related to December

are as follows:

Separable processing costs

to make Super products

Sales

Super A

€200 000

€300 000

Super B

80 000

100 000

Super D

90 000

120 000

Schmidsendl had the option of selling products A, B and D at the split-off point. This alternative

would have yielded the following sales for the December production:

Product A

€50 000

Product B

30 000

Product D

70 000

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Exercises

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Required

1 What is the gross-margin percentage for each product sold in December, using the following

methods for allocating the €100 000 joint costs: (a) sales value at split-off, (b) physical measure,

and (c) estimated NRV?

2 Could Schmidsendl have increased its December operating profit by making different decisions

about the further refining of products A, B or D? Show the effect on operating profit of any

changes you recommend.

6.22

Joint and by-products, estimated net realisable value method (CPA, adapted) (30 minutes)

Protomastoras SA produces three products: Alpha, Beta and Gamma. Alpha and Gamma are joint

products and Beta is a by-product of Alpha. No joint costs are to be allocated to the by-product.

The production processes for a given year are as follows:

a In Department 1, 110 000 kg of direct material Rho are processed at a total cost of €120 000.

After processing in Department 1, 60% of the units are transferred to Department 2 and 40%

of the units (now Gamma) are transferred to Department 3.

b In Department 2, the material is further processed at a total additional cost of €38 000. Seventy

per cent of the units (now Alpha) are transferred to Department 4 and 30% emerge as Beta,

the by-product, to be sold at €1.20 per kg. Separable marketing costs for Beta are €8100.

c In Department 4, Alpha is processed at a total additional cost of €23 660. After this processing,

Alpha is ready for sale at €5 per kg.

d In Department 3, Gamma is processed at a total additional cost of €165 000. In this depart-

ment, a normal loss of units of Gamma occurs, which equals 10% of the good output of

Gamma. The remaining good output of Gamma is then sold for €12 per kg.

Required

1 Prepare a schedule showing the allocation of the €120 000 joint costs between Alpha and

Gamma using the estimated NRV method. The estimated NRV of Beta should be treated as

an addition to the sales value of Alpha.

2 Independent of your answer to requirement 1, assume that €102 000 of total joint costs were

appropriately allocated to Alpha. Assume also that there were 48 000 kg of Alpha and 20 000

kg of Beta available to sell. Prepare an income statement through gross margin for Alpha using

the following facts:

a During the year, sales of Alpha were 80% of the kilograms available for sale. There was no

opening stock.

b The estimated NRV of Beta available for sale is to be deducted from the cost of producing

Alpha. The closing stock of Alpha is to be based on the net costs of production.

c All other cost and selling price data are listed in a–d.

Collaborative learning exercise

6.23 Joint-cost allocation, process further or sell by-products (CMA, adapted) (75 minutes)

Nor-Pharma AS manufactures three joint products from a joint process: Altox, Lorex and Hycol.

Data regarding these products for the fiscal year ended 31 May 2022 are as follows:

Altox

Lorex

Hycol

Units produced

170 000

500 000

330 000

Selling price per unit at split-off

€3.50

–

€2.00

Separable costs

–

€1 400 000

–

Final selling price per unit

–

€5.00

–

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Chapter 6 Cost allocation: joint-cost situations

The joint production cost up to the split-off point where Altox, Lorex and Hycol become sepa-

rable products is €1 800 000 (which includes the €17 500 disposal costs for Dorzine as described

below).

The president of Nor-Pharma, Gro Seljord, is reviewing an opportunity to change the way in

which these three products are processed and sold. Proposed changes for each product are as

follows:

● Altox is currently sold at the split-off point to a manufacturer of vitamins. Altox can also be

refined for use as a medication to treat high blood pressure; however, this additional processing

would cause a loss of 20 000 units of Altox. The separable costs to further process Altox are

estimated to be €250 000 annually. The final product would sell for €5.50 per unit.

● Lorex is currently processed further after the split-off point and sold by Nor-Pharma as a cold

remedy. The company has received an offer from another pharmaceutical company to purchase

Lorex at the split-off point for €2.25 per unit.

● Hycol is an oil produced from the joint process and is currently sold at the split-off point to a

cosmetics manufacturer. Nor-Pharma's Research Department has suggested that the company

process this product further and sell it as an ointment to relieve muscle pain. The additional

processing would cost €75 000 annually and would result in 25% more units of product. The

final product would be sold for €1.80 per unit.

The joint process currently used by Nor-Pharma also produces 50 000 units of Dorzine, a hazard-

ous chemical waste product. The company pays €0.35 per unit to dispose of the Dorzine properly.

Nor-Chem, AS, is interested in using the Dorzine as a solvent; however, Nor-Pharma would have

to refine the Dorzine at an annual cost of €43 000. Nor-Chem would purchase all the refined

Dorzine produced by Nor-Pharma and is willing to pay €0.75 for each unit.

Instructions

Form groups of two or more students to complete the following requirements.

Required

1 Allocate the €1 800 000 joint production cost to Altox, Lorex and Hycol using the estimated

NRV method.

2 Identify which of the three joint products Nor-Pharma should sell at the split-off point in the

future and which of the three main products the company should process further in order to

maximise profits. Support your decisions with appropriate calculations.

3 Assume that Nor-Pharma has decided to refine the waste product Dorzine for sale to Nor-Chem

and will treat Dorzine as a by-product of the joint process in the future.

a Evaluate whether Nor-Pharma made the correct decision regarding Dorzine. Support your

answer with appropriate calculations.

b Explain whether the decision to treat Dorzine as a by-product will affect the decisions

reached in requirement 2.

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CHAPTER 7

Income effects of alternative

stock- costing methods

Profit figures capture the attention of managers in a way few other

numbers do. Consider three examples:

Learning objectives

●

Planning decisions typically include an analysis of how the considered

After studying this chapter, you

options affect future reported profit.

should be able to:

●

Increases in reported profit are the object of many decisions related to

cost reduction.

●

Identify what distinguishes

variable costing from absorption

●

Reported profit is a key number in the performance evaluation of

costing

managers.

●

Construct income statements

The reported profit number of manufacturing companies is affected

using absorption costing and

by cost accounting choices related to stock. In this chapter we examine

variable costing

two such choices:

●

Explain differences in profit under

A Stock-costing choices – the choices here relate to which costs are to be

absorption costing and variable

recorded as stock when they are incurred. We discuss two alternatives:

costing

variable costing and absorption costing.

●

Understand how absorption

B Denominator-level choices – the choices here relate to the pre-

costing influences performance

selected level of the cost-allocation base used to set budgeted fixed

evaluation decisions

manufacturing cost rates. We discuss four alternatives: theoretical

●

Describe the various

capacity, practical capacity, normal utilisation and master-budget

denominator-level concepts that

utilisation.

can be used in absorption costing

We will see in this chapter that there are instances when the

●

Explain how the choice of

compensation and reward systems of a firm in relation to the choice of

denominator level affects reported

stock-costing methods used to prepare the financial statements, may

operating profit and stock costs

induce managers to make decisions that benefit short-term reported

earnings at the expense of a firm’s long-term financial health.

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Chapter 7 Income effects of alternative stock- costing methods

PART A: Stock-costing methods

The two most commonly encountered methods of costing stock are variable costing and absorp-

tion costing. Absorption costing is the required method under generally accepted accounting

principles for external reporting in most countries. Management accountants most frequently

use variable costing for decision making and performance evaluation purposes.

Variable costing and absorption costing

These two methods differ in only one conceptual respect: whether fixed manufacturing costs

(both direct and indirect) are ‘inventoriable’ costs. In other words, fixed manufacturing costs are

allocated to product rather than expenses on a period basis. If the former treatment is adopted,

then a proportion of fixed manufacturing costs will be carried forward to future periods in clos-

ing stocks. Recall from Chapter 2 that inventoriable costs for a manufacturing company are costs

associated with the acquisition and conversion of materials and all other manufacturing inputs

into goods for sale; these costs are first recorded as part of stock and then subsequently become

an expense when the goods are sold.

Variable costing is a method of stock costing in which all variable manufacturing costs are

included as inventoriable costs. All fixed manufacturing costs are excluded from inventoriable

costs; they are costs of the period in which they are incurred. Absorption costing is a method of

stock costing in which all variable manufacturing costs and all fixed manufacturing costs are

included as inventoriable costs. That is, stock ‘absorbs’ all manufacturing costs. Throughout

this chapter, to emphasise underlying concepts, we assume that the chosen denominator level for

computing the variable and fixed manufacturing overhead allocation rates is a production-out-

put-related variable. Examples include direct labour-hours, direct machine-hours and units of

production output.

We will use Centurion, which manufactures speciality clothing belts, to illustrate the difference

between variable costing and absorption costing. (The variable versus absorption-costing choice is

but one of several pertaining to stock costing. For example, decisions related to cost flows – FIFO

(‘first-in-first-out’), LIFO (‘last-in-last-out’), weighted average, and so on – must also be made.)

Centurion uses a normal costing system. That is, its direct costs are traced to products using actual

prices and the actual inputs used and its indirect (overhead) costs are allocated using budgeted

indirect cost rate(s) times actual inputs used. The allocation base for all indirect manufacturing

costs is units produced. The allocation base for all variable indirect marketing costs is units sold.

(Only manufacturing costs are included in inventoriable costs.)

To keep our focus on variable versus absorption-costing issues, we assume the following

for 2022:

● The budgeted number and actual number of units produced are equal (1 100 000 units).

● The budgeted number and actual number of units sold are equal (1 000 000 units).

● The budgeted and actual fixed costs are equal.

● Work in progress is minimal.

● No opening stock on 1 January 2022.

● All variable costs are driven by an output-unit-related variable. (We assume, for example, that

batch-level and product-sustaining costs are zero.)

With 2022 production of 1 100 000 units and sales of 1 000 000 units, the closing stock on

31 December 2022 is 100 000 units.

The per unit and total actual costs for 2022 are shown in Exhibit 7.1.

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Exhibit 7.1

Centurion's per unit and total costs for 2022

	Per unit	Total costs
Variable costs		
Direct materials	€3.50	€3 850 000
Direct manufacturing labour	1.60	1 760 000
Indirect manufacturing costs	0.90	

990 000

Manufacturing costs

6.00

6 600 000

Direct marketing costs

0.80

800 000

Indirect marketing costs

1.60

1 600 000

Marketing costs

2.40

2 400 000

Total variable costs

€8.40

€9 000 000

Fixed costs

Direct manufacturing costs

€0.30

€330 000

Indirect manufacturing costs

1.70

1 870 000

Manufacturing costs

2.00

2 200 000

Direct marketing costs

2.10

2 100 000

Indirect marketing costs

3.40

3 400 000

Marketing costs

5.50

5 500 000

Total fixed costs

€7.50

€7 700 000

The heart of the difference between variable and absorption costing for financial reporting is

accounting for fixed manufacturing costs:

Direct

Indirect

Same under

Variable

Direct manufacturing cost

Indirect manufacturing

both methods

Differs under

Fixed

Direct manufacturing cost

Indirect manufacturing

both methods

For stock valuation under both methods, all variable manufacturing costs (both direct and

indirect) are costs which remain unexpired until the stock is sold. That is, they are first recorded

as an asset when they are incurred. Under variable costing, fixed manufacturing costs (both direct

and indirect) are deducted as a period cost in the period in which they are incurred. Examples

of variable direct manufacturing costs are direct materials and direct manufacturing labour. An

example of a fixed direct manufacturing cost is the annual lease cost of a machine dedicated to

the assembly of a single product. The annual lease cost of a building in which multiple products

are assembled illustrates a fixed indirect manufacturing cost. Under absorption costing, fixed

manufacturing costs are initially treated as stock-based costs. They then become expenses in the

form of cost of goods sold when sales occur. The unit inventoriable costs for Centurion under the

two methods are set out in Exhibit 7.2.

Exhibit 7.3 presents the variable-costing and absorption-costing income statements for

Centurion in 2022. The variable-costing income statement differentiates between fixed and

variable costs. It entails the determination of a ‘contribution margin’ which represents sales

less variable costs. We refer to this type of income statement as the ‘contribution’ format. The

absorption-costing income statement calculates a ‘gross margin’ which represents sales less cost

of goods sold. Why these differences in format? The distinction between variable and fixed costs

is central to variable costing; the contribution format highlights this distinction. The distinc-

tion between manufacturing and non-manufacturing costs is central to absorption costing; the

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Exhibit 7.2

Centurion's unit inventoriable costs under variable and

absorption costing

Variable costing

Absorption costing

Variable manufacturing costs

Direct materials

€3.50

€3.50

Direct manufacturing labour

1.60

1.60

Indirect manufacturing costs

0.90

6.00

0.90

6.00

Fixed manufacturing costs

Direct manufacturing costs

0.30

Indirect manufacturing costs

1.70

2.00

Total inventoriable costs

€6.00

€8.00

gross-margin format highlights this distinction. Many companies using absorption costing do not

make any distinction between variable and fixed costs in their accounting system.

See how the fixed manufacturing costs of €2 200 000 are accounted for in Exhibit 7.3. The

income statement under variable costing deducts the €2 200 000 lump sum as a period cost in

2022. In contrast, the income statement under absorption costing regards each finished unit as

absorbing €2 of fixed manufacturing costs. Under absorption costing the €2 200 000 is initially

treated as a product cost in 2022. Given the preceding data for Centurion, €2 000 000 subse-

quently becomes an expense in 2022 and €200 000 remains part of closing finished goods stock,

100 000 units × €2, at 31 December 2022. The variable manufacturing costs are accounted for

in the same way in both income statements in Exhibit 7.3.

Never overlook the heart of the matter. The difference between variable costing and absorption

costing centres on accounting for fixed manufacturing costs. If stock levels change, operating

profit will differ between the two methods because of the difference in accounting for fixed

manufacturing overhead. Compare sales of 900 000, 1 000 000 and 1 100 000 units by Centurion in

2022. Fixed manufacturing costs would be included in the 2022 expense as follows:

Fixed manufacturing costs

treated as an expense in 2022

Variable costing, whether

● sales are 900 000, 1 000 000 or 1 100 000 units

€2 200 000

Absorption costing, where

● sales are 900 000 units, €400 000 (200 000 × €2)

€1 800 000

held back in stock

● sales are 1 000 000 units, €200 000 (100 000 × €2)

€2 000 000

held back in stock

● sales are 1 100 000 units, €0 held back in stock

€2 200 000

Some companies use the term direct costing to describe the stock-costing method we call variable

costing. Direct costing is an unfortunate choice of terms for two reasons.

(1) Variable costing does not include all direct costs as inventoriable costs. Only direct variable

manufacturing costs are included. Any direct fixed manufacturing costs and any direct non-

manufacturing costs (such as marketing) are excluded from inventoriable costs. (2) Variable cost-

ing includes as inventoriable costs not only direct manufacturing costs, but also some indirect

costs (variable indirect manufacturing costs).

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Comparison of variable-costing and absorption-costing income

Exhibit 7.3

statements for the year ended 31 December 2022 for Centurion

(in €000)

Panel A: Variable costing

Revenues: €17.00 × 1 000 000 units

€17 000

Variable costs

Opening stock

€0

Variable cost of goods manufactured:

6 600

€6.00 × 1 100 000

Cost of goods available for sale

6 600

Closing stock: €6.00 × 100 000

600

Variable manufacturing cost of goods sold

6 000

Variable marketing costs

2 400

Adjustment for variable-cost variances

0

Total variable costs

8 400

Contribution margin

8 600

Fixed costs

Fixed manufacturing costs

2 200

Fixed marketing costs

5 500

Adjustment for fixed-cost variances

0

Total fixed costs

7 700

Operating profit

€900

Panel B: Absorption costing

Revenues: €17.00 × 1 000 000 units

€17 000

Cost of goods sold

Opening stock

€0

Variable manufacturing costs: €6.00 × 1 100 000

6 600

Fixed manufacturing costs: €200 × 1 100 000

2 200

Cost of goods available for sale

8 800

Closing stock: €8.00 × 100 000

800

Adjustment for manufacturing variances

0

Cost of goods sold

8 000

Gross margin

9 000

Marketing costs

Variable marketing costs

2 400

Fixed marketing costs

5 500

Adjustment for marketing variances

0

Total marketing costs

7 900

Operating profit

€1 100

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Comparison of variable costing and absorption costing

Our next example explores the implications of accounting for fixed manufacturing costs in more

detail. Daxenberger manufactures and markets telescopes. It uses a standard costing system for

both its manufacturing and marketing costs. (For ease of exposition, we assume that Daxenberger

uses a standard costing system for all its operating costs, that is, it uses standards (or budgeted esti-

mates) for both variable and fixed costs in both its manufacturing and marketing.) Standard costing

systems are further discussed in Chapters 14 and 15. It began business on 1 January 2022 and it is

now March 2022. The chairman asks you to prepare comparative income statements for January

2022 and February 2022. The simplified unit data that are available are set out in Exhibit 7.4.

The standard variable manufacturing costs per unit of €20 include €11 for direct materials. For

simplicity, we assume all fixed manufacturing costs are indirect product costs.

We assume work in progress is minimal. There were no opening or closing stocks of materials.

On 1 January 2022, there was no opening stock of finished goods. In order to highlight the effect

of the ‘production-volume variance’, we assume that actual costs and actual volumes were equal

to budgeted costs and budgeted volumes during January and February of 2022; in other words,

there were no other variances (variances are discussed in Chapters 15 and 16). The standard fixed

manufacturing cost per unit is €16 (€12 800 ÷ 800). Thus the key standard cost data per unit are

Variable costs

Standard variable manufacturing

€20

costs

Standard variable marketing costs

19

Total variable costs

€39

Manufacturing costs

Standard variable manufacturing

€20

costs

Standard fixed manufacturing costs

16

Total manufacturing costs

€36

Assume that managers at Daxenberger receive a bonus based on reported monthly income.

The following points illustrate how the choice between variable and absorption costing will

affect Daxenberger’s reported monthly income and hence the bonuses their managers will

receive.

Exhibit 7.4

Unit data available for Daxenberger at March 2022

Unit data

January 2022

February 2022

Opening stock

0

200

Production

600

650

Sales

400

750

Closing stock

200

100

Other data

Selling price

€99

Standard variable manufacturing costs per unit

€20

Standard variable marketing costs per unit

€19

Standard fixed manufacturing costs per month

€12 800

Standard fixed marketing costs per month

€10 400

Budgeted denominator level of production per month

800 output units

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Comparative income statements

Exhibit 7.5 contains the comparative income statements under variable costing (Panel A) and

absorption costing (Panel B) for Daxenberger in January 2022 and February 2022. The operating

profit numbers are:

January 2022

February 2022

1 Absorption costing

€4 000

€20 200

2 Variable costing

800

21 800

3 Difference (1) – (2)

€3 200

€(1 600)

In Panel A, variable costing, all variable-cost line items are at standard cost except the last line

item, ‘Adjustment for variances’. This line item would include any variance related to variable-cost

items (which are zero in our Daxenberger example). In Panel B, absorption costing, all cost of

goods sold line items are at standard cost except the last line item, ‘Adjustment for variances’. This

line item would include all manufacturing cost variances. Only the production-volume variance

is relevant in our Daxenberger example.

Keep the following points in mind about absorption costing as you study Panel B of

Exhibit 7.5:

1 The inventoriable costs are €36 per unit, not €20, because fixed manufacturing costs (€16) as

well as variable manufacturing costs (€20) are assigned to each unit of product.

2 The €16 fixed manufacturing costs rate was based on a denominator level of 800 units per

month (€12 800 ÷ 800 = €16). Whenever production (not sales) deviates from the denomi-

nator level, a production-volume variance arises. The amount of the variance is €16 multiplied

by the difference between the actual level of production and the denominator level.

3 The production-volume variance, which relates to fixed manufacturing overhead, exists only

under absorption costing and not under variable costing. (All other variances, discussed in

Chapters 15 and 16, exist under both absorption costing and variable costing.)

4 The absorption-costing income statement classifies costs primarily by business function, such

as manufacturing and marketing. In contrast, the variable-costing income statement features

cost behaviour (variable or fixed) as the basis of classification. Absorption-costing income

statements need not differentiate between the variable and fixed costs. Exhibit 7.5 does make

this differentiation for Daxenberger in order to highlight how individual line items are classified

differently under variable- and absorption-costing formats.

Explaining differences in operating profit

If the stock level increases during an accounting period, variable costing will generally report

less operating profit than absorption costing; when the stock level decreases, variable costing will

generally report more operating profit than absorption costing. These differences in operating

profit are due solely to moving fixed manufacturing costs into stock as stock increase and out of

stock as they decrease.

The difference between operating profit under absorption costing and variable costing can be

calculated by formula 1 below, which is illustrated with Exhibit 7.5 data. This formula assumes

that the amounts used for opening and closing stock are after proration of manufacturing over-

head variances (see Chapter 3).

Exhibit 7.5

Daxenberger: Comparison of variable costing and absorption costing income statements for January 2022 and February 2022

Panel A: Variable costing

January 2022

February 2022

Revenue*

€39 600

€74 250

Variable costs

Opening stock

0

4 000

Variable cost of goods manufactured†

12 000

13 000

Cost of goods available for sale

12 000

17 000

Closing stock‡

4 000

2 000

Variable manufacturing cost of goods sold

8 000

15 000

Variable marketing costs§

7 600

14 250

Total variable costs (at standard)

15 600

29 250

Contribution margin (at standard)

24 000

45 000

Adjustment for variable-cost variances

0

0

Contribution margin

24 000

45 000

Fixed costs

Fixed manufacturing costs

12 800

12 800

Fixed marketing costs

10 400

10 400

Total fixed costs (at standard)

23 200

23 200

Adjustment for fixed-cost variances

0

0

Total fixed costs

23 200

23 200

Operating profit

€800

€21 800

* 400 × €99 = €39 600; 750 × €99 = €74 250.

† 600 × €20 = €12 000; 650 × €20 = €13 000.

‡ 200 × €20 = €4000; 100 × €20 = €2000.

§ 400 × €19 = €7600; 750 × €19 = €14 250.

Panel B: Absorption costing

January 2022

February 2022

Revenue*

€39 600

€74 250

Cost of goods sold

Opening stock

0

7 200

Variable manufacturing costs†

12 000

13 000

Fixed manufacturing costs‡

9 600

10 400

Cost of goods available for sale

21 600

30 600

Closing stock§

7 200

3 600

Total cost of goods sold (at standard)

14 400

27 000

Gross margin (at standard costs)

25 200

47 250

Adjustment for manufacturing variances

3 200 U

2 400 U

Gross margin

22 000

44 850

Marketing costs

Variable marketing costs#

7 600

14 250

Fixed marketing costs

10 400

10 400

Total marketing (at standard)

18 000

24 650

Adjustment for marketing variances||

0

0

Total marketing

18 000

24 650

Operating profit

€4 000

€20 200

* 400 × €99 = €39 600; 750 × €99 = €74 250.

† 600 × €20 = €12 000; 650 × €20 = €13 000.

‡ 600 × €16 = €9600; 650 × €16 = €10 400.

§

€

200 × (€20 + €16) = €7200; 100 × (€20 + €16) = €3600.

|| January 2022 has €3200 unfavourable (U) production-volume variance (600 − 800) × 16 = €3200

unfavourable. February 2022 has €2400 unfavourable production-volume variance

(650 − 800) × €16.00 = €2400 unfavourable.

400 × €19 = €7600; 750 × €19 = €14 250.

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Formula 1

□

□

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Absorption-costing □

□ Variable-costing

Fixed

Fixed

□

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operation

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□ manufacturing □ □ manufacturing □

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□□ □□

costs in

□□ □□

costs in

□□

□□

profit

□□

□□

profit

□□

□

□□ □

□□

□□ closing stock □□

□□ opening stock □□

January 2022:

€4000 − €800 = (200 × €16) − (0 × €16)

€3200 = €3200

February 2022: €20 200 − €21 800 = (100 × €16) − (200 × €16)

€

− 1600 = −€1600

Fixed manufacturing costs in closing stock are a current-period expense under variable costing

that absorption costing defers to future period.

Two alternative formulae can be used if we assume that all manufacturing variances are written

off as period costs, that no change occurs in work-in-progress stock and that no change occurs in

the budgeted fixed manufacturing overhead rate between accounting periods:

Formula 2

□□ Absorption-costing □ □ Variable-costing □

□ Budget fixed □

□

□

□

□

□

□

□

□□ □

□□ □ Units

□

Units

□

□□

□

operation

□ − □

operation

□ = □□

–

□□ □ manufacturing □

□

□□ □□

□□ □□ produced

sold □□ × □□

□□

□□

income

□□

□□

income

□□

□□

costs rate

□□

January 2022:

€4000 − €800 = (600 − 400) × €16

€3200 = €3200

February 2022: €20 200 − €21 800 = (650 − 750) × €16

€

− 1600 = −€1600

Formula 3

□□ Absorption-costing □ □ Variable-costing □ □ Closing Opening □ □ Budget fixed □

□

□

□

□

□

□ □

□

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□□ □

□□ □

□□ □

□□

□

operation

□ − □

operation

□ = □ stock in − stock in □ × □ manufacturing □

□

□□ □□

□□ □□

□□ □□

□□

□□

income

□□

□□

income

□□

□□ units

units □□ □□ costs rate □□

January 2022:

€4000 − €800 = (200 − 0) × €16

€3200 = €3200

February 2022: €20 200 − €21 800 = (100 − 200) × €16

€

− 1600 = −€1600

Effect of sales and production on operating profit

The period-to-period change in operating profit under variable costing is driven solely by changes

in the unit level of sales, given a constant contribution margin per unit (that is, unit sales less unit

variable costs). Consider for Daxenberger the variable-costing operating profit in February 2022

versus that in January 2022:

□□ Change in □ □ Contribution □ □Change in unit □

□

□□ □

□□ □

□□

□□ operating profit □□ − □□□

margin

□□ = □□□

sales level

□□

€21 800 − €800 = (€99 − €39) × (750 − 400)

€21 000 = €60 × 350

€21 000 = €21 000

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Daxenberger: effect on absorption-costing operating profit of different

Exhibit 7.6

production levels holding the unit sales level constant, data for

February 2022 with sales of 750 units

February 2022 production level

550

650

700

800

850

Unit data

Opening stock

200

200

200

200

200

Production

550

650

700

800

850

Goods available for sale

750

850

900

1 000

1 050

Sales

750

750

750

750

750

Closing stock

0

100

150

250

300

Income statement

Revenues

€74 250

€74 250

€74 250

€74 250

€74 250

Opening stock

7 200

7 200

7 200

7 200

7 200

Variable manufacturing costs*

11 000

13 000

14 000

16 000

17 000

Fixed manufacturing costs†

8 800

10 400

11 200

12 800

13 600

Cost of goods available for sale

27 000

30 600

32 400

36 000

37 800

Closing stock‡

0

3 600

5 400

9 000

10 800

Cost of goods sold (at standard cost)

27 000

27 000

27 000

27 000

27 000

Adjustment for manufacturing

variances§

4 000 U

2 400 U

1 600 U

0

800 F

Total cost of goods sold

31 000

29 400

28 600

27 000

26 200

Gross margin

43 250

44 850

45 650

47 250

48 050

Total marketing and

administrative costs

24 650

24 650

24 650

24 650

24 650

Operating profit

€18 600

€20 200

€21 000

€22 600

€23 400

* €20 per unit.

† Assigned at €16 per unit.

‡ €36 per unit.

§ (Production in units − 800) × €16. All written off to cost of goods sold at end of the accounting period.

Note that under variable costing, Daxenberger managers cannot increase operating profit (and

hence their bonuses) by producing for stock.

Under absorption costing, however, period-to-period change in operating profit is driven by

variations in both the unit level of sales and the unit level of production. Exhibit 7.6 illustrates this

point. The exhibit shows how absorption-costing operating profit for February 2022 changes as

the production level in February 2022 changes. This exhibit assumes that all variances (including

the production-volume variance) are written off to cost of goods sold at the end of each account-

ing period. The opening stock in February 2022 of 200 units and the February sales of 750 units

are unchanged. Exhibit 7.6 shows that production of only 550 units meets February 2022 sales

of 750. Operating profit at this production level is €18 600. By producing more than 550 units in

February 2022, Daxenberger increases absorption-costing operating profit. Each unit in February

2022 closing stock will increase February operating profit by €16. For example, if 800 units are

produced, closing stock will be 250 units and operating profit will be €22 600. This amount is

€4000 more than the operating profit with zero closing stock (250 units × €16 = €4000) on 28

February 2022. Recall that Daxenberger's managers receive a bonus based on monthly operating

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Exhibit 7.7

Comparative income effects of variable costing and absorption costing

Variable

Absorption

Question

costing

costing

Comment

Are fixed manufacturing costs

No

Yes

Basic theoretical question when these costs

inventoried?

should be expensed as period costs

Is there a production-volume

No

Yes

Choice of denominator level affects

variance?

measurement of operating profit under

absorption costing only

How are the other variances

Same

Same

Highlights that the basic difference is

treated?

the accounting for fixed manufacturing

costs, not the accounting for any variable

manufacturing costs

Are classifications between

Yes

Not always

Absorption costing can be easily modified

variable and fixed costs routinely

to obtain sub-classifications for variable

made?

and fixed costs, if desired (for example, see

Exhibit 7.3, Panel B)

How do changes in unit stock levels

Differences are attributable to the timing

affect operating profit?

of when fixed manufacturing costs become

period costs

Production = sales

Equal

Equal

Production > sales

Lower*

Higher†

Production < sales

Higher

Lower

What are the effects on

Driven by Driven by

Management control benefit: effects of

cost–volume–profit relationships?

unit sales

unit sales level and changes in production level on operating

unit production

profit are easier to understand under

level

variable costing

* That is, lower operating income than under absorption costing.

† That is, higher operating income than under variable costing.

profit. Absorption costing enables them to increase operating profit (and hence their bonuses)

by producing for stock.

Exhibit 7.7 compares the key differences between variable and absorption costing.

Capsule comparison of stock-costing methods

Variable costing or absorption costing may be combined with actual, normal or standard costing

(discussed in Chapters 15 and 16). Exhibit 7.8 presents a capsule comparison of a job-costing

record under six alternative stock-costing systems:

Variable costing

Absorption costing

1 Actual costing

4 Actual costing

2 Normal costing

5 Normal costing

3 Standard costing

6 Standard costing

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Exhibit 7.8

Capsule comparison of alternative stock-costing systems

Actual

Normal

Standard

costing

costing

costing

Variable

Actual prices ×

Actual prices ×

Standard prices ×

direct

Actual inputs

Actual inputs

Standard inputs

conversion

used

used

allowed for actual

costs*

output achieved

Variable

Actual variable

Budgeted variable

Standard variable

Variable costing

indirect

indirect rates ×

indirect rates ×

indirect rates ×

manufacturing

Actual inputs

Actual inputs

Standard inputs

costs

used

used

allowed for actual

output achieved

Fixed direct

Actual prices ×

Actual prices ×

Standard prices ×

manufacturing

Actual inputs

Actual inputs

Standard inputs

Absorption costing

costs

used

used

allowed for actual

output achieved

Fixed indirect

Actual fixed

Budgeted fixed

Standard fixed

manufacturing

indirect rates ×

indirect rates ×

indirect rates ×

costs

Actual inputs

Actual inputs

Standard inputs

used

used

allowed for actual

output achieved

* Conversion costs are all manufacturing costs minus direct materials costs.

The data in Exhibit 7.8 represent the debits to job-costing account (that is, the amounts assigned

to product) under alternative stock-costing systems.

Variable costing has been a controversial subject among accountants – not so much because

there is disagreement about the need for delineating between variable and fixed costs for man-

agement planning and control, but because there is a question about using variable costing for

external reporting. Those favouring variable costing for external reporting maintain that the fixed

portion of manufacturing costs is more closely related to the capacity to produce than to the

production of specific units. Supporters of absorption costing maintain that stock should carry

a fixed manufacturing cost component. Why? Because both variable and fixed manufacturing

costs are necessary to produce goods, both types of cost should be inventoriable, regardless of

their having different behaviour patterns.

Absorption costing (or variants close to it) is the method most commonly used for the external

regulatory purpose of accounting systems. For external reporting to shareholders, most compa-

nies around the globe tend to follow the generally accepted accounting principle that all manu-

facturing overhead is inventoriable.

Performance measures and absorption costing

Undesirable stockbuilding

Absorption costing enables managers to increase operating profit in the short run by increasing

the production schedule independent of customer demand for products. Exhibit 7.6 shows how

a Daxenberger manager could increase February 2022 operating profit from €18 600 to €22 600

by producing an additional 250 units for stock. Such an increase in the production schedule can

increase the costs of doing business without any attendant increase in sales. For example, a man-

ager whose performance is evaluated on the basis of absorption-costing income may increase

production at the end of a review period solely to increase reported income. Each additional

unit produced absorbs fixed manufacturing costs that would otherwise have been written off as

a cost of the period.

The undesirable effects of such an increase in production may be sizeable and they can arise

in several ways as the following examples show.

1 A plant manager may switch production to those orders that absorb the highest amount of

fixed manufacturing costs, irrespective of the customer demand for these products (called

'cherry picking' the production line). Some difficult-to-manufacture items may be delayed,

resulting in failure to meet promised customer delivery dates.

2 A plant manager may accept a particular order to increase production even though another

plant in the same company is better suited to handle that order.

3 To meet increased production, a manager may defer maintenance beyond the current account-

ing period. Although operating profit may increase now, future operating profit will probably

decrease because of increased repairs and less efficient equipment.

Current criticisms of absorption costing have increasingly emphasised its potentially undesirable

incentives for managers. Indeed, one critic labels absorption costing as ‘one of the black holes of

cost accounting’, in part because it may induce managers to make decisions ‘against the long-run

interests’ of the company.

Proposals for revising performance evaluation

Critics of absorption costing have made a variety of proposals for revising how managers are

evaluated. Their proposals include the following:

1 Changing the accounting system. As discussed previously in this chapter, variable costing

reduces the incentives of managers to stockbuild. An alternative approach is to incorporate

into the accounting system a charge for managers who tie up funds in stock. The higher the

amount of stock held, the higher the stock holding charge.

2 Changing the time period used to evaluate performance. Critics of absorption costing give

examples where managers take actions that maximise quarterly or annual income at the poten-

tial expense of long-run income. By evaluating performance over a three- to five-year period,

the incentive to take short-run actions that reduce long-term income is lessened.

3 Careful budgeting and stock planning to reduce management's freedom to build excess stock.

For instance, the budgeted monthly balance sheets have estimates of the value of stock. If the

actual stock values exceed these estimated amounts, top management is alerted to investigate

the stock build-ups.

4 Including non-financial as well as financial variables in the measures used to evaluate per-

formance. Companies are currently using non-financial variables, such as the following, to

monitor managers' performance in key areas:

Closing stock in units this period

a Closing stock in units last period

b

Sales in units this period

Closing stock in units this period

Any build-up of stock at the end of the year would be signalled by tracking the month-to-month

behaviour of these two non-financial stock measures (where a company manufactures or sells

several products, the two measures could be reported on a product-by-product basis).

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Concepts in action

Can ESPN avoid the cord-cutting ‘death spiral’?

For years, ESPN has dominated the sports-broadcasting airwaves in the United States and around the world. Consisting

of eight cable-television networks, a website, a magazine and various international operations, ESPN is an $11 billion

business unit within The Walt Disney Company.

In 2015, ESPN contributed about half of all revenue from Disney’s media networks business, the company’s biggest

segment, and had operating margins of 40%, good for a $4.4 billion profit.

Despite its financial success, ESPN lost more than 16 million subscribers from 2012 to 2018. With new entertain-

ment options from Netflix and Amazon Prime, many television viewers have cancelled their costly cable subscriptions

(people known as ‘cord cutters’) or never signing up for cable to begin with (‘cord nevers’). With subscriber fees for the

ESPN’s networks costing around $8 per month, cord-cutting cost ESPN nearly $1.5billion in 2018 revenue, at a time

when its fixed costs are rising. In recent years, the fees paid by ESPN to sports leagues to carry live events have risen

dramatically. For example, in 2015 ESPN signed a new deal with the NBA that will cost the network $1.4 billion per

year over nine years to show live professional basketball games, three times the amount of the previous agreement.

In 2018, ESPN signed a similar deal with the Ultimate Fighting Championship to pay $300 million per year for five

years for broadcast and streaming rights.

Some observers have wondered whether cord cutting will lead to a downward demand spiral for ESPN and other

cable networks, better known as a ‘death spiral’. Under this scenario, a further reduction in subscribers would force

ESPN to raise its subscription rates to make up for the lost revenue to cover its high fixed costs. The higher unit costs,

in turn, would encourage even more subscribers to cut the cord, further slashing revenues and making ESPN’s model

unsustainable.

As a result, ESPN managers have taken aggressive action to reduce its costs where possible. Between 2015 and

2017, ESPN laid off more than 450 on-air and behind-the-scenes employees. The company is also pursuing new

revenue opportunities, including its new ESPN+ streaming service. For $4.99 per month, subscribers get access to

thousands of Major League Baseball, National Hockey League, Major League Soccer, and Professional Golf Association

events, as well as popular international sports, including soccer, cricket and rugby. While many sports fans are still tun-

ing in, will enough of them pay for ESPN in the years ahead to ensure it avoids a 'death spiral'? That remains to be seen.

Sources: Bowman, J. (2016) 'Don't expect ESPN to cut the cord anytime soon', *The Motley Fool,* 24 January (https://www.fool.com/ investing/

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'With subscriber declines continuing, how much is ESPN worth?' Forbes, 15 March (https://www.
forbes.com/sites/greatspeculations/2018/03/15/with-

subscriber-declines-continuing-how-much-is-espn-worth/); Ramachandran, S. (2018) 'Adding to ESPN's struggles: Politics', *The Wall Street Journal,* 25 May

(https://www.wsj.com/articles/how-a-weakened-espn-became-consumed-bypolitics-1527176425); Littleton, C. (2018) 'ESPN loses 2 million subscribers in Fiscal 2018', *Variety,* 21 November (https://variety.com/2018/biz/ news/espn-disney-channel-subscriber-losses-2018-1203035003/)

PART B: Denominator-level concepts and absorption costing

Now we examine how alternative denominator-level concepts affect fixed manufacturing over-

head rates and operating profit under absorption costing. Reported cost numbers can be sizably

affected by the choice of a denominator level. This can be important in many contexts, such as

pricing and contracting based on reported cost numbers.

Alternative denominator-level concepts

We use a coconut juice bottling plant to illustrate several alternative denominator-level concepts.

Cocobot is a specialist Sri Lankan company with a new process. It produces 500 ml bottles of

coconut juice. The variable manufacturing costs of each bottle are €0.35. The fixed monthly

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manufacturing costs of the bottling plant are €50 000. Cocobot uses absorption costing for its

monthly internal reporting system and for financial reporting to shareholders. Cocobot could use

any one of at least four different denominator-level concepts for computing the fixed manufactur-

ing overhead rate – theoretical capacity, practical capacity, normal utilisation and master-budget

utilisation. Whichever the denominator-level concept, Cocobot defines its denominator in output

units (500 ml bottles of coconut juice).

Theoretical capacity and practical capacity

The term capacity means constraint, an upper limit. Theoretical capacity is the denominator-level

concept that is based on the production of output at full efficiency for all of the time. Cocobot

can produce 2400 bottles an hour when the bottling lines are operating at full speed. There is a

maximum of two 8-hour shifts per day following a trade union agreement. Thus, the theoretical

monthly capacity would be:

2400 per hour × 16 hours × 30 days = 1 152 000 bottles

Theoretical capacity is theoretical in the sense that it does not allow for any plant maintenance,

any interruptions because of bottle breakages on the filling lines, or a host of other factors. While

it is a rare plant that is able to operate at theoretical capacity, it can represent a goal or target

level of usage.

Practical capacity is the denominator-level concept that reduces theoretical capacity for una-

voidable operating interruptions such as scheduled maintenance time, shutdowns for holidays,

and so on. Assume that the practical hourly production rate is 2000 bottles an hour and that the

plant can operate 25 days a month. The practical monthly capacity is thus:

2000 per hour × 16 hours × 25 days = 800 000 bottles

Engineering, economic and human factors are important to consider when estimating theoretical

or practical capacity. Engineers at Cocobot's plant can provide input on the technical capabilities

of machines for filling bottles. In some cases, however, an increase in capacity may be technically

possible but not economically sound. For example, the trade union may actually permit a third

shift per day but only at unusually high wage rates that clearly do not make financial sense in the

coconut juice market. Human-safety factors, such as increased injury risk when the line operates

at faster speeds, are also important to consider.

Normal utilisation and master-budget utilisation

Both theoretical capacity and practical capacity measure the denominator level in terms of what a

plant can supply. In contrast, normal utilisation and master-budget utilisation (discussed further

in Chapters 14 and 15) measure the denominator level in terms of demand for the output of the

plant. In many cases, budgeted demand is well below the supply available (productive capacity).

Normal utilisation is the denominator-level concept based on the level of capacity utilisation

that satisfies average customer demand over a period (say, of two to three years) that includes

seasonal, cyclical or other trend factors. Master-budget utilisation is the denominator-level con-

cept based on the anticipated level of capacity utilisation for the next budget period. These two

denominator levels can differ – for example, when an industry has cyclical periods of high and

low demand or when management believes that the budgeted production for the coming period

is unrepresentative of ‘long-term’ demand.

Consider our Cocobot example of coconut juice production. The master budget for 2022 is

based on production of 400 000 bottles per month. Hence the master-budget denominator level

is 400 000 bottles. However, Cocobot senior management believes that over the next one to three

years the normal monthly production level will be 500 000 bottles. They consider the 2022 budg-

eted production level of 400 000 bottles to be ‘abnormally’ low. Why? A major competitor has

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been sharply reducing its coconut juice prices and has also been spending enormous amounts

on advertising. Cocobot expects that the lower prices and advertising blitz will be a short-run

phenomenon and that in 2022 the market share it has lost to this competitor will be regained.

A major reason for choosing master-budget utilisation over normal utilisation is the difficulty of

forecasting normal utilisation in many industries with long-run cyclical patterns. A similar problem

occurs when estimating ‘normal’ demand. Some marketing managers are prone to overestimating

their ability to regain lost market share. Their estimate of ‘normal’ demand for their product may

be based on an overly optimistic outlook (a case of counting chickens before they have hatched).

Effect on financial statements

Cocobot has budgeted fixed manufacturing costs equivalent to €50 000 per month. Assume that

actual costs are also €50 000. To keep this example simple, we assume all fixed manufacturing

costs are indirect. The budgeted fixed manufacturing overhead rates in May 2022 for the four

alternative denominator-level concepts discussed are:

Budgeted fixed

Budgeted

Budgeted fixed

manufacturing

denominator

manufacturing

overhead

level

overhead

Denominator-level concept

per month

(in bottles)

cost rate

(1)

(2)

(3)

(4) = (2) ÷ (3)

Theoretical capacity

€50 000

1 152 000

€0.0434

Practical capacity

50 000

800 000

0.0625

Normal utilisation

50 000

500 000

0.1000

Master-budget utilisation

50 000

400 000

0.1250

The budgeted fixed manufacturing overhead rate based on master-budget utilisation (€0.1250) is

more than 180% above the rate based on theoretical capacity (€0.0434).

Assume now that Cocobot's actual production in May 2022 is 460 000 bottles of coconut juice.

Actual sales are 420 000 bottles. Also assume no opening stock on 1 May 2022 and no variances in

manufacturing for May 2022. The manufacturing plant sells bottles of coconut juice to another

division for €0.50 per bottle. Its only costs are variable manufacturing costs of €0.35 per bottle

and €50 000 per month for fixed manufacturing overhead. Cocobot writes off all variances to

cost of goods sold on a monthly basis.

The budgeted manufacturing costs per bottle of coconut juice for each denominator-level con-

cept is the sum of €0.35 in variable manufacturing costs and the budgeted fixed manufacturing

overhead costs (shown from the preceding table).

Budgeted fixed

manufacturing

Total

Variable

overhead

manufacturing

Denominator-level concept

manufacturing costs

cost rate

costs

(1)

(2)

(3)

(4) = (2) + (3)

Theoretical capacity

€0.35

€0.0434

€0.3934

Practical capacity

0.35

0.0625

0.4125

Normal utilisation

0.35

0.1000

0.4500

Master-budget utilisation

0.35

0.1250

0.4750

Each denominator-level concept will result in a different production-volume variance.

□□ Denominator Actual □□

Budget fixed

Production−

□

□□

= □□

level in

− output □□ × manufacturing overhead

volume variance

□□

□

□

□

□ output units

units □□

rate per output unit

□

□

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Effect on financial statements

Theoretical capacity

= (1 152 000 − 460 000) × €0.0434

= €30 033 U(rounded up)

Practical capacity

= (800 000 − 460 000) × €0.0625

= €21 250 U

Normal utilisation

= (500 000 − 460 000) × €0.1000

= €4000 U

Master-budget utilisation = (400 000 − 460 000) × €0.1250

= €7500 F

Exhibit 7.9 shows how the choice of a denominator affects Cocobot's operating profit for May

2022. Using the master-budget denominator results in assigning the highest amount of fixed man-

ufacturing overhead costs per bottle to the 40 000 bottles in closing stock. Accordingly, operating

profit is highest using the master-budget utilisation denominator. Recall that Cocobot had no

opening stock on 1 May 2022, production in May of 460 000 bottles and sales in May of 420000

bottles. Hence, the closing stock on 31 May is 40 000 bottles. The differences among the operating

profit for the four denominator-level concepts in Exhibit 7.9 are due to different amounts of fixed

manufacturing overhead being inventoried:

Fixed manufacturing overhead

Denominator-level concept

in 31 May 2022 stock

Theoretical capacity

40 000 × €0.0434 = €1736

Practical capacity

40 000 × 0.0625 = 2500

Normal utilisation

40 000 × 0.1000 = 4000

Master-budget utilisation

40 000 × 0.1250 = 5000

Thus, in Exhibit 7.9 the difference in operating profit between the master-budget utilisation con-

cept and the normal utilisation concept of €1000 (€8000 − €7000) is due to the difference in fixed

manufacturing overhead inventoried (€5000 − €4000).

Exhibit 7.9

Cocobot: Income statement effects of alternative denominator-level concepts

for May 2022

Theoretical

Practical

Normal

Master-budget

capacity

capacity

utilisation

utilisation

Sales, €0.50 × 420 000

€210 000

€210 000

€210 000

€210 000

Cost of goods sold (COGS)

Opening stock

0

0

0

0

Variable manufacturing costs*

161 000

161 000

161 000

161 000

Fixed manufacturing overhead costs†

19 964

28 750

46 000

57 500

Cost of goods available for sale

180 964

189 750

207 000

218 500

Closing stock‡

15 736

16 500

18 000

19 000

Total COGS (at standard costs)

165 228

173 250

189 000

199 500

Adjustment for manufacturing variances§

30 033 U

21 250 U

4 000 U

7 500 F

Total COGS

195 261

194 500

193 000

192 000

Gross margin

14 739

15 500

17 000

18 000

Marketing costs

10 000

10 000

10 000

10 000

Operating profit

€4 739

€5 500

€7 000

€8 000

* €0.35 × 460 000 = €161 000

‡ Closing stock costs

† Fixed manufacturing overhead costs:

(0.35 + 0.0434) × (460 000 − 420 000) = €15 736

€0.0434 × 460 000 = €19 964

(0.35 + 0.0625) × (460 000 − 420 000) = €16 500

€0.0625 × 460 000 = €28 750

(0.35 + 0.1000) × (460 000 − 420 000) = €18 000

€0.1000 × 460 000 = €46 000

(0.35 + 0.1250) × (460 000 − 420 000) = €19 000

€0.1250 × 460 000 = €57 500

§ The only variance for Cocobot in May 2022 is the production-volume variance.

See text for the computations.

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Summary

The following points are linked to the chapter's learning objectives.

1 Variable costing and absorption costing differ in only one respect: how to account for fixed manufacturing over-

head costs. Under variable costing, fixed manufacturing overhead costs are excluded from inventoriable costs

and are a cost of the period in which they are incurred. Under absorption costs, these costs are inventoriable and

become expenses only when a sale occurs.

2 The variable-costing income statement is based on the contribution margin format. The absorption-costing income

statement is based on the gross-margin format.

3 Under variable costing, reported operating profit is driven by variations in unit sales levels. Under absorption

costing, reported operating profit is driven by variations in unit production levels as well as by variations in unit

sales levels.

4 Managers can increase operating profit when absorption costing is used by producing for stock even when there

is no immediate demand for the extra production. Critics of absorption costing label this as the major negative

consequence of treating fixed manufacturing overhead as an inventoriable cost. Such negative consequences can

be highlighted by using non-financial as well as financial variables for performance evaluation.

5 The denominator level chosen for fixed manufacturing overhead can greatly affect reported stock and operating

profit amounts. In some cases it can also affect pricing and contract reimbursement. Denominator levels focusing

on the capacity of a plant to supply product are theoretical capacity and practical capacity. Denominator levels

focusing on the demand for the products a plant can manufacture are normal utilisation and master-budget

utilisation.

6 The smaller the denominator level chosen, the higher the fixed manufacturing overhead cost per output unit that

is inventoriable.

Appendix

Breakeven points in variable and absorption costing

This appendix considers breakeven point calculations (discussed further in Chapter 8) under

variable and absorption costing. If variable costing is used, the breakeven point (where reported

operating profit is zero) is unique: there is only one breakeven point. It is a function of (1) fixed

costs, (2) unit contribution margin and (3) sales level in units. Holding (1) and (2) constant,

operating profit rises as the sales level in units rises and vice versa. As the level of sales in units

rises, operating profit rises and vice versa. In our Daxenberger illustration for February 2022, the

following holds:

Breakeven number of units =

Total fixed costs

Unit contribution margin

Let Q = Number of units sold to break even

Q = €12 800 + €10 400

€99 − (€20 + €19)

= €23 200

€60

= 387 units (rounded)

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Effect on financial statements

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Proof of breakeven point:

Revenues: €99 × 387

€38 313

Costs: €39 × 387

15 093

Contribution margin

23 220

Fixed costs

23 200

Operating profit (rounding error)

€20

If absorption costing is used, the breakeven point (reported operating profit of zero) is not unique.

The following formula, which can be used to calculate the breakeven point under absorption

costing, highlights several factors that will affect the breakeven point:

Fixed

□ Breakeven

□

□□

manufacturing × □□ sales in

Units

×

□□

□

□

cost rate

□

□□

units

produced □□

Breakeven number of units =

Unit contribution margin

Consider Daxenberger in February 2022:

Q = €12 800 + €10 400 + [€16(Q − 650)]

€99 − (€20 − €19)

€23 200 + €16Q − €10 400

=

€60

€60Q = €12 800 + €16Q

€44Q = €12 800

Q = 291 units (rounded)

Proof of breakeven point:

Revenues: €99 × 291

€28 809

Cost of goods sold

Cost of goods sold (standard):

€10 476

€36 × 291

Production-volume variance:

2 400 12 876

(800 − 650) × €16

Gross margin

15 933

Marketing costs

Variable marketing: €19 × 291

5 529

Fixed marketing

10 400 15 929

Operating profit (rounding

€4

error)

The breakeven point under absorption costing depends on (1) fixed costs, (2) unit contribu-

tion margin, (3) sales level in units, (4) production level in units and (5) the denominator level

chosen to set the fixed manufacturing costs rate. For Daxenberger in February 2022, a combina-

tion of fixed costs of €23 200, unit contribution margin of €60, units sold of 291 (rounded), 650

units produced and an 800-unit denominator level would result in an operating profit of zero.

Note, however, there are many combinations of these five factors that would give an operating

profit of zero.

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We see that variable costing accords with cost–volume–profit analysis. Managers using

variable costing can easily calculate the breakeven point or any effects that changes in the sales

level in units may have on operating profit. In contrast, managers using absorption costing

must also consider the unit production level and the denominator level before making such

computations.

Suppose in our illustration that actual production in February 2022 was equal to the denom-

inator level, 800 units. Also suppose that there were no sales and no fixed marketing costs. All

the production would be placed in stock and so all the fixed manufacturing overhead would be

included in stock. There would be no production-volume variance. Thus, the company could

break even with no sales whatsoever. In contrast, under variable costing the operating loss would

be equal to the fixed costs of €12 800.

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CHAPTER 7

Assessment material

Review questions

7.1

Differences in operating profit between variable and absorption costing are due solely to account-

ing for fixed costs. Do you agree? Explain.

7.2

The term variable costing could be improved by calling it variable manufacturing costing. Do you

agree? Why?

7.3

Explain the main conceptual issue under variable and absorption costing regarding the proper

timing for the release of fixed manufacturing overhead as expense.

7.4

‘Companies that make no variable-cost/fixed-cost distinctions must use absorption costing and

those that do make variable-cost/fixed-cost distinctions must use variable costing.' Do you agree?

Explain.

7.5

'The main trouble with variable costing is that it ignores the increasing importance of fixed costs

in modern manufacturing.' Do you agree? Why?

7.6

Give an example of how, under absorption costing, operating profit could fall even though the

unit sales level rises.

7.7

Critics of absorption costing have increasingly emphasised its potential for promoting undesirable

incentives for managers. Give an example.

7.8

What are two ways of reducing the negative aspects associated with using absorption costing to

evaluate the performance of a plant manager?

7.9

Which denominator-level concepts emphasise what a plant can supply? Which denominator-level

concepts emphasise what customers demand for products produced by a plant?

7.10 Name one reason why many companies prefer the master-budget utilisation-level concept rather

than the normal utilisation-level concept.

Exercises

Intermediate level

7.11 Comparison of actual-costing methods (20–30 minutes)

Haselbach GmbH sells its razors at €3 per unit. The company uses a first-in, first-out actual-

costing system. A new fixed manufacturing overhead allocation rate is calculated each year by

dividing the actual fixed manufacturing overhead cost by the actual production units. The follow-

ing simplified data are related to its first two years of operation:

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Year 1

Year 2

Unit data

Sales

1000

1200

Production

1400

1000

Cost

Variable manufacturing

€700

€500

Fixed manufacturing

700

700

Variable marketing and administration

1000

1200

Fixed marketing and administration

400

400

Required

1 Prepare income statements based on (a) variable costing and (b) absorption costing for each

year.

2 Prepare a reconciliation and explanation of the difference in the operating profit for each year

resulting from the use of absorption costing and variable costing.

3 Critics have claimed that a widely used accounting system has led to undesirable stockbuilding

levels. (a) Is variable costing or absorption costing more likely to lead to such build-ups? Why?

(b) What can be done to prevent undesirable stock build-ups?

***7.12 Effects of denominator-level concept choice** (20–35 minutes)

Forza San Marino Srl installed standard costs and a flexible budget on 1 January 2022. The

president had been pondering how fixed manufacturing overhead should be allocated to prod-

ucts. Machine-hours had been chosen as the allocation base. Her remaining uncertainty was the

denominator-level concept for machine-hours. She decided to wait for the first month's results

before making a final choice of what denominator-level concept should be used from that day

forward.

In January 2022, the actual units of output had a standard of 70 000 machine-hours allowed. If

the company used practical capacity as the denominator-level concept, the fixed manufacturing

overhead spending variance would be €10 000, unfavourable and the production-volume variance

would be €36 000, unfavourable. If the company used normal utilisation as the denominator-level

concept, the production-volume variance would be €20 000, favourable. Budgeted fixed manufac-

turing overhead was €120 000 for the month.

Required

1 Calculate the denominator level, assuming that the normal utilisation concept is chosen.

2 Calculate the denominator level, assuming that the practical capacity concept is chosen.

3 Suppose you are the executive vice-president. You want to maximise your 2022 bonus, which

depends on 2022 operating profit. Assume that the production-volume variance is charged or

credited to income at year-end. Which denominator-level concept would you favour? Why?

7.13 Income method alternatives (From ACCA Financial Information for Management, Part 1,

June 2006) (30 minutes)

Pinafore Ltd manufactures and sells a single product. The budgeted profit statement for this

month, which has been prepared using marginal costing principles, is as follows:

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	£000	**£000**
Sales (24 000 units)		864
Less Variable production cost of sales:		
Opening stock (3000 units)	69	
Production (22 000 units)	506	
Closing stock (1000 units)	(23)	
	(552)	
	312	
Less Variable selling cost	(60)	

Contribution

252

Less Fixed overhead costs:

Production

125

Selling and administration

40

(165)

Net profit

87

The normal monthly level of production is 25 000 units and stocks are valued at standard

cost.

Required

1 Prepare in full a budgeted profit statement for this month using absorption-costing principles.

Assume that fixed production overhead costs are absorbed using the normal level of activity.

2 Prepare a statement that reconciles the net profit calculated in (1) with the net profit using

marginal costing.

3 Which of the two costing principles (absorption or marginal) is more relevant for short-run

decision making, and why?

7.14 Income method alternatives (From ACCA Financial Information for Management, Part 1,

June 2005) (30 minutes)

Archibald Ltd manufactures and sells one product. Its budgeted profit statement for the first

month of trading is as follows:

£

£

Sales (1200 units at £180 per unit)

216 000

Less Cost of sales:

Production (1800 units at £100 per unit)

180 000

Less Closing stock (600 units at £100 per unit)

(60 000)

(120 000)

Gross profit

96 000

Less Fixed selling and distribution costs

(41 000)

Net profit

55 000

The budget was prepared using absorption costing principles. If budgeted production in the first

month had been 2000 units then the total production cost would have been £188 000.

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Required

1 Using the high-low method, calculate:

a the variable production cost per unit; and

b the total monthly fixed production cost.

2 If the budget for the first month of trading had been prepared using marginal costing princi-

ples, calculate:

a the total contribution; and

b the net profit.

3 Explain clearly the circumstances in which the monthly profit or loss would be the same using

absorption or marginal costing principles.

7.15 Absorption vs marginal costing (From ACCA Financial Information for Management, Part 1,

June 2004) (40 minutes)

Langdale Ltd is a small company manufacturing and selling two different products – the Lang

and the Dale. Each product passes through two separate production cost centres – a machining

department, where all the work is carried out on the same general purpose machinery, and a fin-

ishing section. There is a general service cost centre providing facilities for all employees in the

factory.

The company operates an absorption costing system using budgeted overhead absorption rates.

The management accountant has calculated the machine hour absorption rate for the machining

department as £3.10 but a direct labour hour absorption rate for the finishing section has yet to

be calculated. The following data have been extracted from the budget for the coming year:

Product

Lang

Dale

Sales (units)

6 000

9 000

Production (units)

7 200

10 400

Direct material cost per unit

£52

£44

Direct labour cost per unit:

– machining department (£8 per hour)

£72

£40

– finishing section (£6 per hour)

£42

£36

Machining department – machine-hours per unit

5

3

Fixed production overhead costs:

– machining department

£183 120

– finishing section

£241 320

– general service cost centre

£82 800

Number of employees:

– machining department

14

– finishing section

32

– general service cost centre

4

Service cost centre costs are reapportioned to production cost centres.

Required

1 Calculate the direct labour hour absorption rate for the finishing section.

2 Calculate the budgeted total cost for one unit of product Dale only, showing each main cost

element separately.

3 The company is considering a changeover to marginal costing. State, with reasons, whether

the total profit for the coming year calculated using marginal costing would be higher or lower

than the profit calculated using absorption costing. No calculations are required.

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7.16 Overhead cost issues (From CIMA Management Accounting Pillar Managerial Level 1 Paper,

November 2006) (25 minutes)

X Ltd has two production departments, Assembly and Finishing, and two service departments,

Stores and Maintenance. Stores provides the following service to the production departments:

60% to Assembly and 40% to Finishing. Maintenance provides the following service to the pro-

duction and service departments: 40% to Assembly, 45% to Finishing and 15% to Stores. The

budgeted information for the year is as follows:

Budgeted fixed production overheads

Assembly

£100 000

Finishing

£150 000

Stores

£50 000

Maintenance

£40 000

Budgeted output

100 000 units

At the end of the year after apportioning the service department overheads, the total fixed produc-

tion overheads debited to the Assembly department's fixed production overhead control account

were £180 000. The actual output achieved was 120 000 units.

Required

1 Calculate the under/over absorption of fixed production overheads for the Assembly department.

Advanced level

7.17 Variable and absorption costing, explaining operating profit differences (30 minutes)

Starzmann GmbH assembles and sells motor vehicles. It uses an actual-costing system, in which

unit costs are calculated on a monthly basis. Data relating to April and May of 2022 are:

April

May

Unit data

Opening stock

0

150

Production

500

400

Sales

350

520

Variable-cost data

Manufacturing costs per unit produced

€10 000

€10 000

Marketing costs per unit sold

3 000

3 000

Fixed-cost data

Manufacturing costs

€2 000 000

€2 000 000

Marketing costs

600 000

600 000

The selling price per motor vehicle is €24 000.

Required

1 Present income statements for Starzmann in April and May of 2022 under (a) variable costing

and (b) absorption costing.

2 Explain any differences between (a) and (b) for April and May.

7.18 Variable and absorption costing, explaining operating profit differences (40 minutes)

Svenborg AS manufactures and sells wide-screen television sets. It uses an actual-costing system, in

which unit costs are calculated on a monthly basis. Data relating to January, February and March

of 2022 are:

January

February

March

Unit data

Opening stock

0

300

300

Production

1 000

800

1 250

Sales

700

800

1 500

Variable-cost data

Manufacturing costs per unit produced

DKK 900

DKK 900

DKK 900

Marketing costs per unit sold

600

600

600

Fixed-cost data

Manufacturing costs

DKK 400 000

DKK 400 000

DKK 400 000

Marketing costs

140 000

140 000

140 000

The selling price per unit is DKr 2500.

Required

1 Present income statements for Svenborg in January, February and March of 2022 under

(a) variable costing and (b) absorption costing.

2 Explain any differences between (a) and (b) for January, February and March.

***7.19 Income statements (SMA, adapted)** (30–40 minutes)

Ericsson AB manufactures and sells a single product. The following data cover the two latest years

of operations:

2022

2023

Unit data

Sales

25 000

25 000

Opening stock

1 000

1 000

Closing stock

1 000

5 000

Selling price per unit

SEK 40

SEK 40

Cost data

Standard fixed costs

Manufacturing overhead

SEK 120 000

SEK 120 000

Marketing and administrative

SEK 190 000

SEK 190 000

Standard variable costs per unit:

Direct materials

SEK 10.50

Direct manufacturing labour

SEK 9.50

Manufacturing overhead

SEK 4.00

Marketing and administrative

SEK 1.20

The denominator level is 30 000 output units per year. Ericsson's accounting records produce

variable-costing information and year-end adjustments are made to produce external reports

showing absorption-costing information. All variances are charged to cost of goods sold.

Required

1 Prepare two income statements for 2023, one under variable costing and one under absorption

costing.

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Exercises

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2 Explain briefly why the operating profit figures calculated in requirement 1 agree or do not

agree.

3 Give two advantages and two disadvantages of using variable costing for internal reporting.

7.20 Alternative denominator-level concepts (25–30 minutes)

Bières Ronsard SA recently purchased a brewing plant from a bankrupt company. The brewery

is in Montpazier, France. It was constructed only two years ago. The plant has budgeted fixed

manufacturing overhead of €42 million (€3.5 million each month) in 2022. Alain Cassandre, the

accountant of the brewery, must decide on the denominator-level concept to use in its absorption

costing system for 2022. The options available to him are:

a Theoretical capacity: 600 barrels an hour for 24 hours a day × 365 days = 5 256 000 barrels.

b Practical capacity: 500 barrels an hour for 20 hours a day × 350 days = 3 500 000 barrels.

c Normal utilisation for 2022: 400 barrels an hour for 20 hours a day × 350 days = 2 800 000 barrels.

barrels.

d Master-budget utilisation for 2022 (separate rates calculated for each half-year):

● January to June 2022 budget: 320 barrels an hour for 20 hours a day × 175 days = 1 120 000 barrels

20 hours a day × 175 days = 1 120 000 barrels

● July to December 2022 budget: 480 barrels an hour for 20 hours a day × 175 days = 1 680 000 barrels.

20 hours a day × 175 days = 1 680 000 barrels.

Variable standard manufacturing costs per barrel are €45 (variable direct materials, €32; variable

manufacturing labour, €6; and variable manufacturing overhead, €7). The Montpazier brewery

'sells' its output to the sales division of Bières Ronsard at a budgeted price of €68 per barrel.

Required

1 Calculate the budgeted fixed manufacturing overhead rate using each of the four denomina-

tor-level concepts for (a) beer produced in March 2022 and (b) beer produced in September

2022. Explain why any differences arise.

2 Explain why the theoretical capacity and practical capacity concepts are different.

3 Which denominator-level concept would the plant manager of the Montpazier brewery prefer

when senior management of Bières Ronsard is judging plant manager performance during

2022? Explain.

7.21 Operating profit effects of alternative denominator-level concepts (continuation of

Exercise 7.20) (30 minutes)

In 2022, the Montpazier brewery of Bières Ronsard showed these results:

Unit data in barrels

Opening stock, 1 January 2022

0

Production

2 600 000

Closing stock, 31 December 2022

200 000

The Montpazier brewery had actual costs of:

Cost data

Variable manufacturing

€120 380 000

Fixed manufacturing overhead

€40 632 000

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Chapter 7 Income effects of alternative stock- costing methods

The sales division of Bières Ronsard purchased 2 400 000 barrels in 2022 at the €68 per

barrel rate.

All manufacturing variances are written off to cost of goods sold in the period in which they are

incurred.

Required

1 Calculate the operating profit of the Montpazier brewery using the following: (a) theoretical

capacity, (b) practical capacity and (c) normal utilisation denominator-level concepts. Explain

any differences among (a), (b) and (c).

2 What denominator-level concept would Bières Ronsard prefer for income tax reporting?

Explain.

3 Explain the ways in which the tax office might restrict the flexibility of a company like Bières

Ronsard, which uses absorption costing, to reduce its reported taxable income.

7.22 Ginnungagap (40 minutes)

It is the end of 2023. Ginnungagap Oy began operations in January 2022. The company is so

named because it has no variable costs. All its costs are fixed; they do not vary with output.

Ginnungagap is located on the bank of a river and has its own hydroelectric plant to supply power,

light and heat. The company manufactures a synthetic fertiliser from air and river water and sells

its product at a price that is not expected to change. It has a small staff of employees, all hired on

a fixed annual salary. The output of the plant can be increased or decreased by adjusting a few

dials on a control panel.

The following are data regarding the operations of Ginnungagap Oy:

2022

2023*

Sales (units)

10 000

10 000

Production (units)

20 000

–

Selling price per tonne

€30

€30

Costs (all fixed):

Manufacturing

€280 000

€280 000

Marketing and administrative

€40 000

€40 000

* Management adopted the policy, effective from 1 January 2023, of producing

only as much product as was needed to fill sales orders. During 2023, sales were

the same as for 2022 and were filled entirely from stock at the start of 2023.

Required

1 Prepare income statements with one column for 2022, one column for 2023 and one column

for the two years together, using (a) variable costing and (b) absorption costing.

2 What is the breakeven point under (a) variable costing and (b) absorption costing?

3 What stock costs would be carried on the balance sheets at 31 December 2022 and 2023 under

each method?

4 Assume that the performance of the top manager of the company is evaluated and rewarded

largely on the basis of reported operating profit. Which costing method would the manager

prefer? Why?

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***7.23 Audumla** (30 minutes)

Audumla Oy began operations in 2022 and differs from Ginnungagap (described in Exercise 7.22)

in only one respect: it has both variable and fixed manufacturing costs. Its variable manufacturing

costs are €7 per tonne, and its fixed manufacturing costs are €140 000 per year. The denominator

level is 20 000 tonnes per year.

Required

1 Using the same data as in Exercise 7.22 except for the change in manufacturing cost behaviour,

prepare income statements with adjacent columns for 2022, 2023 and the two years together,

under (a) variable costing and (b) absorption costing.

2 Why did Audumla have operating profit for the two-year period when Ginnungagap in Exercise

7.22 suffered an operating loss?

3 What value for stock would be shown in the balance sheet as at 31 December 2022 and

31 December 2023 under each method?

4 Assume that the performance of the top manager of the company is evaluated and rewarded

largely on the basis of reported operating profit. Which costing method would the manager

prefer? Why?

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PART I

Case study problems

Case 101

The European Savings Bank

The case considers the ethical issues involved in making illegal copies of a software program by

a professional management accountant.

It is a busy day at the office and Joe Fordham is hard at work for the European Savings Bank. Joe

is in a quandary. He has a piece of software at work that he believes makes him more efficient

and effective at his job. Unfortunately, the bank purchased only one copy. Joe really wants to have

access to the software at home and he also wants to share it with his colleagues. The problem is

that Joe does not have the necessary funds to purchase an additional copy for himself and he does

not want to ask his supervisor for additional copies until he can prove the worth of the software.

Joe knows that he can easily copy the software to use at home and to share with his colleagues.

He is debating whether he should make the copies.

The following may be affected by Joe's decision.

Tareq Hassan

Three years ago, Tareq graduated from university with a combined major in computer science

and accounting. Immediately after graduation, Tareq spent two years and €400 000 developing

a computer software package, Loan Net, that provides a comprehensive loan analysis system.

Loan Net has been proved to predict loan failures six months in advance of the failure date with

87% accuracy, far exceeding older methods that have only a 20% accuracy rate. His software is

copyrighted and is being marketed by Data Sources SA. At the current time the software sells

for €500 per copy. Sales to date have totalled just over 1000 copies, but the package has been well

received and Tarq is very excited about the future potential. In fact, he is currently working on

an upgrade for the package. A friend recently told Tareq that several banks may be using unau-

thorised copies of the program.

Anna Rodriguez

Anna graduated from university seven years ago with a concentration in marketing and a couple

of courses in management information systems. She is currently Director of Sales at Data Sources

Source: Christiansen, A. and Eining, M.M. (1994) 'Software piracy — who does it impact?', *Issues in Accounting Education,* 9(1), Spring 1994.

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Case 101

SA, a medium-sized and rapidly growing software distribution company with current sales of €30

million. All software distributed by Data Sources SA is copyrighted, but because of customer

complaints, copy protection devices were removed from all software packages this year. Anna

is concerned that, while many customers are pleased that it is now easy to make back-up copies

of Data Sources software, it will be difficult to control unauthorised copies. She has also heard

rumours about Loan Net being copied.

Joe Fordham

Joe is a young management accountant who was hired last year by European Savings Bank,

which has multiple branches throughout Europe. He previously worked for a major account-

ing firm and specialised in bank audits. He currently works in the loan department of Savings

Bank and hopes to advance to Director of Finance within the next five years. Joe has found that

competition for promotion to Director is very tight. Joe wants desperately to demonstrate that

he is Director material and, therefore, often takes work home. He has a computer at home with

a spreadsheet and a word processor, all of which he purchased himself and frequently uses for

bank business. Recently, he has been working at the office with the single copy of Loan Net his

company purchased and is very impressed with its performance. He believes that he could increase

his productivity and, therefore, his chances for promotion if he had a copy of Loan Net for home

use. Joe would also like to introduce the program to colleagues at other branches and the four

loan officers whom he supervises. Joe doesn't want to spend €500 for a copy of Loan Net to use

s

at home. He estimates that he can save the bank a minimum of €2000 by making copies of Loan

Net rather than purchasing them.

roblem

Mia Huber

tudy p

Mia is an internal auditor/accounting information system analyst at European Savings Bank.

She is responsible for determining information needs of management, for evaluating the means

of providing this information, and for computer education and training. She is in charge of both

Case s

hardware and software acquisitions. Mia wonders about her responsibility to control software

RT I

usage and account for copies of software. She knows some people would like additional copies

PA

of certain programs, but her budget for software is limited. Mia suspects that some people may

be making more than back-up copies of software programs.

Dave Saunders

At 47, Dave is the dynamic and motivated CEO of European Savings Bank. He wants to see the

bank rise from being the third most profitable in Europe to the first. He takes an interest in his

employees and expects hard work, especially from those who wish to rise in the management

ranks. He is interested in identifying those individuals who have insight into making the bank

more profitable. Three years ago, he was instrumental in upgrading both the mainframe and per-

sonal computer systems at the bank. He is concerned that there is increasing pressure from some

individuals to acquire new software and he is unsure how much the software will really be used.

Society

Society in general is affected by the actions of software developers, software vendors and pur-

chasers of the software. The basic objectives of society include an improved standard of living,

technological progress, and protection of personal freedom. All behaviours, including software

piracy, have potential costs and benefits to society. Society must adopt a stance towards software

piracy that will help achieve its goals and objectives.

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Question

Discuss the facts relevant to the issue of copying the software program, including the ethical issues

involved. Evaluate also the consequences of the different possible courses of action which may be

taken.

Case 102

The ethical dilemma at Northlake

The case assumes no technical knowledge of management and cost accounting but deals with

ethical issues that often face accounting professionals. It engages in a discussion of how far the

notion of ‘different costs for different purposes’ might extend.

Jean Letourneau

Company President

Jim McIntosh

Vice-president, Finance

Frank Carbonneau

Tina Pacquette

Manager

Manager

Corporate Reporting

Financial Analysis

Our story opens with an irate Jim McIntosh confronting his manager of corporate reporting:

‘I thought we had an understanding on this issue, Frank. Tina tells me that you are threatening

to go public with your stupid statements about the report. For Pete’s sake, Frank, come to your

senses! You’re about to damage all the important things in your life: your career, your friendships,

and your company!’

Frank sat quietly in the overstuffed sofa in his Vice President’s expansive office. He thought

that the pale green report lying on the desk looked innocent enough, but it certainly had provided

the basis for some serious turmoil: Jim stood by his desk trembling with rage. His face was bright

red and mottled with anger. Frank had often seen Jim upset, but never in a temper such as this.

‘I’m sorry, Jim’, Frank replied softly, ‘I know how much this means to you, but I don’t think

that I have a choice in this matter. I can’t sit idle while you and that twit from financial analysis

allow this report to go forward. You both know that these numbers have no foundation in fact?’

The report, entitled ‘Endangered Species: The Pulp and Paper Industry in the Upper Peninsula’,

laid out the industry’s response to the new government proposals to put effluent controls on the

discharge of waste water from pulp and paper mills in environmentally sensitive regions of the

province. One section of the report detailed the financial consequences of the emission controls as

Source: Grant, R. (1993) 'The ethical dilemma at Northlake', *CMA Magazine,* March. Reproduced with permission from the Centre for Accounting Ethics.

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determined by each of the five pulp and paper companies operating in the region. Amalgamated

Forest Products had taken the industry lead in developing the report, and the company president,

Janine Letourneau, was scheduled to testify before a legislative sub-committee next week, giving

the industry perspective on the proposed legislation.

Amalgamated had three major mills, located in some of the more remote locations in the prov-

ince. The firm had been facing difficult financial times due to the recession, and this had caused

substantial hardship in the three small communities where the mills were located. Corporate

offices were located in Northlake, a town of approximately 10 000 people.

The section of the report dealing with the dollar impact to Amalgamated Forest Products of

installing the emission control equipment had been prepared by Tina Pacquette. Tina, a long-

term employee of the firm, had risen through the accounting department to become the manager

of financial analysis. While Tina and Frank were at equal levels in the organisational structure,

their working relationship had not been particularly cordial. In Frank's opinion, Tina's work was

barely adequate, but then, no one asked for his opinion.

'Well, Frank, your pig-headedness has really caused a problem for all of us! Wait here! I'll

get Janine Letourneau, and we'll see what she thinks about your efforts.' Jim left the office and

slammed the door.

As he waited in the silence of his boss's beautifully decorated office, Frank looked back over his

ten years with Amalgamated Forest Products. Just like his father before him, Frank started with

the firm after completing high school and his first job was as a yard man sorting out damaged

logs before processing. That's when Frank severely damaged his right leg on the job. He had been

s

celebrating the birth of his son the night before and he was unable to manoeuvre his footing with

the dexterity required. Surgery saved the leg and he was extremely grateful that the company had

brought him inside to the accounting office. An accounting clerk's salary was low compared with

roblem

being a yard helper, but in a short time his natural talent for analysis brought him to the attention

of the Vice President, Finance. Within two years, Jim McIntosh had arranged for him to go to

tudy p

university, complete his CMA designation after graduation, and then return to Amalgamated. The

financial support provided by the firm had been adequate but not lavish by any means, and Frank

had done well in his studies. He was the gold medalist for his province on the CMA examinations,

Case s

and he had returned to Northlake in triumph. With three young children and a proud wife, Frank

RT I

had been appointed to a new position in corporate reporting. After a year of having Jim as his

PA

mentor, he rose to the position of manager of corporate reporting.

The office door opened abruptly, and Jim entered with the company president. Janine

Letourneau was a distinguished woman of approximately 60 years of age. She had a long history

with Amalgamated and a solid reputation in the pulp and paper industry.

‘What’s the problem, Frank?’ Janine’s voice broke into the silence. ‘Jim tells me that you have

a few concerns about the report that we’re submitting to the legislative committee.’

‘Well, Mrs Letourneau, I think we – the company – have some major problems here. The

report indicates that we’ll have severe financial problems if we’re forced into building a lagoon

for waste water treatment. In fact, the report says we are likely to be pushed into bankruptcy if

the legislation is passed. But we all know these estimates of costs are highly inflated. There’s no

way that our operating costs would be raised by 30%. I could see our operating costs rising by

only 8–10%. That’s what the internal report Tina wrote a year ago predicts and there’s really

been no significant change. Moreover, you have to testify before the legislative committee as to

the truthfulness of this report – and there’s not a shred of truth in it. The other cost estimates

are all high, and the prediction of our product demand is based upon a further deepening of the

recession. For our internal purposes, we have been using an estimated increase of 10% in demand.'

'Slow down,' Letourneau's calm voice broke in. 'We have to use different figures for different

purposes. When we report to our shareholders, we give them numbers that are substantially

altered from the internal documents, right? In this case, we have to make those dunderheads in

the government see what all this regulation is doing to us. Besides, they know we're going to use

the most effective numbers to justify our position.'

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'But this isn't simply a matter of different figures', Frank spluttered. 'These numbers have

been totally fabricated. And they don't take into account the damage that we're doing to the

Wanawashee River. The same stuff we're dumping was cleaned up by our competition years ago.

The community downstream is still drinking this garbage. We're going to be subject to a huge

lawsuit if they ever trace it to us. Then, where will we be? I've got to worry about my professional

obligations as well. If this blows up, you could go to jail, and I could get my designation revoked.'

'We'll cross that bridge when we come to it', Jim McIntosh interjected. 'You've got to remem-

ber what's at stake here. Northlake's totally dependent on the mill for its economic survival. As

the mill goes, so goes the town. It's your buddies you'd be threatening to put out of work, Frank.

This legislation may not bankrupt us, but it will certainly put a squeeze on profits. If profits are

gone, no more reinvestment by Chicago. Head office is putting lots of pressure on us to improve

the bottom line since the takeover last year. They're talking about cutting all of that new produc-

tion line equipment we requested.'

'The bottom line is this, Frank', Letourneau spoke softly. 'You're an important part of our team –

we've invested a lot in you. Jim was talking about working you into a new role: V.P.-c ontroller.

We'd hate to let you go because of this small issue. However, we need to have everybody working

towards the same goal. Besides, Jim tells me this isn't even your responsibility. If you hadn't picked

up the copy of the report on Tina's desk, we wouldn't even have involved you. Now take the rest

of the day off, go home to Cheryl and the kids, and take out that new speedboat of yours. Think

the problem through, and I'm sure you'll see the long-term benefit of what we're doing. This pol-

lution problem is a "Northern problem" that we can resolve here, not in some fancy legislature

in the south. Besides, we've had the problem for as far back as I can remember. So a few extra

years certainly won't hurt.'

Question

What would you do if you were Frank?

Case 103

Electronic Boards plc

John Innes and Falconer Mitchell, University of Edinburgh

This is a general case on the design of a management and cost accounting system for a firm

operating in a high-tech environment. It provides an opportunity for a broad discussion not only

of the appropriateness of particular accounting techniques, but also of the need to consider

strategic, behavioural and organisational factors.

Introduction

Jack Watson, an electrical engineer, established Electronic Boards plc as a one person company

thirty years ago. From small beginnings, the company earned a reputation for the quality and

reliability of its products, and grew rapidly and consistently. Last year it achieved a turnover of

Source: Innes, J. and Mitchell, F. (1988) 'Electronic Boards plc', in D. Otley, D. Brown and C. Wilkinson (eds) *Case Studies in Management Accounting* (Hemel Hempstead, UK: Philip Allan Publishers). Reproduced with permission.

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£56 million and a profit after tax of £4.1 million. In addition to Jack Watson, the CEO, the board

consists of a production director, a research director and a marketing director. The company

employs 200 people.

Market circumstances

The company produces customised batches of electronic circuit boards for approximately 15

major customers in the defence, computer, electrical goods and automotive industries. The mar-

ket is highly competitive in respect of both price and quality. Market price has fallen steadily in

recent years. In addition to several other independent firms from both the UK and the Far East,

many of their larger customers have in-house facilities for the production of circuit boards. These

latter firms deliberately subcontract a portion of their circuit board requirements for strategic

reasons. In a recession they can cease or reduce their subcontracting and bring the work in-house,

so stabilising their own employment levels.

Operational circumstances

The production process for circuit boards is complex, multi-stage and highly automated. Produc-

tion flows continuously through the various processes and any hold-up quickly affects the flow

of work at all production stages. Experience has shown that a proportion of the final output

contains faults and has to be scrapped. These scrap levels typically vary between 10% and 25%

s

of good output, a considerable learning effect is apparent and the yield on repeat orders is usually

significantly improved. At present, faulty products are identified only on completion, although

action has been instigated (in the form of an investigative working party) to achieve an earlier

roblem

identification of faults.

Orders are obtained in three ways:

tudy p

1 By written tender for large contracts (approximately 40% of business)

2 By telephone quotation for small orders (approximately 20% of business) – a price is normally

Case s

quoted to the caller during the call

RT I

3 By repeat orders (approximately 40% of business).

PA

Prices are calculated by estimating the direct material cost of an order and adding on an allow-

ance for all other costs and profit. This allowance is based on the previous year's direct material

cost to sales margin. In recent years the cost structure of the firm's output has been as follows:

Cost structure of current boards

Direct materials

65%

Direct labour

5

Production overheads

20

Non-production overheads

10

100%

Direct materials are by far the major cost component and this importance is reflected in the

high levels of materials stock which are held by the company.

Financial information

It is generally accepted by the senior members of management that the development of a man-

agement accounting system has been neglected. This has been attributed mainly to the dismissive

attitude of line management to accountants. Encapsulating this view was the comment of one

senior manager, ‘they are “bean-counters” who know nothing about the electronics industry, the

problems we face and the decisions we have to take’. The consistent success of the company in

the absence of any management accounting system has reinforced this type of attitude among

managers and directors in the company. No qualified accountants have been appointed to the

board, and until last year only one qualified accountant was employed by the company. His prime

responsibility was the preparation of statutory financial accounting statements for shareholders.

A half-yearly company profit and loss account and balance sheet is now prepared for the board.

No product costing system has been in operation. For financial statement preparation, work

in progress is simply valued at an estimate of its direct material content cost and finished goods

stock is valued at a discounted selling price (using the previous year's gross profit percentage).

However, some managers have complained about their lack of knowledge of unit production

costs and about their inability to pinpoint which contracts or types of work have been profitable

for the company.

Budgets are no longer prepared. Attempts were made to produce annual budgets a decade

before but the firm's accountant then experienced great difficulty in obtaining reliable estimates

from line management. His lack of authority within the firm and the absence of a finance director

to provide support rendered his requests for information ineffective. Consequently, acceptance of

the budgets which he prepared was not forthcoming. They were quickly viewed as unrealistic by

management and after a few months ignored.

Capital budgeting decisions have been based upon the need for the firm to remain at the fore-

front of production technology. If new equipment became available which would improve the

firm's product quality, it was usually purchased and then funds were 'found' to finance it. This

had often led to the company having unexpected overdrafts and high bank charges and interest

expenses.

Recession

This year, the firm experienced its first recession. Market share fell, sales dropped to £51.5 million,

a loss of £1.7 million was made and the company's liquidity suffered considerably. The market

decline is expected to continue into next year and the CEO of Electronic Boards plc has sought

ways of alleviating the effects of the recession on the company's financial performance. He found,

however, that the lack of management accounting information hampered him in pinpointing

problem areas and in identifying cost-reduction possibilities. Consequently, he approached a firm

of management consultants to provide a blueprint for the development of a management account-

ing system over the next two years.

Question

As the management consultant, prepare a blueprint for the board of Electronic Boards plc outlining

the main factors which it should consider in establishing a useful management accounting function

within the company.

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PART II

Accounting information for

decision making

Part I introduced fundamental management and cost accounting concepts. Our

objective in Part II is to focus on internal accounting concepts which are aimed at

assisting managerial decision making. Chapters 8, 9 and 10 discuss long-established

principles of cost relationships as organisational activities take place. They mainly

address aspects of decision making in the short term and how a firm's available

resources can be influenced and reallocated to achieve immediate goals. The

focus in these chapters is largely on scale changes, whereas Chapter 11 considers

scope and production complexity issues in relation to cost changes. The costing

approach (activity-based costing) discussed in Chapter 11 looks at both volume-

and non-volume-based cost drivers. Chapter 12 introduces pricing considerations

and cost-related prioritisation of organisational activities. Chapter 13 then provides

a perspective on assessing long-term issues in cost change decisions. It considers

techniques used to evaluate capital budgeting for investments.

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CHAPTER 8

Cost–volume–profit analysis

Cost–volume–profit analysis provides a sweeping financial overview of the planning process. **Cost–volume–profit (CVP) analysis** examines the

Learning objectives

behaviour of total revenues, total costs and operating profit as changes occur in the output level, selling price, variable costs or fixed costs. CVP

After studying this chapter, you

analysis is among the most basic tools available to managers. Managers should be able to:

commonly use CVP as a tool to help them answer such questions as:

●

Distinguish between what drives

How will revenues and costs be affected if we sell 1000 more units? If we

revenues and costs

raise or lower our selling prices, how will that affect the output level? If we expand into Far East markets, what will be the impact on costs? These

●

Describe the assumptions

questions have a ‘what-if’ theme.

underlying cost–volume–profit

Companies need to achieve breakeven before they can produce profits

(CVP) analysis

(this is inherent in the definition of breaking even). Consider, for instance,

●

Understand methods for deter-

Thyssenkrupp, an international group of companies comprising mainly inde-

mining the breakeven point and

pendent industrial and technology businesses and employing more than

target operating profit

100 000 people across 56 countries, which suffered losses during early quar-

●

Explain how sensitivity analysis

ters of 2020. This prompted some downsizing. The company decided to sell

can help managers cope with

its prized lifts unit for €17 bil ion in 2020 after the unit was seen to have been

uncertainty

mismanaged and its il -fated expansion led to losses. Thyssenkrupp also sold

●

Illustrate how CVP can assist cost

its carbon components and infrastructure businesses in 2021, as well as an

planning

Italian stainless-steel plant. The chief financial officer Klaus Keysberg says,

‘Our next major milestone is to reach break-even in cash flow,’ with the turn-

●

Describe the effect of revenue mix

round at Thyssenkrupp remaining ‘in full swing’ (Mil er, 2022).

on operating profit

Executives like Keysberg and Mirza will often consider profitability sce-

narios in relation to breakeven cost points. In fact, for most firms, decisions

at some stage entail an assessment of cost–volume–profit implications.

CVP is built on simplifying assumptions about revenue and cost behaviour

patterns. This chapter examines CVP analysis and explains how the reason-

ableness underlying its assumptions affects the reliability of its results.

Revenue drivers and cost drivers

Revenues are inflows of assets received in exchange for products or services provided to customers.

A revenue driver is a factor that affects revenues. Examples of revenue drivers are units of output

sold, selling prices and levels of marketing costs. Chapter 2 defined cost as a resource sacrificed

or forgone to achieve a specific objective and a *cost driver* as any factor that affects cost – that is,

a change in the cost driver will cause a change in the total cost of a related cost object. Examples

of cost drivers include units of output manufactured, number of sales visits made and number

of packages shipped.

The most detailed way of predicting total revenues and total costs is to consider multiple

revenue drivers and multiple cost drivers. We call this the general case. It can require extensive

analysis and is likely to be very time-consuming. For now, we focus on a special case where we

assume a single revenue driver and a single cost driver. That single driver is units of output

(either output units sold or output units manufactured). The term *CVP analysis* is widely used

as representing this special case. A single revenue driver and a single cost driver are used in this

analysis.

The straightforward relationships provide an excellent base for understanding the more com-

plex relationships that exist with multiple revenues and multiple cost drivers:

General case

Special case

Many revenue drivers

Single revenue driver (output units)

Many cost drivers

Single cost driver (output units)

Various time spans for decisions (short run,

Short-run decisions (time span, typically less

long run, product life cycles)

than one year, in which fixed costs do not

change within the relevant range)

Our restriction to units of output as the sole revenue or cost driver is important to keep in

mind. It means that in the CVP model, changes in the level of revenues and costs arise only

because the output level changes. This restriction means that we will not consider a revenue driver

such as the number of advertisements for a new product. Nor will we consider a cost driver such

as the number of calls a customer makes for after-sales service or service repairs. These factors

are examples of revenue or cost drivers that are not a function of units of output.

Before we can study CVP, we must understand its terminology. In this chapter, we assume total

costs (also termed total expenses) are made up of only two categories: variable costs (variable

with respect to units of output) and fixed costs.

Total costs = Variable costs + Fixed costs

Recall from Chapter 2 (Exhibit 2.6) that variable costs include both direct variable costs and

indirect variable costs of a chosen cost object. Similarly, fixed costs include both direct fixed costs

and indirect fixed costs of a chosen cost object.

Operating profit **is** total revenues from operations minus total costs from operations (excluding

income taxes):

Operating profit = Total revenues − Total costs

Net profit is operating profit plus non-operating revenues (such as interest revenue) minus non-

operating costs (such as interest cost) minus income taxes. For simplicity, throughout this chapter

non-operating revenues and non-operating costs are assumed to be zero. Thus, net profit will be

calculated as follows:

Net profit = Operating profit − Income taxes

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In the examples that follow, the measure of output is the number of units manufactured or

units sold. Different industries often use different terminology to describe their measure of out-

put. Examples include:

Industry	**Measure of output**
Airlines	Passenger-kilometres

Cars

Vehicles manufactured

Hospitals

Patient-days

Hotels

Rooms occupied

The following abbreviations are used in this chapter:

USP

= Unit selling price

UVC = Unit variable costs

UCM = Unit contribution margin (USP – UVC)

FC

= Fixed costs

Q

= Quantity of output units sold (or manufactured)

OP

= Operating profit

TOP = Target operating profit

CVP assumptions

The CVP analysis that we now discuss is based on the following assumptions:

1 Total costs can be divided into a fixed component and a component that is variable with respect

to the level of output.

2 The behaviour of total revenues and total costs is linear (straight line) in relation to output

units within the relevant range.

3 The unit selling price, unit variable costs and fixed costs are known and are constant. (This

assumption is discussed later in the chapter and in the appendix to this chapter.)

4 The analysis either covers a single product or assumes that the proportion of different products

when multiple products are sold will remain constant as the level of total units sold changes.

(This assumption is also discussed later in the chapter.)

5 All revenues and costs can be added and compared without taking into account the time value

of money. (Chapter 13 relaxes this assumption.)

6 Changes in the level of revenues and costs arise only because of changes in the number of

products (or service) units produced and sold. The number of output units is the only revenue

and cost driver.

These CVP assumptions simplify organisational realities. Some managers may prefer a more

sophisticated approach. Nevertheless, CVP provides a useful basis for exploring certain business

decision situations in which cost–volume–profit relationships are highlighted.

The breakeven point

CVP analysis can be used to examine how various ‘what-if’ alternatives being considered by a

decision maker affect operating profit. The breakeven point is frequently one point of interest in

this analysis. Managers wish to avoid the stigma of making a loss. The breakeven point is that

quantity of output where total revenues and total costs are equal, that is, where the operating

profit is zero.

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Example 8.1

Mary Frost plans to sell Do-All Software, a software package, at a heavily attended two-day computer con-

vention. Mary can purchase this software from a computer software wholesaler at €120 per package with

the privilege of returning all unsold units and receiving a full €120 rebate per package. The units (packages)

will be sold at €200 each. Mary has already paid €2000 to Computer Conventions Ltd for the booth rental

for the two-day convention. What quantity of units will she need to sell in order to break even? Assume

there are no other costs.

Using the information in the following example, this section examines three methods for

determining the breakeven point: the equation method, the contribution margin method and the

graph method.

Equation method

The first approach for computing the breakeven point is the equation method. Using the termi-

nology in this chapter, the income statement can be expressed in equation form as follows:

Revenues − Variable costs − Fixed costs = Operating profit

(USP × Q) − (UVC × Q) − FC = OP

This equation provides the most general and easy-to-remember approach to any CVP situation.

Setting operating profit equal to zero in the preceding equation, we obtain

€200Q − €120Q − €2000 = €0

€80Q = €2000

Q = €2000 ÷ €80

= 25 units

If Mary sells fewer than 25 units, she will have a loss; if she sells 25 units, she will break even; and

if she sells more than 25 units, she will make a profit. This breakeven point is expressed in units.

It can also be expressed in sales euros: 25 units × €200 selling price = €5000.

Contribution margin method

A second approach is the contribution margin method, which is simply an algebraic manipulation

of the equation method. Contribution margin is equal to revenues minus all costs of the output

(a product or service) that vary with respect to the units of output. This method uses the fact that:

(UPS × Q) − (UVC × Q) − FC = OP

(USP − UVC) × Q = FC + OP

UCM × Q = FC + OP

Q = FC + OP

UCM

At the breakeven point, operating profit is, by definition, zero. Setting OP = 0, we obtain:

Breakeven

=

Fixed costs

= FC

number of units

Unit contribution margin

UCM

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The calculations in the equation method and the contribution margin method appear similar

because one is merely a restatement of the other. In our example, fixed costs are €2000 and the

unit contribution margin is €80 (€200 − €120). Therefore,

Breakeven number of units = €2000 ÷ €80 = 25 units

A contribution income statement groups line items by cost behaviour pattern to highlight the con-

tribution margin. The following such statement confirms the preceding breakeven calculations:

Revenues, €200 × 25

€5000

Variable costs, €120 × 25

3000

Contribution margin, €80 × 25

2000

Fixed costs

2000

Operating profit

€0

Graph method

In the graph method, we plot the total costs line and the total revenues line. Their point of inter-

section is the breakeven point. Exhibit 8.1 illustrates this method for our Do-All example. We

need only two points to plot each line if each is assumed to be linear:

1 *Total costs line.* This line is the sum of the fixed costs and the variable costs. Fixed costs are

€2000 at all output levels within the relevant range. To plot fixed costs, measure €2000 on the

vertical axis (point A) and extend a line horizontally. Variable costs are €120 per unit. To plot

Exhibit 8.1

Cost–volume–profit graph

10 000

Total

revenues

Operating

line†

profit

D

8000

B

6000

Variable

Euros

costs

Total

Breakeven

4000

costs

point

line*

= 25 units

2000 A

Fixed

costs

C

10

20

30

40

50

Units sold

Operating

Operating

loss area

profit area

* Slope of the total cost line is the variable cost per unit = €120.

† Slope of the total revenue line is the selling price = €200.

the total costs line, use as one point the €2000 fixed costs at 0 output units (point A). Select a

second point by choosing any other convenient output level (say, 40 units) and determining the

corresponding total costs. The total variable costs at this output level are €4800 (40 × €120).

Fixed costs are €2000 at all output levels within the relevant range. Hence, total costs at 40

units of output are €6800, which is point B in Exhibit 8.1. The total costs line is the straight

line from point A passing through point B.

2 *Total revenues line.* One convenient starting point is zero revenues at the zero output level, which

is point C in Exhibit 8.1. Select a second point by choosing any other convenient output level

and determining its total revenues. At 40 units of output, total revenues are €8000 (40 × €200),

which is point D in Exhibit 8.1. The total revenues line is the straight line from point C passing

through point D.

The breakeven point is where the total revenues line and the total costs line intersect. At this

point, total revenues equal total costs. But Exhibit 8.1 shows the profit or loss outlook for a wide

range of output levels. Many people describe the topics covered in this chapter as breakeven

analysis. We prefer to use the phrase cost–volume–profit analysis to avoid overemphasising the

single point where total revenues equal total costs. Managers want to know how operating profit

differs at many different output levels.

Target operating profit

Let us introduce a profit element by asking the following question: How many units must be

sold to earn an operating profit of €1200? The equation method provides a straightforward way

to answer this question. Let QT be the number of units sold to earn the target operating profit:

Revenues − Variable costs − Fixed costs = Target operating profit

€200QT − €120QT − €2000 = €1200

€80QT = €2000 + €1200

€80QT = €3200

QT = €3200 ÷ €80

= 40 units

Alternatively, we could use the contribution margin method. The numerator now consists of

fixed costs plus target operating profit:

Fixed costs + Target operating profit

QT

FC

TOP

=

=

+

Unit contribution margin

UCM

QT

€2000

1200

=

+

€80

€80QT = €3200

QT = €3200 ÷ €80

= 40 units

Proof: Revenues, €200 × 40

€8000

Variable costs, €120 × 40

4800

Contribution margin, €80 × 40

3200

Fixed costs

2000

Operating profit

€1200

The graph in Exhibit 8.1 indicates that at the 40-unit output level, the difference between total

revenues and total costs is the €1200 operating profit.

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The PV graph

We can recast Exhibit 8.1 in the form of a profit–volume (PV) graph. A PV graph shows the impact

on operating profit of changes in the output level. Exhibit 8.2 (Graph A) presents the PV graph

for Do-All (fixed costs of €2000, selling price of €200, and variable costs per unit of €120). The

PV line can be drawn using two points. One convenient point (X) is the level of fixed costs at zero

output – €2000, which is also the operating loss at this output level. A second convenient point

(Y) is the breakeven point – 25 units in our example. The PV line is drawn by connecting points

X and Y and extending the line beyond Y. Each unit sold beyond the breakeven point will add

€80 to operating profit. At the 35-unit output level, for example, operating profit would be €800:

(€200 × 35) − (€120 × 35) − €2000 = €800

A comparison of PV charts representing different what-if possibilities can highlight their

effects on operating profit. Graph B in Exhibit 8.2 shows the PV chart for Do-All assuming fixed

costs of €3300 (compared with €2000 in Graph A) and variable costs per unit of €90 (compared

with €120 in Graph A). The selling price is €200 in both graphs. The unit contribution margin in

Graph B is €110. The breakeven point in Graph B is 30 units:

€200Q − €90Q − €3300 = 0

Q = €3300 ÷ €110

= 30 units

Each unit sold beyond the breakeven point will add €110 to operating profit. The PV graph in

Graph B has a steeper slope for its operating profit line, which means that the operating profit

increases at a faster rate as the level of output increases.

Exhibit 8.2

Profit–volume graph

Graph A

Graph B

2000

Breakeven

2000

Breakeven

point = 25 units

point = 30 units

1000

1000

0

0

Y

Y

−1000

−1000

−2000

Operating profit (€)

X

−2000

Operating profit (€)

−3000

−3000 X

10

20

30

40

50

10

20

30

40

50

Units sold

Units sold

Operating

Operating

loss area

profit area

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Impact of income taxes

When we introduced a target operating profit in our earlier Do-All Software example, the follow-

ing income statement was shown:

Revenues, €200 × 40

€8000

Variable costs, €120 × 40

4800

Contribution margin

3200

Fixed costs

2000

Operating profit

€1200

The net profit of Do-All is operating profit minus income taxes. What number of units of

Do-All must be sold to earn a net profit of €1200, assuming operating profit is taxed at a rate of

40%? The only change in the equation method of CVP analysis is to modify the target operating

profit to allow for income taxes. Recall our previous equation method:

Revenues − Variable costs − Fixed costs = Operating profit

We now introduce income tax effects:

Target net profit = (Operating profit) − [(Operating profit) × (Tax rate)]

Target net profit = (Operating profit) × (1 − Tax rate)

Target net profit

Target net profit =

1 − Tax rate

So, taking income taxes into account, the equation method yields:

Target net profit

Revenues − Variable costs − Fixed costs =

1 − Tax rate

Substituting numbers from our Do-All example, the equation would now be:

Target net profit

€200Q − €120Q − €2000 =

1 − Tax rate

€200Q − €120Q − €2000

€1200

= 1 − 0.40

€200Q − €120Q − €2000 = €2000

€80Q = €4000

Q = €4000 ÷ €80

= 50 units

Proof: Revenues, €200 × 50

€10 000

Variable costs, €120 × 50

6 000

Contribution margin

4 000

Fixed costs

2 000

Operating profit

2 000

Income taxes, €2000 × 0.40

800

Net profit

€1 200

Suppose the target net profit were set at €1680 instead of €1200. The required number of unit

sales would rise from 50 to 60 units:

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Target net profit

Operating profit =

1 − Tax rate

€200Q − €120Q − €2000

€1680

= 1 − 0.40

€80Q − €2000 = €2800

€80Q = €4800

Q = €4800 ÷ €80

= 60 units

The presence of income taxes will not change the breakeven point. Why? Because, by defi-

nition, operating profit at the breakeven point is zero, and thus no income taxes will be paid.

However, other types of tax may affect the breakeven point. For example, a sales tax paid by the

seller that is a fixed percentage of revenues can be treated as a variable cost and hence will increase

the breakeven point.

Sensitivity analysis and uncertainty

Sensitivity analysis is a what-if technique that examines how a result will change if the original

predicted data are not achieved or if an underlying assumption changes. In the context of CVP,

sensitivity analysis answers such questions as: What will operating profit be if the output level

decreases by 5% from the original prediction? What will operating profit be if variable costs per

unit increase by 10%? The sensitivity to various possible outcomes broadens managers' perspec-

tives as to what might actually occur despite their well-laid plans.

The widespread use of electronic spreadsheets has led to an increase in the use of CVP analysis

in many organisations. Using spreadsheets, managers can easily conduct CVP-based sensitivity

analyses to examine the effect and interaction of changes in selling prices, unit variable costs,

fixed costs and target operating profits. Exhibit 8.3 displays a spreadsheet for our Do-All Software

example. Mary Frost can immediately see the revenues that need to be generated to reach particu-

lar operating profit levels, given alternative levels of fixed costs and variable costs per unit. For

example, revenues of €6000 (30 units at €200 per unit) are required to earn an operating profit of

Exhibit 8.3

Spreadsheet analysis of CVP relationships for Do-All Software

Revenue required at €200 selling price

Variable

to earn operating profit of

costs

Fixed costs

per unit

€0

€1 000

€1 500

€2 000

€2 000

€100

€4 000

6 000

7 000

8 000

120

5 000

7 500

8 750

10 000

140

6 667

10 000

11 667

13 333

€2 500

€100

€5 000

7 000

8 000

9 000

120

6 250

8 750

10 000

11 250

140

8 333

11 667

13 333

15 000

€3 000

€100

€6 000

8 000

9 000

10 000

120

7 500

10 000

11 250

12 500

140

10 000

13 333

15 000

16 667

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Sensitivity analysis and uncertainty

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€1000 if fixed costs are €2000 and variable costs per unit are €100. Mary can also use Exhibit 8.3

to assess whether she wants to sell at the computer convention if, for example, the booth rental

is raised to €3000 (thus increasing fixed costs to €3000) or the software supplier raises its price to

€140 per unit (thus increasing variable costs to €140 per unit).

One aspect of sensitivity analysis is the margin of safety, which is the excess of budgeted rev-

enues over the breakeven revenues. The margin of safety is the answer to the what-if question:

If budgeted revenues are above breakeven and drop, how far can they fall below budget before

the breakeven point is reached? Such a fall could be due to a competitor having a better product,

poorly executed marketing, and so on. Assume that Mary Frost has fixed costs of €3000, a selling

price of €200, and variable costs per unit of €140. For 75 units sold, the budgeted revenues are

€15 000 and the budgeted operating profit is €1500. The breakeven point for this set of assump-

tions is 50 units (€3000 ÷ €60) or €10 000 (€200 × 50). Hence, the margin of safety is €5000

(€15000 − €10 000) or 25 units.

Sensitivity analysis is one approach to recognising uncertainty, which is defined here as the

possibility that an actual amount will deviate from an expected amount. Another approach is to

calculate expected values using probability distributions. The appendix to this chapter illustrates

this approach.

Concepts in action

Can cost–volume–profit analysis help Whole Foods escape the ‘whole paycheck’ trap?

For many years, Whole Foods – the American supermarket chain – has been criticised for the high prices of its organic groceries. While it has the highest profit margin in the industry, Whole Foods has struggled to shake its ‘whole paycheck’ reputation as a grocery store for wealthy people who are willing to pay top dollar for asparagus water and ornamental kale.

In 2017, Amazon purchased Whole Foods for $13.7 billion. Its first order of business was to cut prices on more than 500 groceries, including bananas, avocados, and eggs. Why? Amazon believed that lower prices would drive new customers to Whole Foods and boost its profits.

‘We’re determined to make healthy and organic food affordable for everyone. Everybody should be able to eat Whole Foods quality – we will lower prices without compromising Whole Foods’ long-held commitment to the highest standards,’ said Amazon executive Jeff Wilke.

Amazon also rolled out special discounts at Whole Foods for

its Amazon Prime members, including 10% off hundreds of sale items and rotating weekly specials such as $10 per pound off halibut steaks. It also began selling Whole Foods' private-label brands through its Web site and its Amazon Fresh, Prime Pantry, and Prime Now programs. One year after Amazon acquired Whole Foods, annual revenue grew approximately 7% and the number of items purchased per transaction increased.

Sources: Abha Bhattarai (2017) 'Whole Foods has tried to lower prices before. Can Amazon make it work?' *The Washington Post,* 25 August (https://www.washingtonpost.com/business/capitalbusiness/whole-foods-has-tried-lower-prices-before-can-amazon-make-it-work/2017/08/25/2b2d1308-89a1-11e7-a50f-e0d4e6ec070a_story.html); Tonya Garcia (2018) 'Amazon Prime members are adopting Whole Foods benefits faster than previous perks', MarketWatch.com, 31 July (https://www.marketwatch.com/story/amazon-prime-members-are-adopting-whole-foods-benefits-faster-than-previous-perks-2018-07-27); Christian Hetrick (2018) 'A year after Amazon takeover, Whole Foods still hasn't shed its whole paycheck status', *The Philadelphia Inquirer,* 20 August (http://www2.philly.com/philly/business/consumer_news/amazon-whole-foods-prices-prime-wegman-20180820.html); Lisa Baertlein and Jeffrey Dastin (2018) 'Amazon cuts Whole Foods prices for Prime members in new grocery showdown', *Reuters,* 16 May (https://www.reuters.com/article/us-amazon-com-whole-foods/amazon-cuts-whole-foods-prices-for-prime-members-in-new-grocery-showdown-idUSKCN1IH0BM).

Cost planning and CVP

Alternative fixed-cost/variable-cost structures

Sensitivity analysis highlights the risks that an existing cost structure poses for an organisation.

This may lead managers to consider alternative cost structures. CVP helps managers in this task.

Consider again Mary Frost and her booth rental agreement with Computer Conventions Ltd.

Our original example has Mary paying a €2000 booth rental fee. Suppose, however, Computer

Conventions offers her three rental alternatives:

● Option 1: €2000 fixed fee.

● Option 2: €1400 fixed fee plus 5% of the convention revenues from Do-All sales.

● Option 3: 20% of the convention revenues from Do-All sales with no fixed fee.

Mary is interested in how her choice of a rental agreement will affect the risks she faces. Exhibit

8.4 presents these options in the CVP format:

● Option 1 exposes her to fixed costs of €2000 and a breakeven point of 25 units. This option

brings €80 additional operating profit for each unit sold above 25 units.

● Option 2 exposes her to lower fixed costs of €1400 and a lower breakeven point of 20 units.

There is, however, only €70 in additional operating profit for each unit sold above 20 units.

● Option 3 has no fixed costs. Mary makes €40 in additional operating profit for each unit sold.

This €40 addition to operating profit starts from the first unit sold. This option enables Mary

to break even if no units are sold.

The breakeven points are calculated as follows:

● The breakeven point of 25 units for option 1 was calculated earlier in this chapter.

● The breakeven point (Q) for option 2 is calculated as follows:

Fixed costs = €1400

Unit contribution = €120 + 0.05 (€200) = €130

Unit contribution margin = €200 − €130 = €70 per unit

€200Q − €130Q − €1400 = €1400 ÷ €70

Q = €1400 ÷ €70

= 20 units

Exhibit 8.4

CVP graphs for alternative rental schedules for Do-All Software

Option 1

Option 2

Option 3

€10 000

Total

Total

Total

€8000

revenues

Total

revenues

revenues

line

costs

line

Total

line

€6000

line

costs

line

Total

costs

€4000

Breakeven

line

Breakeven

point

Breakeven

€2000

point

= 20 units

point

= 25 units

= 0 units

10

20

30

40

50

10

20

30

40

50

10

20

30

40

50

Units sold

Units sold

Units sold

Operating

Operating

loss area

profit area

● Option 3 has a breakeven point of zero units because there are no fixed costs. The var-

iable costs per unit are €160 (€120 + 0.20 [€200]) The contribution margin per unit is

€40 (€200 − €160).

CVP analysis highlights the different risks and different returns associated with each option.

For example, while option 1 has the most risk (a €2000 fixed up-front payment), it also has the

highest contribution margin per unit. This €80 contribution margin per unit translates to high

potential if Mary is able to generate sales above 25 units. By moving from option 1 to option 2,

Mary faces less risk (lowers her fixed costs) if demand is low, but she must accept less potential

(because of the higher variable costs) if demand is high. The choice among options 1, 2 and 3 will

be influenced by her confidence in the level of demand for Do-All Software and her willingness

to risk money.

The risk–return trade-off across alternative cost structures is usefully summarised in a measure

called *operating leverage.* Operating leverage describes the effects that fixed costs have on changes

in operating profit as changes occur in units sold and hence in contribution margin. Organisations

with a high proportion of fixed costs in their cost structures, as is the case under option 1 in our

example, have high operating leverage. As a result, small changes in sales lead to large changes in

operating profits. Consequently, if sales increase, operating profits increase even more, yielding

higher returns. If sales decrease, however, operating profits decline yet more, leading to a greater

risk of losses. *At any given level of sales,* the *degree of operating leverage* equals contribution

margin divided by operating profit.

The following table shows the degree of operating leverage at sales of 40 units for the three

alternative rental options.

Option 1

Option 2

Option 3

1 Contribution margin per unit (p. 000)

€80

€50

€30

2 Contribution margin (row 1 × 40 units)

€3200

€2000

€1200

3 Operating profit (from Exhibit 8.4)

€1200

€1200

€1200

4 Degree of operating leverage

€3200 = 2.67 €2000 = 1.67

€1200 = 1.00

(line 2 ÷ line 3)

€1200

€1200

€1200

These numbers indicate that, when sales are 40 units, a percentage change in sales and contri-

bution margin will result in 2.67 times that percentage change in operating profit for option 1,

but the same percentage change in operating profit for option 3. Consider, for example, a sales

increase of 50% from 40 units to 60 units. Contribution margin will increase by 50% under each

option. Operating profit, however, will increase by 2.67 × 50% = 133% from €1200 to €2800

in option 1 but only by 1.00 × 50% = 50% from €1200 to €1800 in option 3 (see Exhibit 8.5).

The degree of operating leverage at a given level of sales helps managers calculate the effect of

fluctuations in sales on operating profits.

Exhibit 8.5

Mary Frost's budgets for Do-All and Superword software products

Do-All

Superword

Total

Units sold

60

30

90

Revenues, €200 and €130 per unit

€12 000

€3 900

€15 900

Variable costs, €120 and €90 per unit

7 200

2 700

9 900

Contribution margin, €80 and €40 per unit

€4 800

€1 200

6 000

Fixed costs

2 000

Operating profit

€4 000

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Effect of time horizon

A critical assumption of CVP analysis is that costs can be classified as either variable or fixed. This

classification can be affected by the time period being considered. The shorter the time horizon

we consider, the higher the percentage of total costs we may view as fixed. Consider Lufthansa.

Suppose a Lufthansa plane will depart from its gate in 30 minutes and there are 20 empty seats.

A potential passenger arrives bearing a transferable ticket from a competing airline. What are the

variable costs to Lufthansa of placing one more passenger in an otherwise empty seat? Variable

costs (such as one more meal) would be negligible. Virtually all the costs in that decision situa-

tion are fixed. In contrast, suppose Lufthansa must decide whether to include another city in its

routes. This decision may have a one-year planning horizon. Many more costs would be regarded

as variable and fewer as fixed in this decision.

This example underscores the importance of how the time horizon of a decision affects the

analysis of cost behaviour. In brief, whether costs really are fixed depends heavily on the relevant

range, the length of the time horizon in question, and the specific decision situation.

Effects of revenue mix on profit

Revenue mix (also called sales mix) is the relative combination of quantities of products or services

that constitutes total revenues. If the mix changes, overall revenue targets may still be achieved.

However, the effects on operating profit depend on how the original proportions of lower or

higher contribution margin products have shifted.

Suppose Mary Frost in our computer convention example is now budgeting for the next con-

vention. She plans to sell two software products – Do-All and Superword. Her budgets are set

out in Exhibit 8.5.

What is the breakeven point? Unlike the single product (or service) situation, there is not a unique

number of units for a multiple-product situation. This number instead depends on the revenue mix.

The following approach can be used when it is assumed that the budgeted revenue mix (two units

of Do-All sold for each unit of Superword sold) will not change at different levels of total revenue.

Let S be the number of units of Superword that need to be sold in order to break even. Then

2S is the number of units of Do-All that need to be sold in order to break even.

Revenues − Variable costs − Fixed costs = Operating profit

[€200(2S) + €130S] [

− €120(2S) + €90S] − €2000 = 0

€530S − €330S = €2000

€200S = €2000

S = 10

2S = 20

The breakeven point is 30 units when the revenue mix is 20 units of Do-All and 10 units of

Superword. The total contribution margin of €2000 (Do-All €80 × 20 = €1600 plus Superword

€40 × 10 = €400) equals the fixed costs of €2000 at this mix.

Alternative revenue mixes (in units) that have a contribution margin of €2000 and thus result

in breakeven operations include the following:

Do-All

25

20

15

10

5

0

Superword

0

10

20

30

40

50

Total

25

30

35

40

45

50

Other things being equal, for any given total quantity of units sold, if the mix shifts towards

units with higher contribution margins, operating profit will be higher. Thus, if the mix shifts

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towards Do-All (say, to 70% Do-All from 60% Do-All) with a contribution margin of twice that

of Superword, Mary's operating profit will increase.

Despite their desire to maximise revenues from all products, managers must frequently cope

with limited (constrained) resources. For instance, additional production capacity may be una-

vailable. Which products should be produced? As Chapter 9 explains in more detail, the best

decision is not necessarily to make the product having the highest contribution margin per unit.

Rather, the best decision recognises the contribution margin per unit of the constraining factor.

Not-for-profit organisations and CVP

CVP can be readily applied to decisions by both not-for-profit and for-profit organisations. Sup-

pose a social welfare department has a government budget appropriation (revenue) for 2022 of

€900 000. This not-for-profit agency's major purpose is to assist people with disabilities who are

seeking employment. On average, the agency supplements each person's income by €5000 annu-

ally. The agency's fixed costs are €270 000. There are no other costs. The agency manager wants

to know how many people could be assisted in 2022. We can use CVP analysis here by assuming

zero operating profit. Let Q be the number of people to be assisted:

Revenue − Variable costs − Fixed costs = €0

€900 000 − €5000Q − €270 000 = €0

€5000Q = €900 000 − €270 000

Q = €630 000 ÷ €5000

= 126 people

Suppose the manager is concerned that the total budget appropriation for 2022 will be reduced

by 15% to a new amount of € 765 000. The manager wants to know how many people with dis-

abilities will be assisted. Assume the same amount of monetary assistance per person:

€765 000 − €5000Q − €270 000 = €0

€5000Q = €765 000 − €270 000

Q = €495 000 ÷ €5000

= 99 people

Note the following two characteristics of the CVP relationships in this not-for-profit situation:

1 The percentage drop in service (126 − 99) ÷ 126, or 21.4% is more than the 15% reduction in

the budget appropriation. Why? Because the existence of €270 000 in fixed costs means that

the percentage drop in service exceeds the percentage drop in budget appropriation.

2 If the relationships were graphed, the budget appropriation (revenue) amount would be a straight

horizontal line of €765 000. The manager could adjust operations to stay within the reduced

appropriation in one or more of three major ways: (a) reduce the number of people assisted; (b)

reduce the variable costs (the assistance per person); or (c) reduce the total fixed costs.

Contribution margin and gross margin

Contribution margin is a key concept in this chapter. We now consider how it is related to the

gross margin concept discussed in Chapter 2. First some definitions:

Contribution margin = Revenues − All variable costs

Gross margin = Revenues − Cost of goods sold

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Cost of goods sold in the merchandising sector is made up of goods purchased for resale. Cost of

goods sold in the manufacturing sector consists entirely of manufacturing costs (including fixed

manufacturing costs).

Service-sector companies can calculate a contribution margin figure but not a gross margin

figure. Service-sector companies do not have a cost of goods sold item in their income statement.

Merchandising sector

The two areas of difference between contribution margin and gross margin for companies in the

merchandising sector are fixed cost of goods sold (such as a fixed annual payment to a supplier

to guarantee an exclusive option to purchase merchandise) and variable non-cost of goods sold

items (such as a salesperson's commission that is a percentage of sales euros). Contribution mar-

gin is calculated after all variable costs have been deducted, whereas gross margin is calculated by

deducting only cost of goods sold from revenues. The following example for Lia Ltd illustrates this

difference. Lia Ltd is a London-based seller of jewellery, lounge wear, beachwear and accessories.

Figures given are assumed to be in pounds sterling (£).

Contribution margin format

Gross margin format

Revenues (£)

200

Revenues (£)

200

Variable cost of goods sold

120

Cost of goods sold (120)

120

Other variable costs

43

163

Gross margin

80

Contribution margin

37

Operating costs (43 + 19)

62

Other fixed costs

19

Operating profit (£)

18

Operating profit (£)

18

Manufacturing sector

The two areas of difference between contribution margin and gross margin for companies in the

manufacturing sector are fixed manufacturing costs and variable non-manufacturing costs. The

following example (figures assumed to be in €million) illustrates this difference:

Revenues (£)

1000 Revenues (£)

1000

Variable manufacturing costs

250

Cost of goods sold (250 + 160)

410

Variable non-manufacturing costs

270 520 Gross margin

590

Contribution margin

480 Non-manufacturing costs (270 + 138) 408

Fixed manufacturing costs

160

Operating profit (£ million)

182

Fixed non-manufacturing costs

138 298

Operating profit (£)

182

Fixed manufacturing costs are not deducted from revenues when computing contribution margin

but are deducted when computing gross margin. Cost of goods sold in a manufacturing company

includes entirely manufacturing costs. Variable non-manufacturing costs are deducted from reve-

nues when computing contribution margins but are not deducted when computing gross margins.

Both the contribution margin and the gross margin can be expressed as totals, as an amount

per unit, or as percentages. The contribution margin percentage is the total contribution mar-

gin divided by revenues. The variable-cost percentage is the total variable costs (with respect to

units of output) divided by revenues. The contribution margin percentage in our manufactur-

ing-sector example is 48% (480 ÷ 1000), while the variable-cost percentage is 52% (520 ÷ 1000).

The gross margin percentage is the gross margin divided by revenues −59% (590 ÷ 1000) in our

manufacturing-sector example.

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Summary

The following points are linked to the chapter's learning objectives.

1 General profit planning in its full complexity assumes that there are many revenue drivers and many cost drivers.

CVP is a special case that, in a restricted number of settings, can assist managers in understanding the behaviour

of total costs, total revenues and operating profit as changes occur in the output level, selling price, variable costs

or fixed costs.

2 Using CVP requires simplifying assumptions, including that costs are either fixed or variable with respect to the

number of output units (units produced and sold) and that total sales and total cost relationships are linear.

3 Managers often select the method they find easiest for computing the breakeven point: the equation method,

the contribution margin method or the graph method. Income taxes can be incorporated into CVP analysis in a

straightforward way by adjusting operating profit by the income tax rate. The breakeven point is unaffected by the

presence of income taxes because no income taxes are paid if there is no operating profit.

4 Sensitivity analysis, a ‘what-if’ technique, can systematically examine the effect on operating profit and net profit

of different levels of fixed costs, variable costs per unit, selling prices and output.

5 CVP can highlight to managers the risk and potential reward of alternatives that differ in their fixed costs and

variable costs.

6 When CVP is applied to a multiple-product firm, it is assumed that there is a constant sales mix of products as the

total quantity of units sold changes.

Appendix

Decision models and uncertainty

Managers make predictions and decisions in a world of uncertainty. This appendix explores the

characteristics of uncertainty and describes how managers can cope with it. We also illustrate the

additional insights gained when uncertainty is recognised in CVP analysis.

Coping with uncertainty

Role of a decision model

Uncertainty is the possibility that an actual amount will deviate from an expected amount. For

example, marketing costs might be forecast at €400 000 but actually turn out to be €430 000. A

decision model helps managers deal with uncertainty; it is a formal method for making a choice

that often involves quantitative analysis. It usually includes the following elements:

1 A choice criterion, which is an objective that can be quantified. This objective can take many

forms. Most often the choice criterion is expressed as a maximisation of income or a minimi-

sation of cost. The choice criterion provides a basis for choosing the best alternative action.

2 A set of the alternative actions being considered.

3 A set of all the relevant events that may occur, where an event is a possible occurrence. This

set of events should be mutually exclusive and collectively exhaustive. Events are mutually

exclusive if they cannot occur at the same time. Events are collectively exhaustive if, taken

together, they make up the entire set of possible occurrences (and no other event can occur).

Exhibit 8.6

A decision model and its link to performance evaluation

Uncertainty

resolved

Decision model

*

1 Choice criterion

Implementation

Outcome

2 Set of alternative actions

of

of

Performance

3 Set of relevant events

chosen

chosen

evaluation

4 Set of probabilities

action

action

5 Set of possible outcomes

Feedback

* Uncertainty resolved means the event becomes known.

Examples are growth or no growth in industry demand, and increase, decrease or no change in

interest rates. Only one event in a set of mutually exclusive and collectively exhaustive events

will actually occur.

4 A set of probabilities, where a probability is the likelihood or chance of occurrence of an event.

5 A set of possible outcomes that measures, in terms of the choice criterion, the predicted con-

sequences of the various possible combinations of actions and events.

It is important to distinguish actions from events. Actions are choices made by management–

for example, the prices it should charge for the company's products. Events are occurrences that

management cannot control – for example, a growing or declining economy. The outcome is

the operating profit the company makes, which depends on both the action management selects

(pricing strategy) and the event that occurs (how the economy performs). Exhibit 8.6 presents an

overview of a decision model, the implementation of the chosen action, its outcome and subse-

quent performance evaluation.

Probabilities

Assigning probabilities is a key aspect of the decision model approach to coping with uncer-

tainty. A probability distribution describes the likelihood (or probability) of each of the mutu-

ally exclusive and collectively exhaustive set of events. The probabilities of these events will

add to 1.00 because they are collectively exhaustive. In some cases there will be much evidence

to guide the assignment of probabilities. For example, the probability of obtaining a head in

the toss of a fair coin is 1 that of drawing a particular playing card from a standard, well-

2

shuffled pack is 1 . In business, the probability of having a specified percentage of defective

52

units may be assigned with great confidence, on the basis of production experience with

thousands of units. In other cases, there will be little evidence supporting estimated probabil-

ities. For example, how many units of a new pharmaceutical product will be sold next year?

Expected value

An expected value is a weighted average of the outcomes with the probability of each outcome

serving as the weight. Where the outcomes are measured in monetary terms, expected value is

often called expected monetary value**.**

Managers often prefer being presented with the entire probability distribution. Information

can also be presented in three categories: best-case scenario, most likely and worst-case scenario.

All three categories remind the user that uncertainty exists in the decision at hand.

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Illustrative problem

Reconsider Mary Frost and the booth rental alternatives offered by Computer Conventions to

sell Do-All Software:

● Option 1: €2000 fixed fee.

● Option 2: €1400 fixed fee plus 5% of the convention revenues from Do-All sales.

● Option 3: 20% of the convention revenues from Do-All sales (but no fixed fee).

Mary estimates a 0.60 probability that sales will be 40 units and a 0.40 probability that sales

will be 70 units. Each Do-All Software package will be sold for €200. Mary will purchase the

package from a computer software wholesaler at €120 per unit with the privilege of returning all

unsold units. Which booth rental alternative should Mary choose?

General approach to uncertainty

The construction of a decision model consists of five steps that are keyed to the five characteristics

described at the beginning of this appendix.

Step 1 Identify the choice criterion of the decision maker. Assume that Mary's choice criterion is

to maximise expected net cash inflow at the convention.

Step 2 Identify the set of alternative actions under consideration. The notation for an action is

a. Mary has three possible actions:

a = Pay €2000 fixed fee

a = Pay €1400 fixed fee plus 5%of convention revenues

2

a = Pay 20%of convention revenues(but no fixed fee)

3

Step 3 Identify the set of relevant events that can occur. Mary's only uncertainty is the number

of units of Do-All Software that she can sell. Using *x* as the notation for an event,

x = 40 units

1

x = 70 units

2

Step 4 Assign the set of probabilities for the events that can occur. Mary assesses a 60% chance

that she will sell 40 units and a 40% chance that she will sell 70 units. Using *P*(*x*) as the notation

for the probability of an event, the probabilities are:

P(*x*) = 0.60

1

P(*x*) = 0.40

2

Step 5 Identify the set of possible outcomes that are dependent on specific actions and events.

The outcomes in this example take the form of six possible net cash flows that are displayed in a

decision table in Exhibit 8.7. A decision table is a summary of the contemplated actions, events,

outcomes and probabilities of events.

Mary can now use the information in Exhibit 8.7 to calculate the expected net cash inflow of

each action as follows:

Pay €2000 fixed fee:

E (*a*) = 0.60 (€1200) + 0.40 (€3600) = €2160

1

Pay €1400 fixed fee plus 5% of revenues:

E (*a*) = 0.60 (€1400) + 0.40 (€3500) = €2240

2

Pay 20% of revenues (but no fixed fee):

E (*a*) = 0.60 (€1600) + 0.40 (€2800) = €2080

3

Exhibit 8.7

Decision table for Do-All Software

Probability of events

x 1 = 40 units sold *x* 2 = 70 units sold

Actions

P(*x* 1) = 0.60

P(*x* 2) = 0.40

a 1: Pay €2000 fixed fee

€1200*

€3600†

a 2: Pay €1400 fixed fee plus 5% of convention revenues

€1400‡

€3500§

a 3: Pay 20% of convention revenues (but no fixed fee)

€1600#

€2800**

* Net cash flows = (€200 − €120)(40) − €2000 = €1200.

† Net cash flows = (€200 − €120)(70) − €2000 = €3600.

‡ Net cash flows = (€200 − €120 − €10)(40) − €1400 = €1400.

§ Net cash flows = (€200 − €120 − €10)(70) − €1400 = €3500.

|| €10 = 5% of selling price of €200.

Net cash flows = (€200 − €120 − €40††) − (40) = €1600.

** Net cash flows = (€200 − €120 − €40‡†) − (70) = €2800.

†† €40 = 20% of selling price of €200.

To maximise expected net cash inflows, Mary should select action *a* 2 that is, contracting to pay

Computer Conventions a €1400 fixed fee plus 5% of convention revenues.

Consider the effect of uncertainty on the preferred action choice. If Mary was certain that she

would sell only 40 units of Do-All Software (that is, P(*x*) = 1

1

), she would prefer alternative *a* 3 –

pay 20% of revenues and no fixed fee. To follow this reasoning, examine Exhibit 8.7. When

40 units are sold, alternative *a* 3 yields the maximum net cash inflows of €1600. Because fixed costs

are zero, booth rental costs are low when sales are low.

However, if Mary was certain that she would sell 70 units of Do-All Software (that is,

P(*x* 2 = 1), she would prefer alternative *a* 1 – pay a €2000 fixed fee. Exhibit 8.7 indicates that when 70 units are sold, alternative *a* 1 yields the maximum net cash inflows of €3600. Rental payments

under *a* 2 and *a* 3 increase with units sold but are fixed under *a* 1.

Good decisions and good outcomes

Always distinguish between a good decision and a good outcome. One can exist without the other.

By definition, uncertainty rules out guaranteeing, after the fact, that the best outcome will always

be obtained. It is possible that bad luck will produce unfavourable consequences even when good

decisions have been made.

Suppose you are offered a one-time-only gamble tossing a fair coin. You will win €20 if the

event is heads, but you will lose €1 if the event is tails. As a decision maker, you proceed through

the logical phases: gathering information, assessing outcomes and making a choice. You accept the

bet. Why? Because the expected value is €9.50[0.5(€20) + 0. −

5(€1)]. The coin is tossed and the

event is tails. You lose. From your viewpoint, this was a good decision but a bad outcome.

A decision can be made only on the basis of information available at the time of the decision.

Hindsight is flawless, but a bad outcome does not necessarily mean that a bad decision was made.

Making a good decision is our best protection against a bad outcome.

Reference and further reading

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Times, 10 February (https://www.ft.com/content/be06fa73-87ae-4f5d-8351-29f2d0d378b6)

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CHAPTER 8

Assessment material

Review questions

Note: To underscore the basic CVP relationships, the assessment material ignores income taxes

unless stated otherwise.

8.1

Describe how the special case labelled CVP is different from the general case for predicting total

revenues, total costs and operating profit.

8.2

Distinguish between operating profit and net profit.

8.3

Describe the assumptions underlying CVP analysis.

8.4

‘CVP is both simple and simplistic. If you want realistic analysis to underpin your decisions, look

beyond CVP.’ Do you agree? Explain.

8.5

Define contribution margin, gross margin, contribution margin percentage, variable-cost percent-

age and margin of safety.

8.6

Give an example of how a manager can decrease variable costs while increasing fixed costs.

8.7

Give an example of how a manager can increase variable costs while decreasing fixed costs.

8.8

‘There is no such thing as a fixed cost. All costs can be “unfixed” given sufficient time.’ Do you

agree? What is the implication of your answer for CVP analysis?

8.9

How can a company with multiple products calculate its breakeven point?

8.10 How does an increase in the income tax rate affect the breakeven point?

Exercises

Basic level

***8.11 CVP computations** (20 minutes)

Fill in the blanks for each of the following independent cases.

Variable

Total

Total con-

Selling

costs

units

tribution

Total

Operating

Case

price

per unit

sold

margin

fixed costs

profit/loss

a

£ 30

£ 20

70 000

£?

£?

− £ 15000

b

25

?

180 000

900 000

800 000

?

c

?

10

150 000

300 000

220 000

?

d

20

14

?

120 000

?

12 000

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Chapter 8 Cost–volume–profit analysis

8.12 CVP, changing revenues and costs (15–20 minutes)

Soleil Voyages SA is a travel agency specialising in flights between Paris and London. It books

passengers on Air Chanson. Air Chanson charges passengers €1000 per round-trip ticket. Soleil

Voyages receives a commission of 8% of the ticket price paid by the passenger. Soleil Voyages's

fixed costs are €22 000 per month. Its variable costs are €35 per ticket, including an €18 delivery

fee by Lièvre-Express SA. (Assume each ticket purchased is delivered in a separate package; thus

the delivery fee applies to every individual ticket.)

Required

1 What is the number of tickets Soleil Voyages must sell each month to (a) break even, and (b)

make a target operating profit of €10 000?

2 Assume Tortue-Express SA offers to charge Soleil Voyages only €12 per ticket delivered. How

would accepting this offer affect your answers to (a) and (b) in requirement 1?

8.13 CVP, changing revenues and costs (continuation of Exercise 8.12) (20 minutes)

Air Chanson changes its commission structure to travel agents. Up to a ticket price of €600, the

8% commission applies. For tickets costing €600 or more, there is a fixed commission of €48.

Assume Soleil Voyages has fixed costs of €22 000 per month and variable costs of €29 per ticket

(including a €12 delivery fee by Lièvre-Express).

Required

1 What is the number of Paris-to-London round-trip tickets Soleil Voyages must sell each month

to (a) break even, and (b) make a target operating profit of €10 000? Comment on the results.

2 Soleil Voyages decides to charge its customers a delivery fee of €5 per ticket. How would this

change affect your answers to (a) and (b) in requirement 1? Comment on the results.

8.14 CVP exercises (20 minutes)

Grünberg Lehrmittelverlag GmbH manufactures and sells pens. Present sales output is 5 million

annually at a selling price of €0.50 per unit. Fixed costs are €900 000 per year. Variable costs are

€0.30 per unit.

Required

(Consider each case separately.)

1 a What is the present operating profit for a year?

b What is the present breakeven point in revenues?

Calculate the new operating profit for each of the following changes:

2 A €0.04 per unit increase in variable costs.

3 A 10% increase in fixed costs and a 10% increase in units sold.

4 A 20% decrease in fixed costs, a 20% decrease in selling price, a 10% decrease in variable costs

per unit, and a 40% increase in units sold.

Calculate the new breakeven point in units for each of the following changes:

5 A 10% increase in fixed costs.

6 A 10% increase in selling price and a €20 000 increase in fixed costs.

8.15 CVP, changing cost inputs (5–10 minutes)

Maria Kabaliki is planning to sell a vegetable slicer-dicer for €15 per unit at a country fair. She

purchases units from a local distributor for €6 each. She can return any unsold units for a full

refund. Fixed costs for booth rental, set-up and cleaning are €450.

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Required

1 Calculate the breakeven point in units sold.

2 Suppose the unit purchase cost is €5 instead of €6, but the selling price is unchanged. Calculate

the new breakeven point in units sold.

8.16 CVP, international cost structure differences (10 minutes)

Knitwear Ltd is considering three countries for the sole manufacturing site of its new sweater:

Cyprus, Turkey and Ireland. All sweaters are to be sold to retail outlets in Ireland at €32 per unit.

These retail outlets add their own mark-up when selling to final customers. The three countries

differ in their fixed costs and variable costs per sweater.

Variable

Variable

marketing and

Annual fixed

manufacturing

distribution costs

costs

costs per sweater

per sweater

Cyprus

€6.5 million

€8.00

€11.00

Turkey

4.5 million

5.50

11.50

Ireland

12.0 million

13.00

9.00

Required

1 Calculate the breakeven point of Knitwear Ltd in both (a) units sold, and (b) revenues for each

of the three countries considered for manufacturing the sweaters.

2 If Knitwear Ltd sells 800 000 sweaters in 2022, what is the budgeted operating profit for

each of the three countries considered for manufacturing the sweaters? Comment on the

results.

8.17 CVP, income taxes (10–15 minutes)

Koninklijke BolsWessanen NV has fixed costs of €300 000 and a variable-cost percentage of 80%.

The company earns net profit of €84 000 in 2022. The income tax rate is 40%.

Required

Calculate (1) operating profit, (2) contribution margin, (3) total revenues and (4) breakeven

revenues.

8.18 CVP, movie production (10 minutes)

Espasso SA has just finished production of *Tornado,* the latest action film directed by Domingos

Vieira and starring Arnaldo Moura and Victoria Rebello. The total production cost to Espasso

was €5 million. All the production personnel and actors on *Tornado* received a fixed salary

(included in the €5 million) and will have no 'residual' (equity interest) in the revenues or operating

income from the movie. Artes e Media Ltda will handle the marketing of *Tornado.* Media agrees

to invest a minimum €3 million of its own money in marketing the movie and will be paid 20%

of the revenues Espasso itself receives from the box-office receipts. Espasso receives 62.5% of the

total box-office receipts (out of which comes the 20% payment to Artes e Media).

Required

1 What is the breakeven point to Espasso for *Tornado* expressed in terms of (a) revenues received

by Espasso, and (b) total box-office receipts?

2 Assume in its first year of release, the box-office receipts for *Tornado* total €300 million. What

is the operating income to Espasso from the movie in its first year?

8.19

CVP, cost structure differences, movie production (continuation of Exercise 8.18) (20 minutes)

Espasso is negotiating for *Tornado 2,* a sequel to its mega-blockbuster *Tornado.* This negotiation

is proving more difficult than for the original movie. The budgeted production cost (excluding

payments to the director Vieira and the stars Moura and Rebello) for *Tornado 2* is €21 million.

The agent negotiating for Vieira, Moura and Rebello proposes either of two contracts:

● *Contract A*: Fixed-salary component of €15 million for Vieira, Moura and Rebello (combined)

with no residual interest in the revenues from *Tornado 2.*

● *Contract B*: Fixed-salary component of €3 million for Vieira, Moura and Rebello (combined)

plus a residual of 15% of the revenues Espasso receives from *Tornado 2.*

Artes e Media will market *Tornado 2.* It agrees to invest a minimum of €10 million of its own

money. Because of its major role in the success of *Tornado,* Artes e Media will now be paid 25%

of the revenues Espasso receives from the total box-office receipts. Espasso receives 62.5% of the

total box-office receipts (out of which comes the 25% payment to Artes e Media).

Required

1 What is the breakeven point for Espasso expressed in terms of:

a revenues received by that company

b total box-office receipts for Tornado 2

for contracts A and B? Explain the difference between the breakeven points for contracts A and B.

2 Assume *Tornado 2* achieves the same €300 million in box-office revenues as *Tornado.* What

is the operating income to Espasso from *Tornado 2* if it accepts contract B? Comment on the

difference in operating income between the two films.

8.20 Not-for-profit institution (15–25 minutes)

The Ville de Genève, Switzerland, makes a SFr 400 000 lump-sum budget appropriation to an

agency to conduct a counselling programme for drug addicts for a year. All of the appropriation

is to be spent. The variable costs for drug prescriptions average SFr 400 per patient per year. Fixed

costs are SFr 150 000.

Required

1 Calculate the number of patients that could be served in a year.

2 Suppose the total budget for the following year is reduced by 10%. Fixed costs are to remain

the same. The same level of service to each patient will be maintained. Calculate the number

of patients that could be served in a year.

3 As in requirement 2, assume a budget reduction of 10%. Fixed costs are to remain the same.

The drug counsellor has discretion over how much in drug prescriptions to give to each patient.

She does not want to reduce the number of patients served. On average, what is the cost of

drugs that can be given to each patient? Calculate the percentage decline in the annual average

cost of drugs per patient.

8.21 Appendix: CVP under uncertainty (15 minutes)

Bomuldstaft AS is considering two new colours for their umbrella products – emerald green and

shocking pink. Either can be produced using present facilities. Each product requires an increase

in annual fixed costs of €400 000. The products have the same selling price (€10) and the same

variable costs per unit (€8).

Management, after studying past experience with similar products, has prepared the following

probability distribution:

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Probability for

Event (units

Emerald green

Shocking pink

demanded)

umbrella

umbrella

50 000

0.0

0.1

100 000

0.1

0.1

200 000

0.2

0.1

300 000

0.4

0.2

400 000

0.2

0.4

500 000

0.1

0.1

1.0

1.0

Required

1 What is the breakeven point for each product?

2 Which product should be chosen, assuming the objective is to maximise expected operating

profit? Why? Show your computations.

3 Suppose management is absolutely certain that 300 000 units of shocking pink will be sold,

but it still faces the same uncertainty about the demand for emerald green as outlined in the

problem. Which product should be chosen? Why? What benefits are available to management

from having the complete probability distribution instead of just an expected value?

Intermediate level

***8.22 CVP, income taxes** (20–25 minutes)

La Pilotta has two restaurants in Lausanne that are open 24 hours a day. Fixed costs for the two

restaurants together total SFr 450 000 per year. Service varies from a cup of coffee to full meals.

The average bill for each customer is SFr 8.00. The average cost of food and other variable costs

for each customer is SFr 3.20. The income tax rate is 30%. Target net profit is SFr 105 000.

Required

1 Calculate the revenues needed to obtain the target net profit.

2 How much in sales terms is needed (a) to earn net income of SFr 105 000, and (b) to break even?

3 Calculate net income if the number of bills is 150 000.

8.23 Appendix: uncertainty, CVP (15–20 minutes)

Kristina Larsson is the Stockholm promoter for Gustav Häglund Larsson is promoting a new

world championship fight for Häglund The key area of uncertainty is the size of the cable pay-

per-view TV market. Larsson will pay Häglund a fixed fee of SEK 2 million and 25% of net cable

pay-per-view revenue. Every cable TV home receiving the event pays SEK 29.95, of which Larsson

receives SEK 16. Larsson pays Häglund 25% of the SEK 16.

Larsson estimates the following probability distribution for homes purchasing the pay-per-view

event:

Demand

Probability

100 000

0.05

200 000

0.10

300 000

0.30

400 000

0.35

500 000

0.15

1 000 000

0.05

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Required

1 What is the expected value of the payment Larsson will make to Häglund?

2 Assume the only uncertainty is cable TV demand for the fight. Larsson wants to know the

breakeven point given her own fixed costs of SEK 1 million and her own variable costs of SEK

2 per home. (Also include Larsson's payments to Häglund in your answer.)

8.24 CVP (From CIMA, Paper P1, November 2014) (20–30 minutes)

The manager of a tourist attraction is considering whether to open on 1 January, a day when the

attraction has, in previous years, been closed. The attraction has a daily capacity of 1000 visitors.

If the attraction opens for business on that day it will incur additional specific fixed costs of

£30 000.

The contribution from the sale of tickets would be £25 per visitor. The number of visitors is

uncertain but based on past experience it is expected to be as follows:

Probability

800 visitors

50%

900 visitors

30%

1000 visitors

20%

It is expected that visitors will also purchase souvenirs and refreshments. The contribution which

would be made from these sales has been estimated as follows:

Probability

£8 per visitor

35%

£10 per visitor

40%

£12 per visitor

25%

Required

1 Calculate whether it is worthwhile opening the tourist attraction on 1 January. You should use

expected value as the basis of your analysis.

a Prepare a two-way data table to show the contribution to general fixed overheads for each

of the nine possible outcomes.

b Calculate the probability of making a positive contribution to general fixed overheads by

opening on 1 January.

8.25 CVP (From CIMA, Paper P2, November 2014) (Continuation of Exercise 8.24) (15 minutes)

A company sells three products: D, E and F. The market for the products dictates that the numbers

of products sold are always in the ratio of 3D:4E:5F.

Budgeted sales volumes and prices, and cost details for the previous period were as follows:

D

E

F

Sales units

300

400

500

Selling price per unit

£80

£55

£70

Contribution to sales

70%

65%

50%

ratio

The budgeted total fixed costs for that period were £31 200.

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Required:

Calculate for that period:

1 The breakeven sales revenue.

2 The volume of each product that would have needed to be sold if the company had wanted to

earn a profit of £29 520 in that period.

***8.26 Revenue mix, two products** (20–25 minutes)

Presencia Equipajes SA retails two products, a standard and a deluxe version of a luggage carrier.

The budgeted income statement is as follows:

Standard carrier Deluxe carrier

Total

Units sold

150 000

50 000

200 000

Revenues

@ €20 and €30 per unit

€3 000 000

€1 500 000

€4 500 000

Variable costs

@ €14 and €18 per unit

2 100 000

900 000

3 000 000

Contribution margins

@ €6 and €12 per unit

€900 000

€600 000

1 500 000

Fixed costs

1 200 000

Operating profit

€300 000

Required

1 Calculate the breakeven point in units, assuming that the planned revenue mix is maintained.

2 Calculate the breakeven point in units (a) if only standard carriers are sold, and (b) if only

deluxe carriers are sold.

3 Suppose 200 000 units are sold, but only 20 000 are deluxe. Calculate the operating profit.

Calculate the breakeven point if these relationships persist in the next period. Compare your

answers with the original plans and the answer in requirement 1. What is the major lesson of

this problem?

8.27 Budget issues (From CIMA Management Accounting Pillar Managerial Level Paper, May 2006)

(25 minutes)

S plc produces and sells three products, X, Y and Z. It has contracts to supply products X and Y,

which will utilise all of the specific materials that are available to make these two products during

the next period. The revenue these contracts will generate and the contribution to sales (c/s) ratios

of products X and Y are as follows:

Product X

Product Y

Revenue

£ 10 million

£ 20 million

C/S ratio

15%

10%

Product Z has a c/s ratio of 25%.

The total fixed costs of S plc are £ 5.5 million during the next period and management have budg-

eted to earn a profit of £ 1 million.

Required

Calculate the revenue that needs to be generated by Product Z for S plc to achieve the budgeted

profit.

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Chapter 8 Cost–volume–profit analysis

8.28 Margin of safety (From CIMA Performance Management, section B, March 2014)

(30 minutes)

GF is a company that manufactures clothes for the fashion industry. The fashion industry is fast

moving and consumer demand can change quickly due to the emergence of new trends.

GF manufactures three items of clothing: the S, the T and the B using the same resources but in

different amounts.

Budget information per unit is as follows:

S

T

B

€

€

€

Selling price

250

40

100

Direct material(€20 per m 2)

100

10

30

Direct labour (€12 per hour)

36

12

27

Variable overhead (€3 per

9

3

6.75

machine hour)

Total fixed costs are €300 000 per month.

Included in the original budget constructed at the start of the year, was the sales demand for the

month of March as shown below:

S

T

B

Demand in

2000

6000 4000

March (units)

After the original budget had been constructed, items of clothing S, T and B have featured in a

fashion magazine. As a result of this, a new customer (a fashion retailer), has ordered 1000 units

each of S, T and B for delivery in March. The budgeted demand shown above **does not** include

this order from the new customer.

In March there will be limited resources available. Resources will be limited to:

Direct materials 14 500 m 2

Direct labour 30 000 hours

There will be no opening inventory of material, work in progress or finished goods in March.

The Board of Directors have now addressed the shortage of key resources at GF to ensure that

production will meet demand in April. The production plan for the month of **April** is shown

below:

S

T

B

Production (units)

4000

5000 4000

Required

For April:

1 Calculate the breakeven sales revenue for the given product mix in the production plan.

2 Calculate the margin of safety percentage.

3 Explain THREE limitations of breakeven analysis for GF.

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CHAPTER 9

Determining how costs behave

This chapter focuses on how to determine cost behaviour, that is, on

understanding how costs change with changes in activity levels, units of

Learning objectives

products produced, and so on. Knowing how costs vary by identifying the drivers of costs and by distinguishing fixed from variable costs is

After studying this chapter, you

frequently the key to making considered management decisions. Many should be able to:

managerial functions such as planning and control rely on knowing how

- Explain the two assumptions

costs will behave. For example, consider the following questions: Should a frequently used in cost-behaviour

component part be made or purchased? What price should we charge for estimation

altering a product's packaging? Should we make the item or buy it? What effect will a 20% increase in units sold have on operating profit? Decisions

- Describe linear cost functions and

in the control area, such as the interpretation of some variances, similarly three common ways in which they

rely heavily on knowledge of cost behaviour. Determining and visual-

behave

ising how costs behave are among the most important functions of the

●

Recognise various approaches to

management accountant. Moreover, understanding the drivers of costs

cost estimation

and revenues is a valuable technical skill whose importance has grown in

●

Outline six steps in estimating

recent years with the increased availability of new, massive datasets and

a cost function on the basis of

cheap computing power to analyze them. The knowledge gained in this

current or past cost relationships

process can motivate an organisation to alter its operations in innovative

●

Describe three criteria to evaluate

ways and tackle important challenges.

and choose cost drivers

●

Explain and give examples of

non-linear cost functions

- Distinguish between the cumulative average-time learning model and the incremental unit-time learning model

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General issues in estimating cost functions

Basic assumptions and examples of cost functions

A cost function is a mathematical function describing cost-behaviour patterns – how costs change with changes in the cost driver. Cost functions can be plotted on graph paper by measuring the cost driver on the *x*-axis and the corresponding amount of total costs on the *y*-axis.

Two assumptions are frequently made when estimating cost functions:

1 Variations in the total costs of a cost object are explained by variations in a single cost driver.

2 Cost behaviour is adequately approximated by a linear cost function of the cost driver within

the relevant range. A linear cost function is a cost function where, within the relevant range,

the graph of total costs versus a single cost driver forms a straight line.

We use these assumptions throughout much of this chapter. Later sections give examples of

non-linear cost-behaviour patterns in which the plot of the relationship between the cost driver

and total costs is not a straight line. The last section in the appendix describes how changes in

two or more cost drivers can explain changes in the level of total costs. We illustrate cost func-

tions in the context of negotiations between Verre-Laine and Nord-Sud Communications (NSC)

for exclusive use of a telephone line between Paris and Barcelona. NSC offers Verre-Laine three

alternative cost structures.

● *Alternative 1*: €5 per minute of phone use. As we saw in Chapter 2, this is a *strictly variable*

cost for Verre-Laine. The number of phone-minutes used is the cost driver; that is, the number

of phone-minutes used is the factor whose change causes a change in total costs.

Graph 1 in Exhibit 9.1 presents the *strictly variable or proportionately variable* cost. Total

costs (measured along the vertical *y*-axis) change in proportion to the number of phone-

minutes used (measured along the horizontal *x*-axis) within the relevant range. The *relevant*

range, described in Chapter 2, is the range of the cost driver where the relationship between

total costs and the driver is valid. There are no fixed costs. Every additional minute adds €5

to total costs. Graph 1 of Exhibit 9.1 illustrates the €5 slope coefficient, the amount by which

total costs change for a unit change in the cost driver within the relevant range.

We can write the cost function in Graph 1 of Exhibit 9.1 as:

$y = €5\ X$

where *X* measures the number of phone-minutes used and *y* measures the total costs of the

phone-minutes determined from the cost function.

● *Alternative 2*: €10 000 per month. Under this alternative, Verre-Laine has a fixed cost of

€10 000. Graph 2 in Exhibit 9.1 presents the *fixed cost.* The total costs will be €10 000 per

month regardless of the number of phone-minutes used. (We use the same cost driver, the num-

ber of phone-minutes used, to compare cost-behaviour patterns under various alternatives.)

Graph 2 in Exhibit 9.1 refers to the fixed cost of €10 000 as a constant or intercept, the com-

ponent of total costs that, within the relevant range, does not vary with changes in the level of

the cost driver. Under alternative 2, the constant or intercept accounts for all the costs, since

there are no variable costs. The slope is zero.

We can write the cost function in Graph 2 of Exhibit 9.1 as:

y = €10 000

showing that total costs will be €10 000, regardless of the number of phone-minutes used by

Verre-Laine.

● *Alternative 3*: €3000 per month plus €2 per minute of phone use. This is an example of a *mixed*

cost. A mixed cost (or semivariable cost) is a cost that has both fixed and variable elements.

Graph 3 in Exhibit 9.1 presents the mixed cost. It has one component that is fixed regardless

of the number of phone-minutes used (€3000 per month) and another component that is

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Exhibit 9.1

Examples of linear cost functions

Graph 1: Variable cost

Graph 2: Fixed cost

Graph 3: Mixed cost

20 000

20 000

20 000

€)

€)

€)

Slope is the

10

variable cost of

Slope is the

000

10 000

10 000

€5 per phone-

variable cost of

Constant or

€2 per phone-

Total costs (

minute used

Total costs (

intercept

Total costs (

minute used

of €10 000

3000

Constant or intercept

of €3000

4000

8000

4000

8000

4000

8000

Cost driver: number of

Cost driver: number of

Cost driver: number of

phone-minutes used

phone-minutes used

phone-minutes used

variable with respect to the number of phone-minutes used (€2 per minute of phone use). In

this example, the constant or intercept is €3000 and the slope coefficient is €2.

We can write the cost function in Graph 3 of Exhibit 9.1 as:

$y = €3000 + €2\ X$

In the case of mixed costs, the total costs in the relevant range increase as the number of

phone-minutes used increases in the relevant range. *However, total costs do not change in pro-*

portion to the change in the number of phone-minutes used in the relevant range. For example,

when 4000 phone-minutes are used, the total costs are [€3000 + (€2 × 4000)] = €11 000, but

when 8000 phone-minutes are used, the total costs are [€3000 + (€2 × 8000)] = €19 000.

Although the number of phone-minutes used has doubled, the total costs have increased to

only 1.73(€19 000 ÷ €11 000) times the original costs.

Understanding cost-behaviour patterns is a crucial input in choosing among the alternatives.

Suppose Verre-Laine expects to use at least 4000 phone-minutes per month. Its costs for 4000

phone-minutes under the three alternatives would be: alternative 1, €20 000 (€5 × 4000); alter-

native 2, €10 000; alternative 3, €11 000 [€3000 + (€2 × 4000)]. Alternative 2 is the least costly.

Moreover, if Verre-Laine used more than 4000 phone minutes, alternatives 1 and 3 would be

even more costly than alternative 2. Verre-Laine would prefer alternative 2.

Basic terms

Note two features of the cost functions in the Verre-Laine/NSC example. For specificity, consider

Graph 3 in Exhibit 9.1.

1 Variations in a *single* cost driver (number of phone-minutes used) explain variations in total costs.

2 The cost functions are linear; that is, the plot of total costs versus phone-minutes used is a

straight line. Because Graph 3 is a straight line, the only information we need to draw is the

constant or intercept term (€3000) and the slope coefficient (€2 per phone-minute used). These

two pieces of information describe total costs for the entire relevant range of the number of

phone-minutes used. That is, within the relevant range, linear cost functions (in the single

cost driver case) can be described by a single constant or intercept (called *a*) and a single slope

coefficient (called *b*). We write the linear cost function as:

$y = a + bX$

Under alternative 1, a = €0 and b = €5 per phone-minute used; under alternative 2,

a = €10 000, b = €0 per phone-minute used; and under alternative 3, a = €3000, b = €2

per phone-minute used.

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The Verre-Laine/NSC example illustrates variable, fixed and mixed cost functions using

information about future cost structures proposed to Verre-Laine by NSC. Often, however, cost

functions are estimated from past cost data. Cost estimation is the attempt to measure *past* cost

relationships between total costs and the drivers of those costs. For example, managers could

use cost estimation to understand what causes marketing costs to change from year to year (the

number of cars sold or the number of new models introduced), and its fixed- and variable-

cost components. Managers are interested in estimating past cost-behaviour patterns primarily

because these estimates can help them make more accurate cost predictions, or forecasts, about

future costs. Better cost predictions help managers make more informed planning and control

decisions, such as the marketing costs budget for next year.

Chapter 2 outlined three other specifications necessary to classify costs into their variable and

fixed-cost components. We review them briefly here.

Choice of cost object

A particular cost item could be variable with respect to one cost object and fixed with respect

to another. For example, annual van registration and licence costs would be a variable cost with

respect to the number of vans owned and operated by Reise-Plus GmbH, an airport transporta-

tion company, but registration and licence costs for a particular van are a fixed cost with respect

to the number of kilometres that the van covered during the year.

Time span

Whether a cost is variable or fixed with respect to a particular driver depends on the time span

considered in the decision situation. The longer the time span, other things being equal, the more

likely that the cost will be variable. For example, inspection salaries and costs at Aérospatiale are

typically fixed in the short run with respect to hours of inspection activity. But in the long run,

Aérospatiale's total inspection costs will vary with the inspection time required: more inspectors

will be hired if more inspection is needed, while some inspectors will be reassigned to other tasks

if less inspection is needed.

Relevant range

Accountants and managers use linear cost functions to approximate the relation of total costs to

cost drivers within a relevant range. Exhibit 9.2 plots the relationship over several years between

total direct manufacturing labour costs and the number of valves produced each year by an

Exhibit 9.2

Linearity within relevant range

350

300

Relevant

250

range

€000) 200

150

Direct manufacturing labour costs (100

50

20

40

60

80

Cost driver: quantity of

valves produced (’000)

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industrial machinery component producer, AMC Ltd, at its Leeds plant. Costs are non-linear

outside the relevant range. In this case, non-linearities occur when the valve output is low because

of inefficiencies in using manufacturing labour. Non-linearities occur at very high levels of pro-

duction because of greater congestion in the plant and the need for more coordination.

The cause-and-effect criterion in choosing cost drivers

The most important issue in estimating a cost function is to determine whether a cause-and-effect

relationship exists between the cost driver and the resulting costs. The cause-and-effect relation-

ship might arise in several ways.

1 It may be due to a physical relationship between costs and the cost driver. An example of a

physical relationship is when units of production is used as the cost driver of materials costs.

To produce more units requires more materials, which results in higher materials costs.

2 Cause and effect can arise from a contractual arrangement, as in the Verre-Laine example

described earlier, where the number of phone-minutes used is the cost driver of the telephone

line costs.

3 Cause and effect can be implicitly established by logic and knowledge of operations. An exam-

ple is when the number of component parts is used as a cost driver of design costs. It seems

intuitively clear that a complex product design with many component parts that must fit

together precisely will incur higher design costs than a simple product with few parts.

Be careful not to interpret a high correlation, or connection, between two variables to mean

that either variable causes the other. A high correlation between two variables, *u* and *v,* indicates

merely that the two variables move together. It is possible that *u* may cause *v*; *v* may cause *u*; *u* and *v* may interact; both may be affected by a third variable *z*; or the correlation may be due to

chance. No conclusions about cause and effect are warranted by high correlations. For example,

higher production generally results in higher materials costs and higher labour costs. Materials

costs and labour costs are highly correlated, but neither causes the other.

Consider another example. Observation in a Swedish town revealed that ‘in years when more

storks build their nests on house chimneys, more babies were born in the town and vice versa’

(Rees, 2000). There is, however, no plausible cause-and-effect explanation for this correlation.

Only a true cause-and-effect relationship, not merely correlation, establishes an economically

plausible relationship between costs and their cost drivers. Economic plausibility gives the analyst

confidence that the estimated relationship will appear again and again in other similar sets of

data. Establishing economic plausibility is a vital aspect of cost estimation.

Cost estimation approaches

There are four approaches to cost estimation:

1 industrial engineering method

2 conference method

3 account analysis method

4 quantitative analysis of current or past cost relationships.

These approaches differ in the costs of conducting the analysis, the assumptions they make, and

the evidence they provide about the accuracy of the estimated cost function. They are not mutu-

ally exclusive. Many organisations use a combination of these approaches.

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Industrial engineering method

The industrial engineering method, also called the work-measurement method, estimates cost func-

tions by analysing the relationship between inputs and outputs in physical terms. This method has

its roots in studies and techniques developed by Frank and Lillian Gilbreth in the early twentieth

century (Opex Learning, 2019). Consider, for example, a carpet manufacturer that uses inputs of

cotton, wool, dyes, direct labour, machine time and power. Production output is square metres of

carpet. Time-and-motion studies analyse the time and materials required to perform the various

operations to produce the carpet. For example, a time-and-motion study may conclude that to

produce 20 square metres of carpet requires 2 kilograms of cotton and 3 litres of dye. Standards

and budgets transform these physical input and output measures into costs. The result is an esti-

mated cost function relating total manufacturing costs to the cost driver, square metres of carpet.

The industrial engineering method can be very time-consuming. Some government contracts

mandate its use. Many organisations, however, find it too costly for analysing their entire cost

structure. More frequently, organisations use this approach for direct-cost categories such as

materials and labour but not for indirect-cost categories such as manufacturing overhead. Phys-

ical relationships between inputs and outputs may be difficult to specify for individual overhead

cost items.

Conference method

The conference method estimates cost functions on the basis of analysis and opinions about costs

and their drivers gathered from various departments of an organisation (purchasing, process

engineering, manufacturing, employee relations, and so on). The Metro Bank in the UK has a

cost-estimating department that develops cost functions for its retail banking products (current

account, Mastercards, mortgages, and so on) on the basis of a consensus of estimates from the rel-

evant departments. The bank uses this information to price products, to adjust its product mix to

the products that are most profitable, and to monitor and measure cost improvements over time.

The conference method allows cost functions and cost estimates to be developed quickly. The

pooling of expert knowledge from each value-chain area gives the conference method credibility.

The accuracy of the cost estimates largely depends on the care and detail taken by the people

providing the inputs.

Account analysis method

The account analysis method estimates cost functions by classifying cost accounts in the ledger

as variable, fixed, or mixed with respect to the identified cost driver. Typically, managers use

qualitative rather than quantitative analysis when making these cost-classification decisions. The

account analysis approach is widely used.

Consider indirect manufacturing labour costs for a small production area (or cell) at Møre-

Teppe AS which weaves carpets for homes and offices and uses state-of-the-art automated weaving

machines. These costs include maintenance, quality control and set-up costs for the machines.

During the most recent twelve-week period, Møre-Teppe worked the machines in the cell for a

total of 862 hours and incurred total indirect manufacturing labour costs of €12 501. Manage-

ment wants the cost analyst to use the account analysis method to estimate a linear cost function

for indirect manufacturing labour costs with machine-hours as the cost driver.

The cost analyst decides to separate total indirect manufacturing labour costs

(€12 501) into costs that are fixed (€2157) and costs that are variable (€10 344) with

respect to the number of machine-hours worked. Variable costs per machine-hour are

€10 344 ÷ 862 = €12. The general cost equation, $y = a +$

,

bX is indirect manufacturing labour

costs = €2157 + (€12 × number of machine-hours). The indirect manufacturing labour cost

per machine-hour is €12 501 ÷ 862 = €14.50.

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Management at Møre-Teppe can use the cost function to estimate the indirect manufactur-

ing labour costs of using 950 machine-hours to produce carpet in the next twelve-week period.

Using the cost function, estimated costs = €2157 + (950 × 12) = €13 557. The indirect man-

ufacturing labour costs per machine-hour decrease to €13 557 ÷ 950 = €14.27, as fixed costs

are spread over a greater number of units.

Organisations differ with respect to the care taken in implementing account analysis. In some

organisations, individuals thoroughly knowledgeable about the operations make the cost-

classification decisions. For example, manufacturing personnel may classify costs such as machine

lubricants and materials-handling labour, while marketing personnel may classify costs such as

advertising brochures and sales salaries. In other organisations, only cursory analysis is con-

ducted, sometimes by individuals with limited knowledge of operations, before cost-classification

decisions are made. Clearly, the former approach would provide more reliable cost classifications,

and hence estimates of the fixed and variable components of the cost, than the latter. Supplement-

ing the account analysis method by the conference method improves its credibility.

One survey of 300 UK manufacturing companies reports that 59% of these companies used

a subjective approach to classify costs in terms of their behaviour. Twenty-eight per cent viewed

all overheads as fixed costs and direct costs as variable costs. Only 2% of these companies used

statistical regression techniques (see section below) and 11% did not distinguish between fixed

and variable costs.

Steps in estimating a cost function

Quantitative analyses of cost relationships are formal methods to fit linear cost functions to past

data observations. Columns 1 and 2 of Exhibit 9.3 break down the €12 501 of total indirect man-

ufacturing labour costs and the 862 total machine-hours for the most recent twelve-week period

into weekly data. Note that the data are paired. For example, week 12 shows indirect manufac-

turing labour costs of €963 and 48 machine-hours. In this section, the data in Exhibit 9.3 are used

to illustrate how to use quantitive analysis.

Exhibit 9.3

Weekly indirect manufacturing labour costs, machine-hours and

direct manufacturing labour-hours for Møre-Teppe

Indirect

Alternative cost driver:

manufacturing

Cost driver:

direct manufacturing

labour costs

machine-hours

labour-hours

Week

(1)

(2)

(3)

1

€1190

68

30

2

1211

88

35

3

1004

62

36

4

917

72

20

5

770

60

47

6

1456

96

45

7

1180

78

44

8

710

46

38

9

1316

82

70

10

1320

94

30

11

752

68

29

12

963

48

38

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There are six steps in estimating a cost function on the basis of an analysis of current or

past cost relationships. (1) Choose the dependent variable (the variable to be predicted, which is

some type of cost); (2) identify the cost driver(s) (independent variable(s)); (3) collect data on the

dependent variable and the cost driver(s); (4) plot the data; (5) estimate the cost function; and

(6) evaluate the estimated cost function. As we discussed earlier in this chapter, choosing a cost

driver is not always straightforward. Frequently, the cost analyst will cycle through these steps

several times trying alternative economically plausible cost drivers to see which cost driver best

fits the data.

Step 1: Choose the dependent variable. Choice of the dependent variable (the cost variable to be

predicted) will depend on the purpose for estimating a cost function. For example, if the purpose

is to determine indirect manufacturing costs for a production line, then the dependent variable

should incorporate all costs that are classified as indirect with respect to the production line.

Step 2: Identify the independent variable(s) or cost driver(s) The independent variable (level

of activity or cost driver) is the factor used to predict the dependent variable (costs). Usually we

use the term ‘cost driver’ to describe the independent variable. The chosen cost driver should

have an economically plausible relationship with the dependent variable and be accurately meas-

urable. Ideally, all the individual items included in the dependent variable should have the same

cost driver(s). Where a single relationship does not exist, the cost analyst should investigate the

possibility of estimating more than one cost function.

Consider several types of fringe benefit paid to employees and their cost drivers:

Fringe benefit

Cost driver

Health benefits

Number of employees

Canteen meals

Number of employees

Pension benefits

Salaries of employees

Life insurance

Salaries of employees

The costs of health benefits and cafeteria meals can be combined into one cost pool because they

both have the same cost driver, number of employees. Pension benefits and life insurance costs

have a different cost driver, salaries of employees, and hence should not be combined with health

benefits and canteen meals. Instead, they should be combined into a separate cost pool and esti-

mated using salaries of employees receiving the benefits as the cost driver.

Step 3: Collect data on the dependent variable and the cost driver(s) This step is usually the

most difficult one in cost analysis. Cost analysts obtain data from company documents, from

interviews with managers, and through special studies. These data may be time-series data or

cross-sectional data. *Time-series data* pertain to the same entity (organisation, plant, activity

area, and so on) over a sequence of past time periods. Weekly observations of indirect man-

ufacturing labour costs and machine-hours in the Møre-Teppe illustration are an example of

time-series data. The ideal time-series database would contain numerous observations for a firm

whose operations have not been affected by economic or technological change. Stable technology

ensures that data collected in the estimation period represent the same underlying relationship

between the dependent variable and the cost driver(s). Moreover, the time periods (for example,

daily, weekly or monthly) used to measure the dependent variable and the cost driver(s) should be

identical. *Cross-sectional data* pertain to different entities for the same time period. For example,

studies of personnel costs and loans processed at 50 individual branches of a bank during March

would produce cross-sectional data for March.

Step 4: Plot the data The expression ‘a picture is worth a thousand words’ conveys the benefits

of plotting the data. The general relation between the dependent variable and the cost driver

can readily be observed in a plot of the data. Moreover, the plot highlights extreme observations

that analysts should check. Was there an error in recording the data or an unusual event, such as

a strike, that makes these observations unrepresentative of the normal relationship between the

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Exhibit 9.4

Plot of weekly indirect manufacturing labour costs and

machine-hours for Møre-Teppe

1600

6

1400

9

1

€) 1200

3

2

7

1000

10

800

12

4

5

11

600

8

labour costs (

400

Indirect manufacturing

200

20

40

60

80

100

Cost driver: machine-hours

dependent variable and the cost driver? Plotting the data can also provide insight into whether the

relation is approximately linear and what the relevant range of the cost function is.

Exhibit 9.4 plots the weekly data from columns 1 and 2 of Exhibit 9.3. There is strong visual evi-

dence of a positive relation between indirect manufacturing labour costs and machine-hours (that

is, when machine-hours go up, so do costs). There do not appear to be any extreme observations

in Exhibit 9.4. The relevant range is from 46 to 96 machine-hours per week.

Step 5: Estimate the cost function We show how to estimate the cost function for our Møre-

Teppe data using the high–low method and regression analysis.

Step 6: Evaluate the estimated cost function We describe criteria for evaluating a cost function

after illustrating the high–low method and regression analysis.

High–low method

Managers, at times, use very simple methods to estimate cost functions. An example is the high–

low method, which entails using only the highest and lowest observed values of the *cost driver*

within the relevant range. The line connecting these two points becomes the estimated cost

function.

We illustrate the high–low method using data from Exhibit 9.3.

Cost driver:

Indirect manufacturing

machine-hours

labour costs

Highest observation of cost driver

(week 6)

96

€1456

Lowest observation of cost driver

(week 8)

46

710

Difference

50

€746

Difference between costs associated with highest

and lowest observations of the cost driver

Slope coeffcient *b* =

Difference between highest and lowest

observations of the cost driver

= €746 ÷ 50

= €14.92 per machine-hour

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Chapter 9 Determining how costs behave

To compute the constant, we can use either the highest or the lowest observation of the cost

driver. Both calculations yield the same answer (because the solution technique solves two linear

equations with two unknowns, the slope coefficient and the constant).

Since $y = a +$

,

$bX\ a = y - bX$

At the highest observation of the cost driver,

Constant a = €1456 − (€14.92 × 96)

= €23.68

At the lowest observation of the cost driver,

Constant a = €710 − (€14.92 × 46)

= €23.68

Therefore, the high–low estimate of the cost function is:

$y = a + bX$

= €23.68 + (€14.92 × machine-hours)

The blue line in Exhibit 9.5 shows the estimated cost function using the high–low method. The

estimated cost function is a straight line joining the observations with the highest and lowest

values of the cost driver (machine-hours). The constant, or intercept, term does not serve as an

estimate of the fixed costs of Møre-Teppe if no machines were run. Why? Because running no

machines and shutting down the plant is outside the relevant range. The intercept term is the

constant component of the equation that provides the best (linear) approximation of how a cost

behaves within the relevant range.

Suppose indirect manufacturing labour costs in week 6 were €1280 instead of €1456 while 96

machine-hours were worked. In this case, the highest observation of the cost driver (machine-

hours of 96 in week 6) will not coincide with newly highest observation of the dependent variable

(costs of €1316 in week 9). Given that causality runs from the cost driver to the dependent variable

in a cost function, choosing the highest and lowest observation of the cost driver is appropriate.

The high–low method would estimate the new cost function still using data from weeks 6 and 8.

Exhibit 9.5

High–low method for weekly indirect manufacturing labour

costs and machine-hours for Møre-Teppe

Relevant range

1600

6

1400

9

1

€) 1200

2

7

1000

3

10

800

12

4

5

11

600

8

labour costs (

400

Indirect manufacturing

200

20

40

60

80

100

Machine-hours

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Steps in estimating a cost function

257

There is an obvious danger of relying on only two observations. Suppose that because of cer-

tain provisions in the labour contract that guarantee certain minimum payments, indirect man-

ufacturing labour costs in week 8 were €1000 instead of €710 when only 46 machine-hours were

worked. The green line in Exhibit 9.5 shows the revised estimated cost function using the high–low

method. It lies above the data. In this case, picking the highest and lowest observations for the

machine-hours variable can result in an estimated cost function that poorly describes the under-

lying (linear) cost relationship between indirect manufacturing labour costs and machine-hours.

Sometimes the high–low method is modified so that the two observations chosen are a rep-

resentative high and a representative low. The reason is that management wants to avoid having

extreme observations, which arise from abnormal events, affecting the cost function. Even with

such a modification, this method ignores information from all but two observations when esti-

mating the cost function.

Regression analysis method

Unlike the high–low method, regression analysis uses all available data to estimate the cost func-

tion. Regression analysis is a statistical method that measures the average amount of change in the

dependent variable that is associated with a unit change in one or more independent variables. In

the Møre-Teppe example, the dependent variable is total indirect manufacturing labour costs. The

independent variable, or cost driver, is machine-hours. Simple regression analysis estimates the rela-

tionship between the dependent variable and one independent variable; multiple regression analysis

estimates the relationship between the dependent variable and multiple independent variables.

We emphasise the interpretation and use of output from computer software programs for

regression analysis and so only present detailed computations for deriving the regression line in

the chapter appendix. Commonly available programs calculate almost all the statistics referred

to in this chapter.

Exhibit 9.6 shows the line developed using regression analysis that best fits the data in columns

1 and 2 of Exhibit 9.3. The estimated cost function is:

$y = €300.98 + €10.31\ X$

where y is the predicted indirect manufacturing labour costs for any level of machine-hours (X).

The constant, or intercept, term of the regression, *a,* is €300.98, and the slope coefficient *b* is

€10.31 per machine-hour.

Exhibit 9.6

Regression model for weekly indirect manufacturing labour

costs and machine-hours for Møre-Teppe

Relevant range

1600

6

1400

9

1

2

€) 1200

7

1000

12

3

10

800

4

5

11

600

8

labour costs (

400

Indirect manufacturing

200

20

40

60

80

100 110

Cost driver: machine-hours

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How do we derive the regression equation and regression line in Exhibit 9.6? We use the

least-squares technique. We draw the regression line to minimise the sum of the squared vertical

distances from the data points (the various points on the graph) to the regression line. Vertical

differences measure distance between actual cost and the estimated cost for each observation. The

difference between actual and predicted cost is called the residual term. The smaller the residual

term, the better the fit between predicted costs and actual cost observations. Goodness of fit

indicates the strength of the relationship between the cost driver and costs. The regression line in

Exhibit 9.6 rises reasonably steeply from left to right. The positive slope of this line indicates that,

on average, indirect manufacturing labour costs increase as machine-hours increase.

The vertical dashed lines in Exhibit 9.6 indicate the relevant range. As discussed previously,

the estimated cost function applies to cost driver levels only *within the relevant range,* not to cost

driver levels outside the relevant range.

The estimate of the slope coefficient *b* indicates that the average indirect manufacturing labour

costs vary at the rate of €10.31 for every machine-hour within the relevant range. Management

can use this equation when budgeting for future indirect manufacturing labour costs. For instance,

if 90 machine-hours are budgeted for the coming week, the predicted indirect manufacturing

labour costs would be:

y = €300.98 + (€10.31 × 90)

= €1228.88

Compare the regression equation with the high–low equation in the preceding section, which

was €23.68 + €14.92 per machine-hour. For 90 machine-hours, the predicted cost based on the

high–low equation is €23.68 + (€14.92 × 90) = €1366.48. Suppose that for three weeks over the

next twelve-week period, Møre-Teppe runs its machines for 90 hours each week. Assume aver-

age indirect manufacturing labour costs for those three weeks is €1300. Based on the high–low

prediction of €1366.48, Møre-Teppe would conclude it has performed well. But comparing the

€1300 performance with the €1228.88 prediction of the regression model tells a different story,

and would probably prompt Møre-Teppe to search for ways to improve its cost performance.

Evaluating and choosing cost drivers

Correctly identifying the cost driver is aided substantially by a thorough understanding of both

operations and cost accounting. Suppose management at Møre-Teppe is thinking of introducing

a new style of carpet. Sales of 650 square metres of this carpet are expected each week at a price

of €12 per square metre. To make this decision, management needs to estimate costs. The key to

doing so is identifying the correct cost drivers and cost functions. This requires some knowledge of

the underlying operational processes. Consider, in particular, indirect manufacturing labour costs.

Management believes that both machine-hours and direct manufacturing labour-hours are plausi-

ble cost drivers of indirect manufacturing labour costs. It estimates 72 machine-hours and 21 direct

manufacturing labour-hours would be required to produce the square metres of carpet it needs.

What guidance do the different cost estimation methods provide for choosing among cost

drivers? The industrial engineering method relies on analysing physical relationships between

costs and cost drivers, which are difficult to specify in this case. The conference method and the

account analysis method use subjective assessments to choose a cost driver and to estimate the

fixed and variable components of the cost function. In these cases, management must go with its

best judgement. Management cannot use these methods to test and try alternative cost drivers.

The major advantage of quantitative methods is that managers can use these methods to evaluate

different cost drivers. We illustrate how using the regression analysis approach.

Suppose Møre-Teppe wants to evaluate whether direct manufacturing labour-hours is a better

cost driver than machine-hours for indirect manufacturing labour costs. The cost analyst at Møre-

Teppe inputs the data in columns 1 and 3 of Exhibit 9.3 into a computer program and estimates

the cost function:

$y = €744.67 + €7.72\,X$

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Exhibit 9.7

Regression model for weekly indirect manufacturing labour costs and direct manufacturing labour-hours for Møre-Teppe

Relevant range

1600

6

1400

9

1

2

€) 1200

7

1000

10

4

3

800

12

5

600

11

8

labour costs (

400

Indirect manufacturing

200

10

20

30

40

50

60

70

80

Cost driver: direct manufacturing labour-hours

Exhibit 9.7 shows the plots for indirect manufacturing labour costs and direct manufacturing

labour-hours, and the regression line that best fits the data.

Which cost driver should Møre-Teppe choose? We consider three of the most important

criteria.

1 *Economic plausibility.* Both cost drivers are economically plausible. However, in the state-of-

the-art, highly automated production environment of Møre-Teppe, costs are likely to be more

closely related to machine-hours than to direct manufacturing labour-hours.

2 *Goodness of fit.* Compare Exhibits 9.6 and 9.7. The vertical differences between actual and

predicted costs are much smaller for machine-hours than for direct manufacturing labour-

hours – machine-hours has a stronger relationship with indirect manufacturing labour costs.

3 *Slope of regression line.* Again compare Exhibits 9.6 and 9.7. The machine-hours regression

line has a relatively steep slope while the direct manufacturing labour-hours regression line is

relatively flat (small slope). A relatively flat regression line indicates a weak or no relationship

between indirect manufacturing labour costs and direct manufacturing labour-hours since,

on average, changes in direct manufacturing labour-hours appear to have a minimal effect on

indirect manufacturing labour costs.

Møre-Teppe should prefer machine-hours as the cost driver and use the cost function

y = €300.98 + (€10.31 × machine-hours) to predict future indirect manufacturing labour costs.

Using this model, Møre-Teppe would predict costs of y = €300.98 + (€10.31 × 72) = €1043.30.

Had it used direct manufacturing labour-hours as the cost driver, it would have incorrectly pre-

dicted costs of €744.67 + (€7.72 × 21) = €906.79. If Møre-Teppe systematically underestimates

costs and chooses incorrect cost drivers for other indirect costs as well, it would conclude that the

costs of manufacturing the new style of carpet are quite low and essentially fixed (the regression

line is relatively flat). But the actual costs driven by machine-hours would prove to be much higher.

Without identifying the correct cost drivers, management would be misled into believing that the

new style of carpets are more profitable than they actually are.

Incorrectly estimating the cost function will also have repercussions for cost management

and cost control. Suppose direct manufacturing labour-hours was used as the cost driver, and

actual indirect manufacturing labour costs were €970. Actual costs would then be higher than

the predicted costs of €906.79. Management would feel compelled to find ways to cut costs. In

fact, on the basis of the preferred machine-hour cost driver, the plant has actual costs lower than

the predicted amount (€1043.30) – a performance that management should seek to replicate,

not change.

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Cost drivers and activity-based costing

In activity-based costing (ABC) systems (discussed more fully in Chapter 11), operations manag-

ers and cost analysts identify key activities, and the cost drivers and costs of each activity at the

output unit-level, batch-level or product-sustaining level. The basic approach to evaluating cost

drivers described in the previous section applies to ABC systems as well. An ABC system, however,

has a greater number and variety of cost drivers and cost pools.

Generally, ABC systems emphasise long-run relationships between the cost driver (level of

activity) and cost. The long-run focus means that more costs are variable, which leads to a

stronger cause-and-effect relationship between the cost driver and the corresponding cost. Hence,

the ideal database to estimate cost driver rates will contain data over a longer time period. If the

time period used to estimate the cost relationship is short, the relationship between changes in the

cost driver and changes in cost may be weak. Why? Because many costs are acquired in lump-sum

amounts and hence are fixed in the short run while the levels of activity vary.

Consider, for example, salaries and fringe benefits of engineers and line managers responsible

for supervising the set-up activity. In the short run, these costs are fixed and will not vary with

changes in the quantity of set-up hours. In the long run, however, there is a clear cause-and-effect

relationship between set-up hours and indirect set-up costs – increases in set-up hours will cause

more engineers and line managers to be hired while decreases will result in engineers and line

managers being assigned to other tasks.

Concepts in action

Activity-based costing and cost estimation

Cost estimation in activity-based costing and other systems blend the various methods presented in this chapter. To

determine the cost of an activity, ABC systems often rely on expert analyses and opinions gathered from operating

personnel (the conference method). For example, Loan Department staff at the Co-operative Bank in the UK sub-

jectively estimate the costs of the loan processing activity and the cost driver of loan processing costs (the number

of loans processed, a batch-level cost driver, rather than the value of the loans, an output unit-level cost driver), to

derive the cost of processing a loan. ABC systems sometimes use input–output relationships (the industrial engineering

method) to identify cost drivers and the cost of an activity.

In complex environments, multiple cost drivers are necessary for accurate product costing. Consider how heavy

equipment manufacturer Caterpillar identifies the cost driver for receiving costs in its ABC system. Three plausible

cost drivers are the weight of parts received, the number of parts received, or the number of shipments received. The

weight of parts and number of parts are output unit-level cost drivers, while the number of shipments is a batch-level

cost driver. Caterpillar uses the weight of parts as the basis for cost assignment because a regression analysis showed

that it is the primary driver of the costs of receiving material. Caterpillar also uses a variety of other cost drivers in

assigning costs to its products. Thus, managers using ABC systems employ a variety of methods to estimate cost rela-

tionships. In the United Kingdom, the City of London Police uses input–output relationships (the industrial engineering

method) to identify cost drivers and the cost of an activity. Using a surveying methodology, officials can determine

the total costs associated with responding to house robberies, dealing with burglaries, and filling out police reports.

The industrial engineering method is also used by US government agencies such as the United States Postal Service,

to determine the cost of each post office transaction, and the United States Patent and Trademark Office, to identify

the costs of each patent examination.

When choosing among methods, managers trade off level of detail, accuracy, feasibility, and costs of estimating

cost functions. For example, to estimate the cost of an activity such as opening a bank account or making a transfer

payment, Bankinter in Spain uses work-measurement methods, while Royal Bank of Canada uses advanced analytical

techniques, including regression.

Source: Kaplan, R.S. and Datar, S.M. (1995) ‘The Co-operative Bank’, *Harvard Business School Cases,* No. 9-195–96, 23 March (revised 22 April 1997).

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Big data, machine learning and cost analysis

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As the ‘Concepts in action’ feature indicates, managers implementing ABC systems use a

variety of methods – conference, industrial engineering and regression – to estimate cost driver

rates. In making these choices, managers trade off level of detail, accuracy, feasibility and costs

of estimating cost functions.

Many ABC systems have a great number and variety of cost drivers and cost pools. This means

the systems require managers to estimate many cost relationships. When estimating the cost func-

tion for each cost pool, the manager must pay careful attention to the cost hierarchy. For example,

if a cost is a batch-level cost such as set-up cost, the manager must only consider batch-level cost

drivers like number of set-up-hours. In some cases, the costs in a cost pool may have more than

one cost driver from different levels of the cost hierarchy. The cost drivers for one company’s indi-

rect manufacturing labour costs could be machine-hours and the number of production batches

of goods manufactured. Furthermore, it may be difficult to subdivide the indirect manufacturing

labour costs into two cost pools and to measure the costs associated with each cost driver. In

cases like these, companies use multiple regression to estimate costs based on more than one

independent variable. The appendix to this chapter discusses multiple regression in more detail.

Big data, machine learning and cost analysis

We have mentioned ‘big data’ in several places in this book. This concept refers formally to data-

sets for which traditional processing techniques (for capturing, storing, querying or analysing)

are inadequate due to the quantity or complexity of the data. Such data sources are increasingly

available because of the presence of inexpensive sensors, including those found on mobile devices,

cameras, drones, satellites and personal fitness devices. The costs of storing the data have dropped

significantly. Moreover, vast quantities of cheap computing power are now available on demand

due to cloud-based providers.

More and more, companies are using big-data-focused quantitative analysis to determine the

cost drivers of activities. DHL Express, the international shipping company, recently switched

from the conference method to performing in-depth quantitative analysis on its big data system.

Now managers have a single, worldwide activity-based costing system that shows the cost and

profitability for every shipment in its network. By rigorously analysing its database, DHL Express

can link the profit of what's being shipped on a particular flight with the cost of shipping it and

then determine which of its 250 airplanes would be best for the job.

Taken in combination, digital technologies and the availability of growing data pools have given

companies the opportunity to carry out sophisticated analyses on larger datasets at relatively low

cost. Companies have taken advantage by using regression and related techniques to better target

customers and optimise operations in order to improve profitability. One tool in particular that

has proven to be powerful is 'logistic regression', which is used when the dependent variable takes

on a limited set of values (for example, a binary variable, such as whether someone will purchase a

car or not). Logistic regression is used in credit scoring by banks to predict whether you are going

to default in the next year on each of your credit products. Regression methods are sometimes

hampered by the presence of large quantities of data because of the sheer number of potential

regressors available. However, analytical approaches can complement regression analysis to reduce

the likelihood of false positives. In other situations, the available data are in the forms of text,

images or audio rather than numbers. Examples include health records, Twitter feeds, webpages

and podcasts. Regression techniques are not feasible in these cases. However, it is possible to use

natural language processing to exploit the linguistic structure inherent in all human communi-

cation, and thereby identify trends in the data. Often, this is done via machine learning, which

can extract value from big and disparate data sources with little reliance on human direction.

It is data driven and runs at machine scale, and, unlike traditional analysis, thrives on growing

datasets. The more data fed into a machine learning system, the more it can learn and apply the

results to higher quality insights, with the goal to discover and display the patterns buried in the

data. The importance to managers of understanding the value of such techniques will only grow.

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Chapter 9 Determining how costs behave

Non-linearity and cost functions

So far we have assumed linear cost functions. In practice, cost functions are not always linear.

A non-linear cost function is a cost function where, within the relevant range, the graph of total

costs versus the level of a single activity is not a straight line. Exhibit 9.2 graphically illustrated

a cost function that is non-linear over the range from 0 to 80 000 valves produced. Consider

another example. Economies of scale in advertising may enable an advertising agency to double

the number of advertisements for less than double the costs. Even direct materials costs are not

always linear variable costs. Consider quantity discounts on direct materials purchases. As shown

in Exhibit 9.8, the total direct materials costs rise, but they rise more slowly as the cost driver

increases because of quantity discounts. The cost function in Exhibit 9.8 has b = €25 for 1–1000

units purchased; b = €15 for 1001–2000 units purchased; and b = €10 for 2001 or more units

purchased (a = €0 for all ranges of the units purchased). The cost per unit falls at each price

break; that is, the cost per unit decreases with larger orders.

Step cost functions are also examples of non-linear cost functions. A step cost function is a

cost function in which the cost is constant over various ranges of the cost driver, but the cost

increases by discrete amounts (that is, in steps) as the cost driver moves from one range to the

next. The graph in Exhibit 9.9 shows a *step variable-cost function,* a step cost function in which

cost is constant over narrow ranges of the cost driver in each relevant range. Exhibit 9.9 shows

Exhibit 9.8

Effects of quantity discounts on slope of direct materials cost

function

50 000

€) 40 000

30 000

20 000

10 000

Direct materials costs (

1000

2000

3000

Cost driver: units of direct

materials purchased

Exhibit 9.9

Step variable-cost function

7500

Actual cost

€)

behaviour

5000

2500

Linear

Set-up costs (

approximation

of cost behaviour

2000

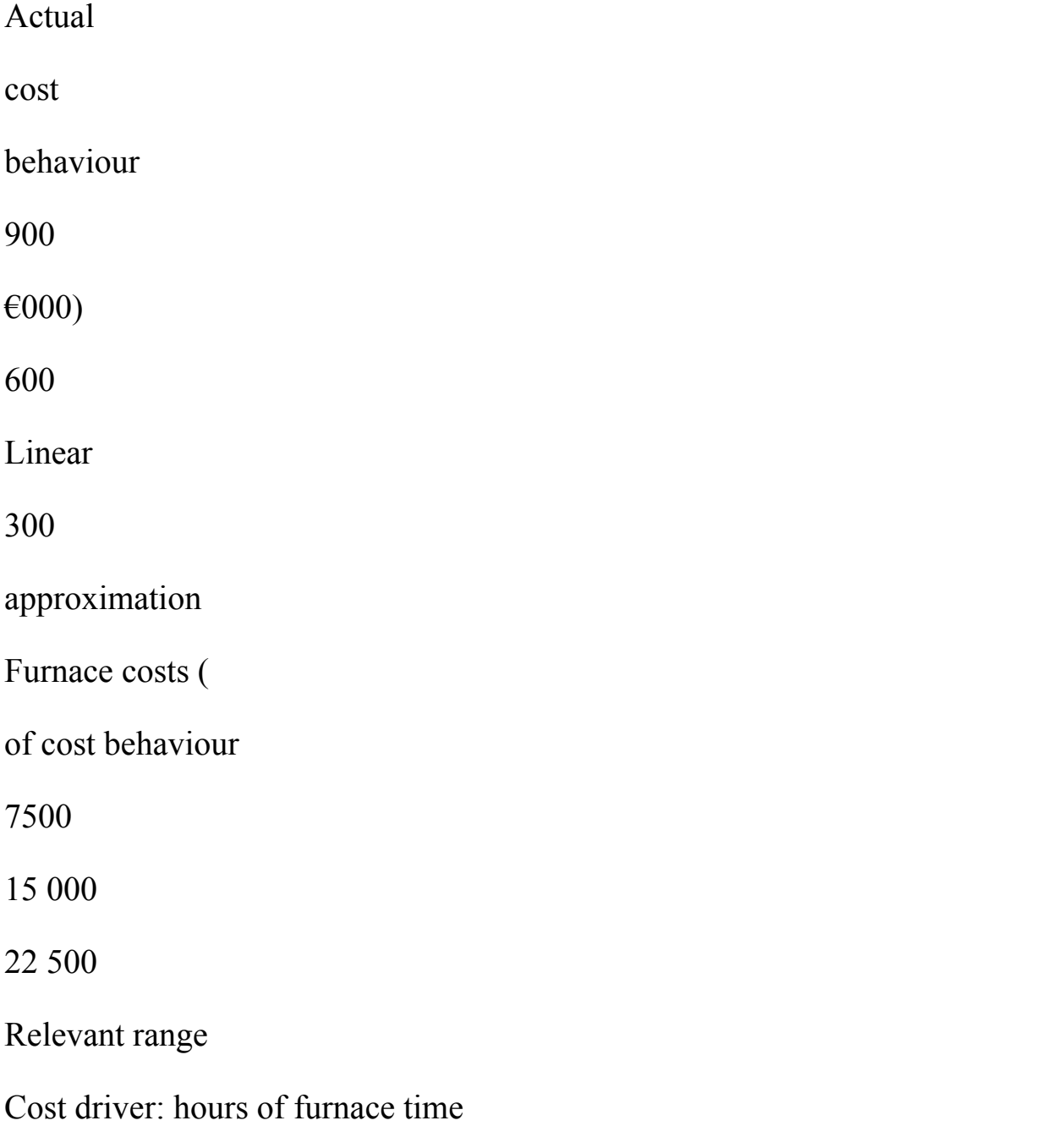
4000

6000

Cost driver: units of production

Exhibit 9.10

Step fixed-cost function



the relationship between set-up costs and units of production. The pattern is a step cost function

because set-up costs are incurred only when each production batch is started. This step-pattern

behaviour also occurs when inputs such as production scheduling, product design labour and

process engineering labour are acquired in discrete quantities but used in fractional quantities.

As shown in Exhibit 9.9, management often approximates step variable costs with a variable cost

function.

The graph in Exhibit 9.10 shows a *step fixed-cost function* for Bayern Metal, a company

that operates large heat-treatment furnaces to harden steel parts. The main difference relative to

Exhibit 9.9 is that the cost in a step fixed-cost function is constant over large ranges of the cost

driver in each relevant range. The ranges indicate the number of furnaces being used (each furnace

costing €300 000). The cost changes from one range to the next higher range when the hours of

furnace time demanded require the use of another furnace. The relevant range indicates that the

company expects to operate with two furnaces at a cost of €600 000. Management considers the

cost of operating furnaces as a fixed cost within the relevant range of operation. However, over

the range from 0 to 22 500 hours, the cost function is non-linear.

Learning curves and non-linear cost functions

Learning curves also result in cost functions being non-linear. A learning curve is a function that

shows how labour-hours per unit decline as units of production increase and workers learn and

become better at what they do. Managers use learning curves to predict how labour-hours (or

labour costs) will change as more units are produced.

The aircraft-assembly industry first documented the effect that learning has on efficiency.

As workers become more familiar with their tasks, their efficiency improves.

Managers learn how to improve the scheduling of work shifts. Plant operators learn how best

to operate the facility. Unit costs decrease as productivity increases, which means that the unit-

cost function behaves non-linearly.

Managers are now extending the learning-curve notion to include other cost areas in the value

chain, such as marketing, distribution and customer service. The term *experience curv* e describes

this broader application of the learning curve. An experience curve is a function that shows how

full product costs per unit (including manufacturing, marketing, distribution, and so on) decline

as units of output increase.

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Exhibit 9.11

Plots for cumulative average-time learning model

Graph 1: Cumulative average time per unit

Graph 2: Cumulative total labour-hours

120

4000

t

3000

80

2000

Time

40

1000

Time per uni (labour-hours)

(labour-hours)

16 32 48 64 80 96 112128

16 32 48 64 80 96 112128

Cumulative units

Cumulative units

We now describe two learning-curve models: the cumulative average-time learning model and

the incremental unit-time learning model.

Cumulative average-time learning model

In the cumulative average-time learning model, the cumulative average time per unit declines by a

constant percentage each time the cumulative quantity of units produced doubles. Exhibit 9.11

illustrates the cumulative average-time learning model with an 80% learning curve. The 80%

means that when the quantity of units produced is doubled from X to 2 X, the cumulative aver-

age time *per unit* for the 2 X units is 80% of the cumulative average time *per unit* for the X units.

In other words, average time per unit has dropped by 20%. Graph 1 in Exhibit 9.11 shows the

cumulative average time *per unit* as a function of units produced. Graph 2 in Exhibit 9.11 shows

the cumulative *total* labour-hours as a function of units produced. The data points underlying

Exhibit 9.11 and the details of their calculation are presented in Exhibit 9.12. To obtain the

cumulative total time, multiply the cumulative average time per unit by the cumulative number of

units produced. For example, to produce 4 cumulative units would require 256.00 labour-hours

(4 × 64).

Incremental unit-time learning model

In the incremental unit-time learning model, the incremental unit time (the time needed to pro-

duce the last unit) declines by a constant percentage each time the cumulative quantity of units

produced doubles. Exhibit 9.13 illustrates the incremental unit-time learning model with an 80%

learning curve. The 80% here means that when the quantity of units produced is doubled from

X to 2 *X,* the time needed to produce the *last unit* at the 2 *X* production level is 80% of the time needed to produce the *last unit* at the *X* production level. Graph 1 in Exhibit 9.13 shows the cumulative average time *per unit* as a function of cumulative units produced. Graph 2 in Exhibit 9.13

shows the cumulative *total* labour-hours as a function of units produced. The data points under-

lying Exhibit 9.13 and the details of their calculation are presented in Exhibit 9.14. We obtain the

cumulative total time by summing the individual unit times. For example, to produce 4 cumulative

units would require 314.21 labour-hours (100.00 + 80.00 + 70.21 + 64.00).

The incremental unit-time model predicts that a higher cumulative total time is required to

produce two or more units than the cumulative average-time model predicts, assuming the same

learning rate for the two models (compare results in Exhibit 9.12 with results in Exhibit 9.14).

For example, to produce four cumulative units, the 80% incremental unit-time learning model

predicts 314.21 labour-hours whereas the 80% cumulative average-time learning model predicts

256.00 labour-hours.

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Exhibit 9.12

Cumulative average-time learning model

Cumulative

Cumulative average

Cumulative

Individual unit

number of

time per unit (y):

total time:

time for X th

units

labour-hours

labour-hours

unit: labour-hours

(1)

(2)

(3) = (1) × (2)

(4)

1

100.00

100.00

100.00

2

80.00 (100 × 0.8)

160.00

60.00

3

70.21

210.63

50.63

4

64.00 (80 × 0.8)

256.00

45.37

5

59.57

297.85

41.85

6

56.17

337.02

39.17

7

53.45

374.15

37.13

8

51.20 (64 × 0.8)

409.60

35.45

–

–

–

–

–

–

–

–

–

–

–

–

16

40.96 (5.12 × 0.8)

655.36

28.06

Note: The mathematical relationship underlying the cumulative average-time learning model is:

y

$pX\,q$

$=$

where y = cumulative average time (labour-hours) per unit

X = cumulative number of units produced

p = time (labour-hours) required to produce the first unit

q = rate of learning.

The value of q is calculated as:

q

ln (% learning)

$=$

ln 2

For an 80% learning curve,

q

0.2231

$= -$

= −0.3219

0.6931

As an illustration, when $X = 3$, $p = 100$, and $q = -0.3219$,

y

100 3−0.3219

=

×

= 70.21 labour-hours

The cumulative total time when $X = 3$ is 70.21× 3 = 210.63 labour-hours.

The individual unit times in column 4 are calculated using the data in column 3. For example,

the individual unit time of 50.63 labour-hours for the third unit is calculated as 210.63 – 160.00.

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Exhibit 9.13

Plots for incremental unit-time learning model

Graph 1: Cumulative average time per unit

Graph 2: Cumulative total labour-hours

120

4000

3000

80

2000

Time

40

1000

Time per unit (labour-hours)

(labour-hours)

16 32 48 64 80 96 112128

16 32 48 64 80 96 112128

Cumulative units

Cumulative units

Exhibit 9.14

Incremental unit-time learning model

Individual unit

Cumulative

Cumulative

Cumulative

time for X th unit (m):

total time:

average time per

number

labour-hours

labour-hours

unit: labour-hours

of units (1)

(2)

(3)

(4) = (3) ÷ (1)

1

100.00

100.00

100.00

2

80.00 (100 × 0.8)

180.00

90.00

3

70.21

250.21

83.40

4

64.00 (80 × 0.8)

314.21

78.55

5

59.57

373.78

74.76

6

56.17

429.95

71.66

7

53.45

483.40

69.06

8

51.20 (64 × 0.8)

534.60

66.82

–

–

–

–

–

–

–

–

–

–

–

–

–

16

40.96 (51.2 × 0.8)

892.00

55.75

Note: The mathematical relationship underlying the incremental unit-time learning model is:

m

pX q

> =

where *m* = time (labour-hours) taken to produce the last single unit

X = cumulative number of units produced

p = time (labour-hours) required to produce the first unit

q = rate of learning.

The value of *q* is calculated as:

q

ln (% learning)

=

ln 2

For an 80% learning curve,

q

0.2231

= −

= −0.3219

0.6931

As an illustration, when $X = 3$, $p = 100$, and $q = -0.3219$,

m

100 3−0.3219

=

×

= 70.21labour-hours

The cumulative total time when $X = 3$ is 100 + 80 + 70.21 = 250.21 labour-hours.



Concepts in action

Learning curves and the falling price of renewable energy

Over time, renewable energy providers have moved ‘up the learning curve’ and reduced manufacturing and deployment costs. As the number of installations around the world increases, *learning by* doing has improved manufacturing and distribution operations, installation procedures, and sales and financing processes. Fixed costs have spread over a larger volume of production. Costs have also decreased with the adop-

tion of newer technologies and spillover effects of innovation from other industries.

The net effect is a dramatic drop in the price of renewable energy. From 2009 to 2017, the price of solar installations globally decreased 81%, while the cost to produce a kilowatt hour (kWh) of solar energy dropped 73% from $0.36 to $0.10. Similar price decreases have also occurred in the hydropower, offshore wind, and onshore wind markets.

Over time, all renewable power- generation technologies that are now in commercial use will produce power at or below the kWh price for fossil fuels such as coal and oil.

Thanks to learning curves, renewable energy is an increasingly competitive way to meet new energy generation needs around the world.

The learning-curve models examined here assume that learning is driven by a single variable (production output).

Other models of learning have been developed (by companies such as Analog Devices and Hewlett-Packard) that focus on how quality — rather than manufacturing labor-hours — will change over time, regardless of whether more units are produced. Studies indicate that factors other than production output, such as job rotation and organizing workers into teams, contribute to learning that improves quality.

Sources: Alan AtKisson (2018) 'The "big push": Transforming the world's energy systems', *North Star* (blog), *GreenBiz,* 23 January (https://www.greenbiz.

com/article/big-push-transforming-worlds-energy-systems); National Academies of Sciences, Engineering, and Medicine (2016) *The Power of Change: Innovation for Development and Deployment of Increasingly Clean Electric Power Technologies,* Washington, DC: The National Academies Press (https://

www.nap.edu/catalog/21712/the-power-of-change-innovation-for-development-and-deployment-of); International Renewable Energy Agency (2018) *Renewable Power Generation Costs in 2017,* Abu Dhabi: International Renewable Energy Agency (https://www.irena.org/-/media/Files/IRENA/Agency/

Publication/2018/Jan/IRENA_2017_Power_Costs_2018.pdf).

Which of these two models is preferable? The one that more accurately approximates the

behaviour of manufacturing labour-hour usage as production levels increase. The choice can be

decided only on a case-by-case basis. Engineers, plant managers and workers are good sources

of information on the amount and type of learning actually occurring as production increases.

Plotting this information is helpful in selecting the appropriate model.

Setting prices, budgets and standards

Predictions of costs should allow for learning. Consider the data in Exhibit 9.12 for the cumulative

average-time learning model. Suppose the variable costs subject to learning effects consist of direct

manufacturing labour (€20 per hour) and related overhead (€30 per hour). Management should

predict the costs shown in Exhibit 9.15.

These data show that the effects of the learning curve could have a major influence on deci-

sions. For example, a company might set an extremely low selling price on its product in order

to generate high demand. As the company's production increases to meet this growing demand,

costs per unit drop. The company rides the product down the learning curve as it establishes a

higher market share. Although the company may have earned little on its first unit sold – it may

actually have lost money – the company earns more profit per unit as output increases.

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Exhibit 9.15

Predicting costs using learning curves

Cumulative

Cumulative

Additions to

number of

total

Cumulative

cumulative

units

labour-hours*

costs

costs

1

100.00

€5 000 (100.00 × €50)

€5 000

2

160.00

8 000 (160.00 × €50)

3 000

4

256.00

12 800 (256.00 × €50)

4 800

8

409.60

20 480 (409.60 × €50)

7 680

16

655.36

32 768 (655.36 × €50)

12 288

* Based on the cumulative average-time learning model. See Exhibit 9.12 for the computation of these amounts.

Alternatively, subject to legal and other considerations, the company might set a low price on

just the final eight units. After all, the labour and related overhead costs per unit are predicted

to be only €12 288 for these final eight units (€32 768 − €20 480). The per unit costs of €1536

on these final eight units (€12 288 ÷ 8) are much lower than the €5000 costs per unit of the first

unit produced.

Many companies incorporate learning-curve effects when evaluating performance. For exam-

ple, the Nissan Motor Company sets assembly-labour efficiency standards for new models of cars

after taking into account the learning that will occur as more units are produced.

The learning-curve models examined in Exhibits 9.11 to 9.14 assume that learning is driven by a

single variable (production output). Other models of learning have been developed by companies

such as Analog Devices and Yokogawa Hewlett-Packard that focus on how quality (rather than

manufacturing labour-hours) will change over time (rather than as more units are produced).

Some recent studies suggest that factors other than production output – such as job rotation and

organising workers into teams – contribute to learning that improves quality.

Summary

The following points are linked to the chapter's learning objectives.

1 Two assumptions frequently made in cost-behaviour estimation are: (a) that changes in total costs can be explained

by changes in the level of a single cost driver, and (b) that cost behaviour can adequately be approximated by a

linear function of the cost driver within the relevant range.

2 A linear cost function is a cost function where, within the relevant range, the graph of total costs versus a single

cost driver forms a straight line. Linear cost functions can be described by a single constant (a), which represents

the estimate of the total cost component that does not vary with changes in the level of the cost driver, and a slope

coefficient (b), which represents the estimate of the amount by which total costs change for each unit change in

the level of the cost driver. Three types of linear cost functions are: variable, fixed and mixed (or semivariable).

3 Four broad approaches to estimating cost functions are: the industrial engineering method, the conference

method, the account analysis method, and quantitative analysis of cost relationships (the high–low method and

regression analysis method). Regression analysis is a systematic approach to estimating a cost function on the basis

of identified cost drivers. Ideally, the cost analyst applies more than one approach; each approach serves as a check

on the others.

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4 The six steps in estimating a cost function on the basis of an analysis of current or past cost relationships are: (a)

choose the dependent variable; (b) identify the cost driver(s); (c) collect data on the dependent variable and the

cost driver(s); (d) plot the data; (e) estimate the cost function; and (f) evaluate the estimated cost function. In

most situations, the cost analyst will cycle through these steps several times before identifying an acceptable cost

function. A growing pool of data is becoming available through big data and machine learning applications which

enhances the potential for cost analysis for many firms.

5 Three criteria for evaluating and choosing cost drivers are: (a) economic plausibility, (b) goodness of fit, and (c) the

slope of the regression line.

6 A non-linear cost function is a cost function where, within the relevant range, the graph of total costs versus a single

cost driver does not form a straight line. Non-linear costs can arise due to economies of scale, quantity discounts,

step cost functions and learning-curve effects.

7 The learning curve is an example of a non-linear cost function. Labour-hours per unit decline as units of produc-

tion increase. In the cumulative average-time learning model, the cumulative average-time per unit declines by a

constant percentage each time the cumulative quantity of units produced doubles. In the incremental unit-time

learning model, the incremental unit time (the time needed to produce the last unit) declines by a constant per-

centage each time the cumulative quantity of units produced doubles.

Appendix

Regression analysis

This appendix describes formulae for estimating the regression equation and several commonly

used statistics. We use the data for Møre-Teppe presented in Exhibit 9.3. The appendix also

discusses goodness of fit, significance of independent variables, and specification analysis of

estimation assumptions for regression analysis.

Estimating the regression line

The least-squares technique for estimating the regression line minimises the sum of the squares

of the vertical deviations (distances) from the data points to the estimated regression line.

The object is to find the values of a and b in the predicting equation $y = a +$

,

bX where y

is the predicted cost value as distinguished from the observed cost value, which we denote by Y.

We wish to find the numerical values of a and b that minimise $\sum(-)2$

Y

y . This calculation is

accomplished by using two equations, usually called the normal equations:

$\Sigma\ Y = na + b\ \Sigma$

(X)

$\Sigma XY = a \Sigma$

(X) + $b \Sigma$

(

2

X)

where n is the number of data points; ΣX and ΣY are, respectively, the sums of the given X and Y

values;

2

ΣX is the sum of squares of the X values; and ΣXY is the sum of the amounts obtained

by multiplying each of the given X values by the associated observed Y value.

Exhibit 9.16 shows the calculations required for obtaining the line that best fits the data of

indirect manufacturing labour costs and machine-hours for Møre-Teppe. Substituting into the

two normal equations simultaneously, we obtain:

12 501 = 12 a + 862 b

928 716 = 862 a + 64 900 b

Exhibit 9.16

Computation for least-squares regression between indirect manufacturing labour costs and machine-hours for Møre-Teppe

Week	Indirect manufacturing hours* X	Machine labour costs* of Y	XY	X^2
	X	Y		

Y

$(- Y)2$

Y

$(- Y)2$ $(X - X)2$

(1)

(2)

(3)

(4)

(5)

(6)

(7)

(8)

(9)

1

68

1 190

4 624

80 920

1 002.06

21 978

35 321

15

2

88

1 211

7 744

106 568

1 208.26

28 646

8

261

3

62

1 004

3 844

62 248

940.20

1 425

4 070

97

4

72

917

5 184

66 024

1 043.30

15 563

15 952

0

5

60

770

3 600

46 200

919.58

73 848

22 374

140

6

96

1 456

9 216

139 776

1 290.74

171 603

27 311

584

7

78

1 180

6 084

92 040

1 105.16

19 113

5 601

38

8

46

710

2 116

32 660

775.24

110 058

4 256

667

9

82

1 316

6 724

107 912

1 146.40

75 213

28 764

103

10

94

1 032

8 836

97 008

1 270.12

95

56 701

491

11

68

752

4 624

51 136

1 002.06

83 955

62 530

15

12

48

963

2 304

46 224

795.86

6 202

27 936

568

Total

862

12 501

64 900

928 716

≈ 12 501

607 699

290 824

2 979

* Same data as in columns 1 and 2 of Exhibit 9.3.

The solution is a = €300.98 and b = €10.31, which can be obtained by direct substitution if the

normal equations are re-expressed symbolically as:

Σ

(Y) Σ

(

2

X) − Σ

(X) Σ

(XY)

$a =$

$n \Sigma$

(

2

$X) - \Sigma$

$(X) \Sigma$

(X)

$n \Sigma$

$(XY) - \Sigma$

$(X) \Sigma$

(Y)

$b = n \Sigma$

(

2

$X) - \Sigma$

$(X) \Sigma$

(X)

For our illustration, we now have:

(12 501)(64 900) − (862)(928 716)

$a =$

= €300.98

12(64 900) − (862)(862)

12(928 716) − (862)(12 501)

b =

= €10.31

12(64 900) − (862)(862)

Placing the amounts for *a* and *b* in the equation of the least-squares line, we have:

y = €300.98 + €10.31 *X*

where *y* is the predicted indirect manufacturing labour costs for any specified number of machine-

hours within the relevant range. Generally, these computations are done using software packages

such as SPSS, SAS and Statistica.

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Goodness of fit

Goodness of fit measures how well the predicted values, *y,* based on the cost driver, *X,* match

actual cost observations, *Y.* The regression analysis method computes a formal measure of good-

ness of fit, called the coefficient of determination. The coefficient of determination, 2

r , measures

the percentage of variation in *Y* explained by *X* (the independent variable). The coefficient of

determination (2

r) indicates the proportion of the variance of *Y,* (−)2

Y

Y ÷ ,

n that is explained

by the independent variable *X* (where *Y* = Σ *Y* ÷ *n*). It is more convenient to express the coef-

ficient of determination as 1 minus the proportion of total variance that is not explained by the

independent variable. The unexplained variance arises because of differences between the actual

values of *Y* and the predicted values of *y*:

Unexplained variation

2

Y

y

2

$r = 1 -$

$= 1$

(

)

$- \Sigma$

–

Total variation

(

$\Sigma\ Y - Y)2$

290 824

$= 1 - 607699$

$= 0.52$

The calculations indicate that 2

r increases as the predicted values *y* more closely approximate the

actual observations *Y.* The range of 2

r is from 0 (implying no explanatory power) to 1 (imply-

ing perfect explanatory power). When 2

$r = 1$, the predicted cost values exactly equal actual

cost values; that is, the independent variable *X* has perfectly explained variations in actual costs

Y. Generally, an 2

r of 0.30 or higher passes the goodness-of-fit test. Do not rely exclusively on

goodness of fit. It can lead to the indiscriminate inclusion of independent variables that increase

2

r but have no economic plausibility as cost driver(s). Goodness of fit has meaning only if the

relationship between costs and the drivers is economically plausible.

Significance of independent variables

A key question that managers ask is: Do changes in the economically plausible independent

variable result in significant changes in the dependent variable, or alternatively, is the slope *b* of

the regression line significant? Recall, for example, that in the regression of machine-hours on

indirect manufacturing labour costs in the Møre-Teppe illustration, *b* is estimated from a sample

of 12 observations. The estimate *b* is subject to random factors, as are all sample statistics. That

is, a different sample of 12 data points will give a different estimate of *b*. The standard error of the

estimated coefficient indicates how much the estimated value *b* is likely to be affected by random

factors. The *t*-value of the *b* coefficient measures how large the value of the estimated coefficient

is relative to its standard error. A *t*-value with an absolute value greater than 2.00 suggests that

the *b* coefficient is significantly different from zero. In other words, a relationship exists between

the independent variable and the dependent variable that cannot be attributed to chance alone.

The benchmark for inferring that a *b* coefficient is significantly different from zero is a func-

tion of the degrees of freedom in a regression. The benchmark of 2.00 assumes a sample size of

60 observations. The number of degrees of freedom is calculated as the sample size minus the

number of *a* and *b* parameters estimated in the regression. For a simple regression, the benchmark

values for the *t*-values are:

Sample size

Benchmark*

12

$|t| > 2.23$

15

$|t| > 2.16$

20

| *t*| > 2.10

30

| *t*| > 2.05

60

| *t*| > 2.00

*| *t*| denotes the absolute value of the *t*-value.

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Simple regression results with indirect manufacturing labour

Exhibit 9.17

costs as dependent variable and machine-hours as independent variable for Møre-Teppe

Coefficient

Standard error

t-value

Variable

(1)

(2)

(3) = (1) ÷ (2)

Constant

€300.98

€229.75

1.31

Independent variable 1:

€10.31

€3.12

3.30

Machine-hours

r 2 = 0.52; Durbin−Watson statistic = 2.05.

For simplicity, we use a cut-off *t*-value of 2.00 throughout this appendix.

Exhibit 9.17 presents a convenient format for summarising the regression results for indi-

rect manufacturing labour costs and machine-hours. The *t*-value for the slope coefficient *b* is

€10.31 ÷ €3.12 = 3.30, which exceeds the benchmark of 2.00. Therefore, the coefficient of the

machine-hours variable is significantly different from zero. The probability is low (less than 5%)

that random factors could have caused the coefficient *b* to be positive. Alternatively, we can

restate our conclusion in terms of a ‘confidence interval’: there is less than a 5% chance that the

true value of the machine-hours coefficient lies outside the range €10.31 ± (2.00 × €3.12) or

€10.31 ± €6.24, or from €4.07 and €16.55. Therefore, we can conclude that changes in machine-

hours do affect indirect manufacturing labour costs. Similarly, using data from Exhibit 9.17, the

t-value for the constant term *a* is €300.98 ÷ €229.76 = 1.31, which is less than 2.00. This value

indicates that, within the relevant range, the constant term is not significantly different from zero.

Specification analysis of estimation assumptions

Specification analysis is the testing of the assumptions of regression analysis. If the assumptions

of (1) linearity within the relevant range, (2) constant variance of residuals, (3) independence of

residuals, and (4) normality of residuals hold, the simplest regression procedures give reliable esti-

mates of unknown coefficient values. This section provides a brief overview of specification anal-

ysis. When these assumptions are not satisfied, more complex regression procedures are necessary

to obtain the best estimates. For details see, for example, Watson et al. (1993) and Greene (2000).

1 *Linearity within the relevant range.* A common assumption is that a linear relationship exists

between the independent variable *X* and the dependent variable *Y* within the relevant range. If

a linear regression model is used to estimate a fundamentally non-linear relationship, however,

the coefficient estimates obtained will be inaccurate.

Where there is only one independent variable, the easiest way to check for linearity is by

studying the data on a scatter diagram, a step that often is unwisely skipped. Exhibit 9.6 pre-

sents a scatter diagram for the indirect manufacturing labour costs and machine-hours varia-

bles of Møre-Teppe shown in Exhibit 9.3. The scatter diagram reveals that linearity appears

to be a reasonable assumption for these data.

The learning-curve models discussed in the chapter are examples of non-linear cost func-

tions; costs increase when the level of production increases, but by lesser amounts than would

occur with a linear cost function. In this case, the analyst should estimate a non-linear cost

function that explicitly incorporates learning effects.

2 *Constant variance of residuals.* The vertical deviation of the observed value *Y* from the regres-

sion line estimate y is called the *residual term, disturbance term* or *error term,* $u = Y - $.

y

The assumption of constant variance implies that the residual terms are unaffected by the level

of the independent variable. The assumption also implies that there is a uniform scatter, or

dispersion, of the data points about the regression line. The scatter diagram is the easiest way

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to check for constant variance. This assumption holds for Graph A of Exhibit 9.18 but not for

Graph B. Constant variance is also known as *homoscedasticity.* Violation of this assumption

is called *heteroscedasticity.*

Heteroscedasticity does not affect the accuracy of the regression estimates a and b. It does,

however, reduce the reliability of the estimates of the standard errors, and thus affects the

precision with which inferences can be drawn.

3 *Independence of residuals.* The assumption of the independence of residuals is that the resid-

ual term for any one observation is not related to the residual term for any other observation.

The problem of *serial correlation* in the residuals (also called *autocorrelation*) arises when the

residuals are not independent. Serial correlation means that there is a systematic pattern in

the sequence of residuals such that the residual in observation n conveys information about

the residuals in observations $n + 1$, $n + 2$, and so on. In time-series data, inflation is a com-

mon cause of autocorrelation because it causes costs (and hence residuals) to be related over

time. Autocorrelation can also occur in cross-sectional data as, for example, in Exhibit 9.19.

The scatter diagram helps in identifying autocorrelation. Autocorrelation does not exist in

Graph A of Exhibit 9.19 but does exist in Graph B. Observe the systematic pattern of the

Exhibit 9.18

Constant variance of residuals assumption

Graph A: Example of constant variance

Graph B: Example of non-constant variance

(uniform scatter of data points around regression line)

(higher outputs have larger residuals)

80

80

70

70

60

60

€000)

€000)

50

50

40

40

30

30

20

20

Energy costs (

Energy costs (

10

10

200

400

600

800

1000

200

400

600

800

1000

Units of production

Units of production

Exhibit 9.19

Independence of residuals assumption

Graph A: Example of independence of residuals

Graph B: Example of serial correlation in residuals

(no pattern in residuals)

(a pattern of positive residuals for extreme direct

materials used; negative residuals for moderate

direct materials used)

120

120

100

100

80

80

60

60

(€000)

(€000)

40

40

20

20

Materials-handling costs

Materials-handling costs

200

400

600

800

1000

200

400

600

800

1000

Tonnes of direct materials used

Tonnes of direct materials used

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residuals in Graph B: positive residuals for extreme quantities of direct materials used and

negative residuals for moderate quantities of direct materials used. No such systematic pattern

prevails for Graph A.

Like non-constant variance in residuals, serial correlation does not affect the accuracy of

the regression estimates *a* and *b.* It does, however, affect the standard errors of the coefficients,

which in turn affect the precision with which inferences about the population parameters can

be drawn from the regression estimates.

The *Durbin–Watson statistic* is one measure of serial correlation in the estimated residuals.

For samples of 10–20 observations, a Durbin–Watson statistic in the 1.10–2.90 range suggests

that the residuals are independent. The Durbin–Watson statistic for the regression results of

Møre-Teppe in Exhibit 9.17 is 2.05. Therefore, an assumption of independence in the estimated

residuals seems reasonable for this regression model.

4 *Normality of residuals.* The normality of residuals assumption means that the residuals are

distributed normally around the regression line. This assumption is necessary for making

inferences about *y, a* and *b.*

Using regression output to choose cost drivers of cost functions

Consider the two choices of cost driver we described earlier:

$y = a + (b \times \text{Machine-hours})$

$y = a + (b \times \text{Direct manufacturing labour-hours})$

Exhibits 9.6 and 9.7 present plots of the data for the two regressions. Exhibit 9.17 reports regres-

sion results for the cost function using machine-hours as the independent variable. Exhibit 9.20

presents comparable regression results for the cost function using direct manufacturing labour-

hours as the independent variable.

On the basis of the material in this appendix, which regression is better? Exhibit 9.21 com-

pares these two cost functions in a systematic way. For several criteria, the cost function based

on machine-hours is preferable to the cost function based on direct manufacturing labour-hours.

The economic plausibility criterion is especially important.

Simple regression results with indirect manufacturing labour

Exhibit 9.20

costs as dependent variable and direct manufacturing labour-

hours as independent variable for Møre-Teppe

Coefficient

Standard error

t-value

Variable

(1)

(2)

(3) = (1) ÷ (2)

Constant

€744.67

€217.61

3.42

Independent variable 1:

€7.72

€5.40

1.43

Direct manufacturing

labour-hours

r 2 = 0.17; Durbin−Watson statistic = 2.26.

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Exhibit 9.21

Comparison of alternative cost functions for indirect manufacturing labour

costs estimated with simple regression for Møre-Teppe

Cost function 1: machine-hours as

Cost function 2: direct manufacturing

Criterion

independent variable

labour-hours as independent variable

Economic plausibility

A positive relationship between indirect

A positive relationship between indirect

manufacturing labour costs (technical

manufacturing labour costs and

support labour) and machine-hours is

direct manufacturing labour-hours is

economically plausible in a highly automated economically plausible, but less so than

plant

machine-hours in a highly automated

plant on a week-to-week basis

Goodness of fit

r 2 = 0.52

r 2 = 0.17

Excellent goodness of fit

Poor goodness of fit

Significance of

The *t*-value of 3.30 is significant

The *t*-value of 1.43 is not significant

independent variable(s)

Specification analysis of Plot of the data indicates that assumptions

Plot of the data indicates that assumptions

estimation assumptions of linearity, constant variance, independence of linearity, constant variance,

of residuals and normality of residuals

independence of residuals and normality

hold, but inferences drawn from

of residuals hold, but inferences drawn

only 12 observations are not reliable;

from only 12 observations are not reliable;

Durbin−Watson statistic = 2.05

Durbin−Watson statistic = 2.26

Do not always assume that any one cost function will perfectly satisfy all the criteria in

Exhibit 9.21. A cost analyst must often make a choice among ‘imperfect’ cost functions, in the

sense that the data of any particular cost function will not perfectly meet one or more of the

assumptions underlying regression analysis.

Multiple regression and cost hierarchies

In some cases, a satisfactory estimation of a cost function may be based on only one independent

variable, such as machine-hours. In many cases, however, basing the estimation on more than one

independent variable is more economically plausible and improves accuracy. The most widely used

equations to express relationships between two or more independent variables and a dependent

variable are linear in the form

$Y = a + b\ 1\ X\ 1 + 2$

$b\ 2$

$X + + u$

where

Y = cost variable to be predicted

X , X , = independent variables on which the prediction is to be based

1

2

,

$a\ b$, b = estimated coefficients of the regression model

1

2

u = residual term that includes the net effect of other factors not in the model

and measurement errors in the dependent and independent variables.

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Chapter 9 Determining how costs behave

Example 9A.1

Consider the Møre-Teppe data in Exhibit 9.22. Indirect manufacturing labour costs include sizeable costs

incurred for set-up and changeover costs when production on one carpet batch is stopped and production

on another batch is started. Management believes that in addition to machine-hours (an output unit-level

cost driver), indirect manufacturing labour costs are also affected by the number of different batches of

carpets produced during each week (a batch-level driver). Møre-Teppe estimates the relation between two

independent variables, machine-hours and number of separate carpet jobs worked on during the week,

and indirect manufacturing labour costs.

Exhibit 9.23 presents results for the following multiple regression model, using data in columns

1, 2 and 4 of Exhibit 9.22:

y = €42.58 + €7.60 X + €37.77

1

X 2

where X 1 is the number of machine-hours and X 2 is the number of production batches. It is

economically plausible that both machine-hours and production batches would help explain

variations in indirect manufacturing labour costs at Møre-Teppe. The 2

r of 0.52 for the simple

regression using machine-hours (Exhibit 9.17) increases to 0.72 with the multiple regression in

Exhibit 9.23. The t-values suggest that the independent variable coefficients of both machine-

hours and production batches are significantly different from zero (t = 2.74 for the coefficient

on machine-hours, and t = 2.48 for the coefficient on production batches). The multiple regres-

sion model in Exhibit 9.23 satisfies both economic and statistical criteria, and it explains much

greater variation in indirect manufacturing labour costs than does the simple regression model

using only machine-hours as the independent variable. The information in Exhibit 9.23 indicates

that both machine-hours and production batches are important cost drivers of monthly indirect

manufacturing labour costs at Møre-Teppe.

Exhibit 9.22

Weekly indirect manufacturing labour costs, machine-hours, direct

manufacturing labour-hours and number of production batches for Møre-Teppe

Indirect

Direct

Number of

manufacturing

manufacturing

production

labour costs

Machine-hours

labour-hours

batches

Week

(1)

(2)

(3)

(4)

1

€1190

68

30

12

2

1211

88

35

15

3

1004

62

36

13

4

917

72

20

11

5

770

60

47

10

6

1456

96

45

12

7

1180

78

44

17

8

710

46

38

7

9

1316

82

70

14

10

1032

94

30

12

11

752

68

29

7

12

963

48

38

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Exhibit 9.23

Multiple regression results with indirect manufacturing labour costs and two

independent variables (machine-hours and production batches) for Møre-Teppe

Variable	Coefficient (1)	Standard error (2)	*t*-value (3) = (1) ÷ (2)
Constant	€42.58	€213.91	0.20

Independent variable 1:

€7.60

€2.77

2.74

Machine-hours

Independent variable 2:

€37.77

€15.25

2.48

Production batches

r 2 = 0.72; Durbin−Watson statistic = 2.49.

In Exhibit 9.23, the slope coefficients −€7.60 for machine-hours and €37.77 for production

batches – measure the change in indirect manufacturing labour costs associated with a unit change

in an independent variable (assuming that the other independent variable is held constant). For

example, indirect manufacturing labour costs increase by €37.77 when one more production batch

is added, assuming that the number of machine-hours is held constant.

An alternative approach would create two separate cost pools – one for costs tied to machine-

hours and another for costs tied to production batches. Møre-Teppe would then estimate the

relationship between the cost driver and overhead costs separately for each cost pool. The difficult

task under that approach would be properly dividing overhead costs into the two cost pools.

Multicollinearity

A major concern that arises with multiple regression is multicollinearity. Multicollinearity exists

when two or more independent variables are highly correlated with each other. Generally, users

of regression analysis believe that a coefficient of correlation between independent variables

greater than 0.70 indicates multicollinearity. Multicollinearity increases the standard errors of

the coefficients of the individual variables. The result is that there is greater uncertainty about

the underlying value of the coefficients of the individual independent variables. That is, variables

that are economically and statistically significant will appear insignificant.

The coefficients of correlation between the potential independent variables for Møre-Teppe

in Exhibit 9.22 are:

Coefficient of

Pairwise combinations

correlation

Machine-hours and direct manufacturing labour-hours

0.12

Machine-hours and production batches

0.40

Direct manufacturing labour-hours and production batches

0.31

These results indicate that multiple regressions using any pair of the independent variables in

Exhibit 9.23 are not likely to encounter multicollinearity problems.

If severe multicollinearity exists, try to obtain new data that does not suffer from multicollin-

earity problems. Do not drop an independent variable (cost driver) that should be included in a

model because it is correlated with another independent variable. Omitting such a variable will

cause the estimated coefficient of the independent variable included in the model to be biased

away from its true value.

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Chapter 9 Determining how costs behave

References and further reading

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CHAPTER 9

Assessment material

Review questions

9.1

Describe three alternative linear cost functions.

9.2

What two assumptions are frequently made when estimating a cost function?

9.3

What is the difference between a linear and a non-linear cost function? Give an example of each

type of cost function.

9.4

‘High correlation between two variables means that one is the cause and the other is the effect.’

Do you agree? Explain.

9.5

Name four approaches to estimating a cost function.

9.6

Describe three criteria for evaluating cost functions and choosing cost drivers.

9.7

Define learning curve. Outline two models that can be used when incorporating learning into the

estimation of cost functions.

9.8

What are the four key assumptions examined in specification analysis in the case of simple

regression?

9.9

‘All the independent variables in a cost function estimated with regression analysis are cost driv-

ers.’ Do you agree? Explain.

9.10 ‘Multicollinearity exists when the dependent variable and the independent variable are highly

correlated.’ Do you agree? Explain.

Exercises

Basic level

***9.11 Estimating a cost function** (10 minutes)

The controller of Iso-Mets Oy wants you to estimate a cost function from the following two

observations in a general-ledger account called Maintenance:

Maintenance

Month

Machine-hours

costs incurred

January

4000

€3000

February

7000

3900

Required

1 Estimate the cost function for maintenance.

2 Can the constant in the cost function be used as an estimate of fixed maintenance cost per

month? Explain.

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9.12 Identifying variable, fixed and mixed cost functions (15 minutes)

Bellingwolde BV operates car rental agencies at over 20 airports. Customers can choose from one

of three contracts for car rentals of one day or less:

- Contract 1: €50 for the day.
- Contract 2: €30 for the day plus €0.20 per km travelled.
- Contract 3: €1.00 per km travelled.

Required

1 Present separate plots for each of the three contracts, with costs on the vertical axis and kilo-

metres travelled on the horizontal axis.

2 Describe each contract as a linear cost function of the form $y = a +$

.

bX

3 Describe each contract as a variable, fixed or mixed cost function.

9.13 Matching graphs with descriptions of cost behaviour (20 minutes)

Given below are a number of charts, each indicating some relationship between cost and a cost

driver. No attempt has been made to draw these charts to any particular scale; the absolute num-

bers on each axis may be closely or widely spaced.

1

2

3

4

5

6

7

8

9

10

No

Some other

relationship

pattern

11

12

13

14

15

Required

Indicate by number which one of the charts best fits each of the situations or items described.

Each situation or item is independent of all the others; all factors not stated are assumed to be

irrelevant. Some charts will be used more than once; some may not apply to any of the situations.

Note that category 14, ‘No relationship’, is not the same as 15, ‘Some other pattern’.

If the horizontal axis represents the production output over the year and the vertical axis repre-

sents total cost or revenue, indicate the one best pattern or relationship for:

1 Direct material costs.

2 Supervisors’ salaries.

3 A breakeven chart.

4 Mixed costs – for example, fixed electrical power demand charge plus variable usage rate.

5 Depreciation of plant, calculated on a straight-line basis.

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6 Data supporting the use of a variable cost rate, such as manufacturing labour cost of SFr 14

per unit produced.

7 Incentive bonus plan that pays managers SFr 0.10 for every unit produced above some level of

production.

8 Interest charges on money borrowed at a fixed rate of interest to finance the acquisition of a

plant, before any payments on principal.

Intermediate level

9.14 Account analysis method (20 minutes)

Lorenzo-Netto, Srl, operates a brushless car wash. Incoming cars are put on an automatic, contin-

uously moving conveyor belt. Cars are washed as the conveyor belt carries the car from the start

station to the finish station. After the car moves off the conveyor belt, the car is dried manually.

Workers then clean and vacuum the inside of the car. Workers are managed by a single supervisor.

Lorenzo-Netto serviced 80 000 cars in 2022. Lorenzo-Netto reports the following costs for 2022:

Account description

Costs

Car wash labour

€240 000

Soap, cloth and supplies

32 000

Water

28 000

Power to move conveyor belt

72 000

Depreciation

64 000

Supervision

30 000

Cashier

16 000

Required

1 Classify each account as variable or fixed with respect to cars washed. Explain.

2 Lorenzo-Netto expects to wash 90 000 cars in 2023. Use the cost classification you developed

in requirement 1 to estimate Lorenzo-Netto's total costs in 2023.

3 Calculate the average cost of washing a car in 2022 and 2023. (Use the expected 90 000 car

wash level for 2023.)

9.15 Linear cost approximation (25 minutes)

Pierre Corneille, managing director of Marre-Quise Consultants SA, is examining how overhead

costs behave with variations in monthly professional labour-hours billed to clients. Assume the

following historical data:

Professional labour-hours

Total overhead costs

billed to clients

€340 000

3000

400 000

4000

435 000

5000

477 000

6000

529 000

7000

587 000

8000

Required

1 Calculate the linear cost function, relating total overhead cost to professional labour-hours,

using the representative observations of 4000 and 7000 hours. Plot the linear cost function.

Does the constant component of the cost function represent the fixed overhead costs of Marre-

Quise Consultants? Why?

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2 What would be the predicted total overhead costs for (a) 5000 hours and (b) 8000 hours using

the cost function estimated in requirement 1? Plot the predicted costs and actual costs for 5000

and 8000 hours.

3 Corneille had a chance to accept a special job that would have boosted professional labour-

hours from 4000 to 5000 hours. Suppose Corneille, guided by the linear cost function, rejected

this job because it would have brought a total increase in contribution margin of €38 000,

before deducting the predicted increase in total overhead cost, €43 000. What is the total con-

tribution margin actually forgone?

9.16 Regression analysis, service company (CMA, adapted) (25 minutes)

Hans Mehrlich owns a catering company that prepares banquets and parties for both individual

and business functions throughout the year. Mehrlich's business is seasonal, with a heavy schedule

during the summer months and the year-end holidays and a light schedule at other times. During

peak periods there are extra costs.

One of the major events Mehrlich's customers request is a cocktail party. He offers a standard

cocktail party and has developed the following cost structure on a per-person basis:

Food and beverages

€15.00

Labour (0.5 hour × €10 per hour)

5.00

Overhead (0.5 hour × €14 per hour)

7.00

Total costs per person

€27.00

Mehrlich is quite certain about his estimates of the food, beverages and labour costs but is not

as comfortable with the overhead estimate. This estimate was based on the actual data for the

past 12 months presented below. These data indicate that overhead expenses vary with the direct

labour-hours expended. The €14 estimate was determined by dividing total overhead expended

for the 12 months by total labour-hours.

Month

Labour-hours

Overhead costs

January

2 500

€55 000

February

2 700

59 000

March

3 000

60 000

April

4 200

64 000

May

4 500

67 000

June

5 500

71 000

July

6 500

74 000

August

7 500

77 000

September

7 000

75 000

October

4 500

68 000

November

3 100

62 000

December

6 500

73 000

Total

57 500

€805 000

Mehrlich has recently become aware of regression analysis. He estimated the following regression

equation with overhead costs as the dependent variable and labour-hours as the independent

variable:

$y = €48\ 271 + €3.93\ X$

Required

1 Plot the relationship between overhead costs and labour-hours. Draw the regression line and

evaluate it using the criteria of economic plausibility, goodness of fit and slope of the regression

line.

2 Using data from the regression analysis, what is the variable cost per person for a cocktail

party?

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3 Hans Mehrlich has been asked to prepare a bid for a 200-person cocktail party to be given next

month. Determine the minimum bid price that Mehrlich would be willing to submit to earn a

positive contribution margin.

9.17 Learning curve, cumulative average-time learning curve (20 minutes)

Genève Défense Systèmes manufactures radar systems. It has just completed the manufacture of

its first newly designed system, RS-32. It took 3000 direct manufacturing labour-hours (DMLH)

to produce this one unit. Genève Défense Systèmes believes that a 90% cumulative average-time

learning model for direct manufacturing labour-hours applies to RS-32. (A 90% learning curve

implies $q = -0.1520$.) The variable costs of producing RS-32 are:

Direct materials costs

SFr 80 000 per RS-32

Direct manufacturing labour costs

SFr 25 per DMLH

Variable manufacturing overhead costs

SFr 15 per DMLH

Required

Calculate the total variable costs of producing 2, 4 and 8 units.

9.18 Learning curve, incremental unit-time learning curve (20 minutes)

Assume the same information for Genève Défense Systèmes as in Exercise 9.17 except that Genève

Défense Systèmes uses a 90% *incremental unit-time* learning curve as a basis for forecasting direct

manufacturing labour-hours. (A 90% learning curve implies $q = -0.1520$.)

Required

1 Calculate the total variable costs of producing 2, 3 and 4 units.

2 If you solved Exercise 9.17, compare your cost predictions in the two exercises for 2 and 4 units.

Why are the predictions different?

9.19 Evaluating alternative simple regression models, not for profit (Chapter appendix) (30–40

minutes)

Pauline Raphaël, executive assistant to the principal of Ecole Supérieure des Mines de St Etienne,

is concerned about the overhead costs at her university. Cost pressures are severe, so controlling

and reducing overheads is very important. Raphaël believes overhead costs incurred are generally

a function of the number of different academic programmes (including different specialisations,

degrees and research programmes) that the university has and the number of enrolled students.

Both have grown significantly over the years. She collects the following data:

Overhead

Number of

Number of

costs

academic

enrolled

Year

(’000)

programmes

students

1

€13 500

29

3400

2

19 200

36

5000

3

16 800

49

2600

4

20 100

53

4700

5

19 500

54

3900

6

23 100

58

4900

7

23 700

88

5700

8

20 100

72

3900

9

22 800

83

3500

10

29 700

73

3700

11

31 200

101

5600

12

38 100

103

7600

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She finds the following results for two separate simple regression models:

● *Regression 1.* Overhead costs = a + (b × Number of academic programmes)

Variable

Coefficient

Standard error

***t*-value**

Constant

€7127.75

€3335.34

2.14

Independent variable 1:

€240.64

€47.33

5.08

Number of academic

programmes

2

r = 0.72; Durbin W

− atson statistic = 1.81

● *Regression 2.* Overhead costs = a + (b × Number of enrolled students)

Variable

Coefficient

Standard error

***t*-value**

Constant

€5991.75

€5067.88

1.18

Independent variable 1:

€3.78

€1.07

3.53

Number of enrolled

students

2

r = 0.55; Durbin W

− atson statistic = 0.77

Required

1 Plot the relationship between overhead costs and each of the following variables: (a) number

of academic programmes, and (b) number of enrolled students.

2 Compare and evaluate the two simple regression models estimated by Raphaël. Use the com-

parison format employed in Exhibit 9.20.

3 What insights do the analyses provide about controlling and reducing overhead costs at the

Ecole Supérieure?

***9.20 Evaluating multiple regression models, not for profit** (continuation of Exercise 9.19)

(Chapter appendix) (30 minutes)

Required

1 Given your findings in Exercise 9.19, should Raphaël use multiple regression analysis to better

understand the cost drivers of overhead costs? Explain your answer.

2 Raphaël decides that the simple regression analysis in Exercise 9.19 should be extended to a

multiple regression analysis. She finds the following result:

● *Regression 3.* Overhead costs = a + (b × Number of academic programmes)

1

+

(b × Number of enrolled students)

2

Variable

Coefficient

Standard error

***t*-value**

Constant

€2779.62

€3620.05

0.77

Independent variable 1:

€178.37

€51.54

3.46

Number of academic programmes

Independent variable 2:

€1.87

€0.92

2.03

Number of enrolled students

2

$r = 0.81$; Durbin W

− atson statistic = 1.84

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Exercises

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The coefficient of correlation between number of academic programmes and number of stu-

dents is 0.60. Use the format in Exhibit 9.21 to evaluate the multiple regression model. (Assume

linearity, and constant variance and normality of residuals.) Should Raphaël choose the mul-

tiple regression model over the two simple regression models of Exercise 9.19?

3 How might the principal of the Ecole Supérieure use these regression results to manage over-

head costs?

Advanced level

***9.21 High–low and regression approaches** (Chapter appendix) (30–40 minutes)

Bildt-Östersund AN wishes to set a flexible budget for its power costs, which are primarily a

function of machine-hours worked. Data for the first four periods follows:

Period

Power costs (*Y*)

Machine-hours (*X*)

1

SKr 350

200

2

450

300

3

300

100

4

500

400

Required

1 Plot the relationship between power costs and machine-hours.

2 Calculate the constant *a* and slope coefficient *b* of the function $y = a + bX$ using (i) the high–low approach, and (ii) the regression approach. Comment on the results.

3 For the regression approach, calculate the coefficient of determination, 2

r . Comment on the

result.

9.22 Labour cost focus (From CIMA, Paper P2, May 2014) (15 minutes)

SVC is a car manufacturer. SVC is planning the development of a prototype hydrogen-powered

car, the Model Q. The prototype Model Q car will have a limited production run of 250 cars. To

ensure that the Model Q is ready by SVC's stated deadline, production will take place over the

course of one month. Details for the development and production of the prototype Model Q are

shown below.

Forecast development cost

€6 500 000

Forecast design cost

€1 300 000

Forecast manufacturing costs

Material cost

€25 500 per car

Variable production overhead cost

€780 per car (this is not related to

labour-hours)

Direct labour

€60 per hour (see note 2 below)

Direct labour

SVC plans to hire a team of 12 specialist production staff. The specialist production staff will be

paid a premium on their basic hourly rate of pay dependent on the total number of labour-hours

required to produce all 250 prototype Model Q cars as follows:

Note: a prototype is defined as a preliminary version of a vehicle from which other forms may be developed.

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Premium on basic	**Total labour-hours**	**hourly labour rate**
0–2000	35%	
2001–2500	30%	
2501–3000		

25%

3001–3500

20%

More than 3500

0%

The premium on the basic hourly labour rate will be applicable to all labour-hours during

production.

Learning curve

It is estimated that the manufacture of the first car will take 13 labour-hours. There is expected

to be a 95% learning curve that will continue until 128 cars have been produced. Thereafter, each

car will take the same time to produce as the 128th.

Notes

1 The learning index for a 95% learning curve = −0.074.

2 The hourly direct labour rate stated above under ‘Forecast manufacturing cost’ is inclusive of

a premium on the basic hourly labour rate, which has been calculated assuming that each of

the 250 cars takes the same time to produce as the first.

Required

Calculate the total labour cost of producing 250 cars.

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CHAPTER 10

Relevant information for decision making

The provision of decision-relevant information is one important function of the management accountant. In fact, it is for individuals as well. To

Learning objectives

take a simple example, you might make a decision to buy a coffee maker. When you make the decision to do so, you might evaluate the costs and

After studying this chapter, you

benefits. But once you have purchased the coffee maker, its cost is irrel-

should be able to:

evant when calculating how much money you save each time you brew

- Describe a five-step sequence in

coffee at home versus buy it at Costa. You incurred the cost of the coffee

the decision process

maker in the past, and you cannot recoup that cost. In this chapter, we focus on decisions such as accepting or rejecting a one-time-only special

- Differentiate relevant costs from
order, insourcing or outsourcing products or services, and replacing or
irrelevant costs and revenues
keeping equipment. We stress the importance of distinguishing between
- Distinguish between quantitative
relevant and irrelevant items in making these decisions.
factors and qualitative factors in
decisions
- Identify two potential problems in
relevant-cost analysis
- Describe the opportunity cost
concept; explain why it is used in
decision making
- Describe the key concept in
choosing which among multiple

products to produce when there

are capacity constraints

- Explain why the book value

of equipment is irrelevant in

equipment-replacement decisions

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Information and the decision process

Managers often adopt a personalised approach for deciding among different courses of action.

The approach may be highly stylised, informal and subjective. It will usually also draw on for-

mally structured information. A decision model is here taken to signify a formal method for

making a choice, frequently involving quantitative and qualitative analyses. Accountants aim

to supply managers with relevant data to guide their decisions. There are many instances where

the data is first analysed by the accountant and their implications are presented to the decision

maker. This is increasingly the case with big data analyses where the naked human eye cannot

decipher trends but quantitative explorations of the data using machine learning functions can

produce important indications of options to consider. The information assessed by management

accountants is usually structured and acts as an input to decision making which will rely also on

other information forms.

Consider a decision that Home Appliances, a manufacturer of vacuum cleaners, faces: Should

it rearrange a manufacturing assembly line to reduce manufacturing labour costs? For simplicity,

assume that the only alternatives are ‘do not rearrange’ and ‘rearrange’. The rearrangement will

eliminate all manual handling of materials. The current manufacturing line uses 20 workers –

15 workers operate machines, and 5 workers handle materials. Each worker puts in 2 000 hours

annually. The rearrangement is predicted to cost €90 000. The predicted production output of

25 000 units for the next year will be unaffected by the decision. Also unaffected by the decision

are the predicted selling price per unit of €250, direct-materials costs per unit of €50, other man-

ufacturing overhead of € 750 000, and marketing costs of €2 000 000. The cost driver is units of

production.

To make the decision, management may hypothetically proceed in a sequence of steps. The first

step is to gather more information about manufacturing labour costs. The historical manufac-

turing labour rate of €14 per hour is the starting point for predicting total manufacturing labour

costs under both alternatives. The manufacturing labour rate is expected to increase to €16 per

hour following a recently negotiated increase in employee benefits.

The second step is to predict future costs under the two alternatives. Predicted

manufac turing labour costs under the ‘do not rearrange’ alternative are

20 workers × 2000 hours × €16 per hour = €640 000. Predicted manufacturing labour costs

under the ‘rearrange’ alternative are 15 workers × 2000 hours × €16 per hour = €480 000.

Predicted costs of rearrangement are €90 000.

As the third step, Home Appliances’ management compares the predicted savings from elimi-

nating materials handling labour costs 15 workers × 2000 hours × €16 per hour = €160 000

to the costs of rearrangement of €90 000. It also takes into account other qualitative considera-

tions such as the effect that reducing the number of workers will have on employee morale. After

weighing the costs and benefits, management chooses the ‘rearrange’ alternative. Management

next implements the decision in the fourth step by rearranging the manufacturing assembly line.

As the fifth and final step, management gathers information about the actual results of the

plant rearrangement to evaluate performance and to provide feedback. Actual results show that

the new manufacturing labour costs are €550 000 (due to, say, lower than expected manufactur-

ing labour productivity) rather than the predicted €480 000. This feedback may lead to better

implementation through, for example, a change in supervisory behaviour, employee training or

personnel so that the €480 000 target is achieved in subsequent periods. However, the feedback

may convince the decision maker that the prediction method, rather than the implementation,

was faulty. Perhaps the prediction method for similar decisions in the future should be modified

to allow for worker training or learning time.

Exhibit 10.1 summarises the five-step decision process that we just described: gathering infor-

mation, making predictions, choosing an alternative, implementing the decision, and evaluating

actual performance to provide feedback. The feedback, in turn, might affect future predictions,

the prediction method itself, the decision model or the implementation.

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Exhibit 10.1

Accounting information and the decision process

Five-step sequence

An illustration

Step 1:

Historical labour costs were €14 per hour. A recently

Gathering

negotiated increase in employee benefits of €2 per hour will

information

apply in the future. The rearrangement of the manufacturing

assembly line is expected to eliminate material handling costs.

Historical

Other

costs

information

Use the information from step 1 together with an assessment

Step 2:

of probability as a basis for predicting the future labour costs of

Making

€640

predictions

000 and €480 000 respectively for the ‘do not arrange’

and ‘rearrange’ alternatives. The rearrangement is predicted

to cost €90 000.

Specific

predictions

The predicted benefits of the different alternatives in step 2 are

Step 3:

Choosing an

compared and are related to the size of the required investment

Feedback

alternative

along with other considerations (such as likely effects on employee morale). Management chooses the rearrange alternative.

Step 4:

Implementing

The manager implements the decision reached in step 3 by

the decision

rearranging the manufacturing assembly line.

Evaluation of performance of the decision implemented in step 4

Step 5:

provides the feedback as the five-step sequence is then repeated

Evaluating

in whole or in part. New manufacturing labour costs are

performance

€550 000 rather than the predicted €480 000. This historical information can help managers in making subsequent predictions, or improving implementation through, for example, employee training.

The concept of relevance

Relevant costs and relevant revenues

The most important decision-making concepts in this chapter are relevant costs and relevant reve-

nues. Relevant costs are those *expected future costs* that differ among alternative courses of action.

The two key aspects to this definition are that the costs must occur in the future and that they must

differ among the alternative courses of action. We focus on the future because *every decision deals*

with the future – nothing can be done to alter the past. Also, the future costs must differ among

the alternatives because if they do not, there will be no difference in costs no matter what decision

is made. Likewise, relevant revenues are those expected future revenues that differ among alterna-

tive courses of action. It is important to recognise that relevant costs and relevant revenues must:

● *Occur in the future*: every decision deals with a manager selecting a course of action based on

its expected future results.

● *Differ among the alternative courses of action*: future costs and revenues that do not differ will

not matter and, therefore, will have no bearing on the decision being made.

The question is always, ‘What difference will a particular action make?’

In Exhibit 10.2, the €640 000 and €480 000 manufacturing labour costs are relevant

costs – they are expected future costs that differ between the two alternatives. The past

manufacturing labour rate of €14 per hour and total past manufacturing labour costs of

€560 000 (2000 hours × 20 workers × €14 per hour) are not relevant, even though they may

play a role in preparing the €640 000 and €480 000 labour cost predictions. Although they may be a

useful basis for making informed judgements for predicting expected future costs, historical costs in

themselves are irrelevant to a decision. Why? Because they deal strictly with the past, not the future.

Exhibit 10.2 presents the quantitative data underlying the choice between the ‘do not rearrange’

and the ‘rearrange’ alternatives. The first two columns present all data. The last two columns

present only relevant costs or revenues. The revenues, direct materials, manufacturing overhead

and marketing items can be ignored. Why? Because although they are expected future costs,

they do not differ between the alternatives. They are thus irrelevant. The data in Exhibit 10.2

indicate that rearranging the production line will increase next year's predicted operating profit

by €70 000. Note that we reach the same conclusion whether we use all data or include only the

relevant data in the analysis. By confining the analysis to only the relevant data, managers can

clear away related but irrelevant data that might confuse them.

The difference in total cost between two alternatives is a differential cost. The differential cost

between alternatives 1 and 2 in Exhibit 10.2 is €70 000.

Qualitative factors can be relevant

We divide the consequences of alternatives into two broad categories: quantitative and qualitative.

Quantitative factors are outcomes that are measured in numerical terms. Some quantitative factors

Exhibit 10.2

Determining relevant revenues and relevant costs for Home Appliances

All data

Relevant data

Alternative 1:

Alternative 1:

Do not

Alternative 2:

Do not

Alternative 2:

rearrange

Rearrange

rearrange

Rearrange

Revenues*

€6 250 000

€6 250 000

–

–

–

–

Costs

Direct materials†

1 250 000

1 250 000

–

–

Manufacturing labour

640 000‡

480 000§

€640 000‡

€480 000§

Manufacturing overhead

750 000

750 000

–

–

Marketing

2 000 000

2 000 000

–

–

Rearrangement costs

–

90 000

–

90 000

Total costs

4 640 000

4 570 000

640 000

570 000

Operating profit

€1 610 000

€1 680 000

€(640 000)

€(570 000)

€70 000 difference

€70 000 difference

* 25 000 × €250 = €6 250 000.

† 25 000 × €50 = €1 250 000.

‡ 20 × 2000 × €16 = €640 000.

§ 15 × 2000 × €16 = €480 000.

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are financial, that is, they can be easily expressed in financial terms. Examples include the costs

of direct materials, direct manufacturing labour and marketing. Other quantitative factors are

non-financial, that is, they can be measured numerically, but they are not expressed in finan-

cial terms. Reduction in page download time for an Internet company and the percentage of

on-time flight arrivals for an airline company are examples of quantitative, non-financial factors.

Qualitative factors are outcomes that cannot be measured in numerical terms. Employee morale

is an example.

Cost analysis generally emphasises quantitative factors that can be expressed in financial terms.

But just because qualitative factors and non-financial quantitative factors cannot be easily meas-

ured in financial terms does not make them unimportant. Managers must at times give more

weight to qualitative or non-financial quantitative factors. For example, Home Appliances may

find that it can purchase a part from an outside supplier at a price that is lower than what it costs

to manufacture the part in-house. Home Appliances may still choose to make the part in-house

because it feels that the supplier is unlikely to meet the demanding delivery schedule – a quanti-

tative non-financial factor – and because purchasing the part from outside may adversely affect

employee morale – a qualitative factor. Trading off non-financial and financial considerations,

however, is seldom easy.

An illustration of relevance: choosing output levels

Managers often make decisions that affect output levels. For example, managers must choose

whether to introduce a new product or sell more units of an existing product. When changes in

output levels occur, managers are interested in the effect it has on the organisation and on oper-

ating profit. Why? Because maximising organisational objectives (typically operating profit in our

illustrations) also increases managers' rewards.

One-off special orders

Management sometimes faces the decision of accepting or rejecting one-off special orders when

there is idle production capacity and where the order has no long-run implications. We assume

that all costs can be classified as either variable with respect to a single driver (units of output)

or fixed. The following example illustrates how focusing on revenues, variable costs and contri-

bution margins can provide key information for decisions about the choice of output level. The

example also indicates how reliance on unit-cost numbers calculated after allocating fixed costs

can mislead managers about the effect that increasing output has on operating profit.

Exhibit 10.3 presents data in an absorption-costing format: fixed manufacturing costs are

included as product costs. The manufacturing cost per unit is €12 (€7.50 of which is variable and

€4.50 of which is fixed), which is above the €11 price offered by the hotel chain. Using the €12

absorption cost as a guide in decision making, a manager might reject the offer.

Exhibit 10.3

Budgeted income statement for August, absorption-costing format

for Huber GmbH

Total

Per unit

Sales (30 000 towels × €20)

€600 000

€20

Cost of goods sold

360 000

12

Gross margin (gross profit)

240 000

8

Marketing costs

210 000

7

Operating profit

€30 000

€1

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Example 10.1

Huber GmbH manufactures quality bath towels at its highly automated Heidelberg plant. The plant has

a production capacity of 48 000 towels each month. Current monthly production is 30 000 towels. Retail

department stores account for all existing sales. Expected results for the coming month (August) are shown

in Exhibit 10.3. (Note that these amounts are predictions.) The manufacturing costs per unit of €12 con-

sist of direct materials €6 (all variable), direct manufacturing labour €2 (€0.50 of which is variable), and

manufacturing overhead €4 (€1 of which is variable). The marketing costs per unit are €7 (€5 of which is

variable). Huber GmbH has no R&D costs or product-design costs. Marketing costs include distribution

costs and customer-service costs.

A luxury hotel chain offers to buy 5000 towels per month at €11 a towel for each of the next three

months. No subsequent sales to this customer are anticipated. No marketing costs will be necessary for the

5000-unit one-off special order. The acceptance of this special order is not expected to affect the selling

price or the quantity of towels sold to regular customers. Should Huber GmbH accept the hotel chain's offer?

Exhibit 10.4 presents data in a contribution income statement format. The relevant costs

are the expected future costs that differ between the alternatives – the variable manufacturing

costs of €37 500 (€7.50 per unit × 5000 units). The fixed manufacturing costs and all market-

ing costs (including variable marketing costs) are irrelevant in this case; they will not change

in total whether or not the special order is accepted. Therefore, the only relevant items here

are sales revenues and variable manufacturing costs. Given the €11 relevant revenue per unit

(the special- order price) and the €7.50 relevant costs per unit, Huber would gain an additional

€17500 [(€11.00 – €7.50) × 5000] in operating profit per month by accepting the special order.

In this example, comparisons based on either total amounts or relevant amounts (Exhibit 10.4)

avoid the misleading implication of the absorption cost per unit (Exhibit 10.3).

The additional costs of €7.50 per unit that Huber will incur if it accepts the special order

for 5000 towels are sometimes called incremental costs. Incremental costs are additional costs to

obtain an additional quantity, over and above existing or planned quantities, of a cost object.

Huber could avoid these costs if it did not accept the special order. Huber incurs no incremental

fixed manufacturing costs if it accepts the special order; those costs will not change whether or

not the special order is accepted. Fixed manufacturing costs do not change because the analysis

in Exhibit 10.4 assumes that the 5000-towel special order will use already acquired capacity that

will otherwise remain idle for each of the next three months.

The assumption of no long-run or strategic implications is crucial in the analysis we present

for the one-off special order decision. Suppose, for example, that Huber is concerned that the

retail department stores (its regular customers) will demand a lower price if it sells towels at €11

each to the luxury hotel chain. In this case, the analysis of the luxury hotel chain order must be

modified to consider both the short-term benefits from accepting the order and the long-term

consequences on Huber's business and profitability.

Potential problems in relevant-cost analysis

It is important in relevant-cost analysis not to assume that all variable costs are relevant. In the

Huber GmbH example, the marketing costs of €5 per unit are variable but not relevant. Why?

Because for the special-order decision, Huber incurs no extra marketing costs.

Similarly, it is important not to assume that all fixed costs are irrelevant. Consider fixed man-

ufacturing costs. In our example, we assume that the extra production of 5000 towels per month

does not affect fixed manufacturing costs. That is, we assume that the relevant range is at least

between 30 000 and 35 000 towels per month. In some cases, however, the extra 5000 towels

might increase fixed manufacturing costs. Assume that Huber would have to run three shifts of

16 000 towels per shift to achieve full capacity of 48 000 towels per month. Increasing the monthly

production from 30 000 to 35 000 would require a partial third shift because two shifts alone

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Exhibit 10.4

Comparative income statements for August, contribution income statement

format for Huber GmbH

Without one-off special

With one-off special

Difference,

order, 30 000 units

order, 35 000 units

5000 units

Per unit

Total

Total

Total

Sales

€20.00

€600 000

€655 000

€55 000‡

Variable costs

Manufacturing

7.50*

225 000

262 500

37 500§

Marketing

5.00

150 000

150 000

–||

Total variable costs

12.50

375 000

412 500

37 500

Contribution margin

7.50

225 000

242 500

7 500

Fixed costs

Manufacturing

4.50†

135 000

135 000

–#

Marketing

2.00

60 000

60 000

–#

Total fixed costs

6.50

195 000

195 000

–

Operating profit

€1.00

€30 000

€47 500

€17 500

* Variable manufacturing cost = direct materials, €6 + direct manufacturing labour, €0.50 + manufacturing overhead, €1 = €7.50.

Variable manufacturing cost = direct materials, €6 + direct manufacturing labour, €0.50 + manufacturing overhead, €1 = €7.50.

† Fixed manufacturing costs = direct manufacturing labour, €1.50 + manufacturing overhead, €3 = €4.50.

‡ 5000 × €11.00 = €55 000.

§ 5000 × €7.50 = €37 500.

|| No variable marketing costs would be incurred for the 5000-unit one-off special order.

Fixed manufacturing costs and fixed marketing costs are also unaffected by the special order.

could produce only 32 000 towels. This extra shift would probably increase fixed manufacturing

costs, thereby making any partial additional fixed manufacturing costs relevant for this decision.

The best way to avoid these problems is to require each item included in the analysis *both* (1)

to be an expected future revenue or cost, and (2) to differ among the alternatives. Note also that

unit-cost data mislead decision makers in two major ways: (a) when costs that are irrelevant to a

particular decision are included in unit costs, and (b) when unit costs that are calculated at differ-

ent output levels are used to choose among alternatives. Unitised fixed costs are often erroneously

interpreted as if they behave like unit variable costs. Generally, use total costs rather than unit

costs in relevant-cost analysis.

Outsourcing and make-or-buy decisions

We now consider the strategic decision of whether a company should make a part or buy it from

a supplier. We again assume idle capacity.

Outsourcing and idle facilities

Outsourcing is the process of purchasing goods and services from outside vendors rather than

producing the same goods or providing the same services within the organisation, which is

called insourcing. Outsourcing is an increasingly common practice though it has a long history.

As Kim (2018) explains in relation to the UK, for well over a century, an increase of legal and

accounting jobs being outsourced has been in evidence. During the 1850s, the common law system

required business cases to be settled by qualified specialists who were familiar with settling similar

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cases. As a consequence, private law offices emerged across the country. The greater the amount

of services they provided, the broader their consulting routines became and they ultimately turned

into the law outsourcing firms. The Big Four accountancy firms rose in a similar manner. Over

time PwC (PricewaterhouseCoopers), Deloitte, Ernst & Young and KPMG, outsourced their legal

work with accounting audits becoming common and becoming the focus of their business but

evolving into the provision of a variety of professional business services. Today, firms like Nike,

IBM, Coca-Cola and LinkedIn use service suppliers for sales, marketing, system integration,

and ongoing customer support. Hallmark UK, the greetings card manufacturer, outsources much

of its card production to the South East Asia. Likewise, Honda relies on outside vendors as

outsourcers to supply some component parts but chooses to manufacture other parts internally

(insourcing). Foxconn, the Taiwanese electronics manufacturer, acts as an outsourcee for Apple

Inc. and Amazon.com, and Toyota relies on outside suppliers to supply some parts and compo-

nents but chooses to manufacture other parts internally. The BBC likewise outsources many of

its accounting-based activities, as does British Airways. Similarly, WhatsApp which was founded

by two former Yahoo! employees, Brian Acton and Jan Koum, and acquired by Meta (previously

Facebook) for over $19 billion, outsourced much of its core development to a Russian contractor.

This proved useful as the company had very little starting capital – namely a ‘seed round’ of

$250 000 (see Bhimani 2022). Following the invasion of Ukraine, companies like Meta, Microsoft

and Spotify reduced or entirely stopped trading with Russian enterprises and consumers. In mak-

ing decisions about outsourcing and insourcing, cost is usually a major factor for any company

as discussed in the Concepts in action box below. But qualitative factors are equally important

and often take precedence.

Concepts in action

Costs, outsourcing and politics

Prior to 1980, outsourcing of public services to the private sector in the UK was a foreign idea. Local authorities directly

employed workers to collect rubbish and build roads. But in 1980, Margaret Thatcher changed that with privatisation

policies, putting work out to tender. By 2019–2020, outsourcing amounted to about half of public spending (£233

billion) (Sass and Davies, 2020).

The collapse of Carillion, a British multinational facilities management and construction services company and the

government’s biggest contractor, is considered a harbinger to the end of the privatisation era. It went into liquidation

on 15 January 2018 with debts of up to £7 billion, making it the most dramatic insolvency case in the UK. Prior to its

liquidation, the company, as do many other private tenderers, signed up for contracts committing to provide various

public services, from hospital-building to school-meals-supplying, at questionably low costs. Private providers in turn

tried to reduce their workers' pay, holiday and sickness entitlements. This has fuelled dissatisfaction and thousands of

workers have transferred into the public sector. A decade of austerity and a change in political mood has prompted

councils to cut their payment to private providers as they realised they could provide many services more cheaply and

effectively. The opposition party Labour's then leader, Jeremy Corbyn, called for an end to the policy of extreme out-

sourcing by public-sector organisations, claiming that this has 'fleeced the public of billions of pounds' and 'wreaked

havoc' as it is often, according to him, 'the same companies that have gone from service to service, creaming off profits

and failing to deliver the quality of service our people deserve'.

The trend to reduced costs through outsourcing is clearest in IT and technology-intensive sectors where human

resources and payroll functions have declined in absolute terms in the past decade. Politics are at the heart of many

decisions. However, consider Infosys which was founded in 1981, providing business consulting, information technol-

ogy and outsourcing services. The Indian tech giant halted its operations in Russia in April 2022 following accusations

that co-founder NR Narayan Murthy's son-in-law, the UK's Prime Minister Rishi Sunak, has profited from the Putin

regime. The company stated that it was 'in the process of urgently closing down its Russian operation' and 'relocating

staff to other countries'. While the economics matter, politics are at the heart of many decisions and the two are often

intertwined.

Sources: Parker, G. and Tetlow, G. (2017) 'Fall of Carillion should herald end of outsourcing, says Corbyn', *Financial Times,* 17 January; Plimmer, G. (2018) and

'How outsourcing fell out of fashion in the UK', *Financial Times,* 9 February (www.ft.com/content/983c4598-0d88-11e8-839d-41ca06376bf2); *Arab News* (2022), 'Indian tech giant Infosys closes down operations in Russia over UK FinMin accusations', 3 April (https://arab.news/zhre7); Sass, T. and Davies, N.

(2020) 'Outsourcing and privatisation', Institute for Government (https://www.instituteforgovernment.org.uk/explainers/outsourcing-and-privatisation)

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Decisions about whether a producer of goods or services will insource or outsource are also

called make-or-buy decisions**.** Often qualitative factors dictate management's make-or-buy

decision.

In the Brumaire SA example described here, assume that financial factors predominate in the

make-or-buy decision. The question we address is: What financial factors are relevant?

Brumaire SA manufactures thermostats for home and industrial use. Thermostats consist of

relays, switches and valves. Brumaire makes its own switches. Columns 1 and 2 of Exhibit 10.5

report the current costs for its heavy-duty switch (HDS) based on an analysis of its various man-

ufacturing activities.

Materials handling and set-up activities occur each time a batch of HDS is made. Brumaire

produces the 10 000 units of HDS in 25 batches of 400 units each. The cost driver is the number

of batches. Total materials handling and set-up consist of fixed costs of €5000 plus variable costs

of €500 per batch, amounting to €5000 + 25 × €500 = €17 500. Brumaire only commences pro-

duction after it receives a firm customer order. Brumaire's customers are pressuring the company

to supply thermostats in smaller batch sizes. Brumaire anticipates that next year, the 10 000 units

of HDS will be manufactured in 50 batches of 200 units each. Through continuous improvement,

Brumaire expects to reduce variable costs per batch for materials handling and set-up costs to €300

per batch. No other changes in fixed costs or unit variable costs are anticipated.

Another manufacturer offers to sell Brumaire 10 000 units of HDS next year for €16 per unit

on whatever delivery schedule Brumaire wants. Should Brumaire make or buy the part?

Columns 3 and 4 of Exhibit 10.5 indicate the expected total costs and the expected per unit

cost of producing 10 000 units of HDS next year. Direct materials, direct manufacturing labour,

and variable manufacturing overhead costs that vary with units produced are not expected to

change since Brumaire plans to continue to produce 10 000 units next year at the same vari-

able costs per unit as this year. The costs of materials handling, and set-ups are expected to

increase even though there is no expected change in the total production quantity. Why? Because

these costs vary with the number of batches started, not the quantity of production. Expected

total materials handling and set-up costs = €5000 + 50 batches × the cost per batch of

€300 = €5000 + €15 000 = €20 000. Brumaire expects fixed overhead costs to remain the

Exhibit 10.5

Financial data for HDS manufacturing at Brumaire SA

Expected total

Total current

Current

costs of

Expected

costs of

cost

producing

cost per

producing

per unit

10 000 units

unit

10 000 units

(2) = (1)

next year

(4) = (3)

(1)

÷ 10 000

(3)

÷ 10 000

Direct materials

€80 000

€8.00

€80 000

€8

Direct manufacturing labour

10 000

1.00

10 000

1

Va riable manufacturing overhead costs

40 000

4.00

40 000

4

for power and utilities

Mi xed overhead costs of materials

17 500

1.75

20 000

2

handling and set-ups

Fi xed overhead costs of plant depreciation,

30 000

3.00

30 000

3

insurance and administration

Total manufacturing costs

€177 500

€17.75

€180 000

€18

same. The expected manufacturing cost per unit equals €18. At this cost, it seems that the com-

pany should buy HDS from the outside supplier because making the part appears to be more

costly than the €16 per unit to buy it. A make-or-buy decision, however, is rarely obvious. A key

question for management is: What is the difference in relevant costs between the alternatives?

For the moment, suppose the capacity now used to make HDS will become idle if HDS is pur-

chased and that the €30 000 of fixed manufacturing overhead will continue to be incurred next

year, regardless of the decision made. Assume that the €5000 in fixed clerical salaries to support

set-up, receiving and purchasing will not be incurred if the manufacture of HDS is completely

shut down. Further suppose that the €30 000 in plant depreciation, insurance and administration

costs represents fixed manufacturing overhead that will not vary regardless of the decision made.

Exhibit 10.6 presents the relevant cost calculations. Brumaire saves €10 000 by making HDS

rather than buying it from the outside supplier. Alternatively stated, purchasing HDS costs

€160 000 but saves only €150 000 in manufacturing costs. Making HDS is thus the preferred

alternative. Exhibit 10.6 excludes the €30 000 of plant depreciation, insurance and administration

costs under both the make and the buy alternatives. Why? Because these costs are irrelevant; they

do not differ between the two alternatives. Alternatively, the €30 000 could be included under

both alternatives since the €30 000 will continue to be incurred whether HDS is bought or made.

Exhibit 10.6 includes the €20 000 of materials handling and set-up costs under the make alterna-

tive but not under the buy alternative. Why? Because buying HDS and not having to manufacture

it saves both the variable costs per batch and the avoidable fixed costs. The €20 000 of costs differ

between the alternatives and hence are relevant to the make-or-buy decision.

In Exhibit 10.6, the incremental cost of making HDS is the additional cost of €150 000. Like-

wise, the incremental cost of buying HDS from an outside supplier is the additional cost of

€160 000. The differential cost between making and buying HDS is €10 000. Note that, in practice,

incremental and differential costs are often used interchangeably.

The figures in Exhibit 10.6 are valid only if the released facilities remain idle. If the component

part is bought from the outside supplier, the released facilities can potentially be used for other,

more profitable purposes. More generally, then, the choice in our example is not fundamentally

whether to make or buy, it is how best to use available facilities.

Exhibit 10.6

Relevant (incremental) items for make-or-buy decision for HDS at Brumaire SA

Total relevant costs

Per unit relevant costs

Relevant items

Make

Buy

Make

Buy

Outside purchase of parts

€160 000

€16

Direct materials

€80 000

€8

Direct manufacturing labour

10 000

1

Va riable manufacturing overhead and

40 000

4

set-up overhead*

Mixed materials handling

20 000

2

Total relevant costs

€150 000

€160 000

€15

€16

⌋ | | | | ⌈ | | | | ⌉

⌋ | | ⌈ | | ⌉

Difference in favour of making HDS

€10 000

€1

* Alternatively, the €30 000 of depreciation, plant insurance and plant administration costs could be included under both

alternatives. These are, however, irrelevant to the decision.

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The use of otherwise idle resources can often increase profitability. For example, consider

the machine-repair plant of Beijing Engineering, where the decision was whether to drop or

keep a product. The plant kept producing electric plaster-spraying machines even though the

unit cost exceeded the selling price. Based on cost calculations, each sprayer cost 1230 yuan to

make but sold for only 985 yuan, resulting in a loss of 245 yuan per sprayer. Still, to meet market

demand, the plant continued to produce sprayers. Workers and machines would otherwise be

idle, and the plant would still have to pay 759 yuan even if no sprayers were made. In the short

run, the production of sprayers, even at a loss, actually helps cut the company’s operating loss.

Consider also, Tesla, which in 2017 had a total market value of $51 billion but showed a loss

of $1.96 billion. Ford's market value was then $45 billion, reporting a profit of $7.6 billion and

selling over 6.6 million cars in 2017 versus Tesla's 101,000. By the end of 2020, Tesla's profit was

$5.5 billion and was valued at $658 billion. Ford was then valued at $20 billion losing $1.3 billion.

Similarly, in early December 2021, Tesla's value was $1.09 trillion for profit of $3.3 billion in the

first quarter of 2022. Tesla was worth more at the time than every other car brand in the top 10

(Fallah, 2022). One reason for the difference in these companies' market worth is that Tesla's

valuation reflects the expectation that clean energy will replace fossil fuels and the battery market

will grow exponentially. Tesla will convert the market from coal and petroleum and its Model S

is expected to be produced in high volumes once production bottlenecks are resolved. With both

the Tesla and Beijing Engineering illustrations there is also the notion that fixed costs can be high

and lead to losses but they have to be incurred to enable scale. Once over a critical production

point, unit costs go down such that total unit costs fall below selling prices and profits follow.

Depending on future expectations, sustaining losses for a time can be justified if it is thought that

profitability will follow.

Opportunity costs, outsourcing and capacity constraints

Reconsider the Brumaire SA example where we assumed that the capacity currently used to make

HDS became idle if the parts were purchased. Suppose instead that Brumaire has alternative uses

for the extra capacity. The best available alternative is for Brumaire to use the capacity to produce

5000 units each year of a regular switch (RS) that Ventôse SA wants. Charlotte de Calonne, the

accountant at Brumaire, estimates the following future revenues and future costs if RS is manu-

factured and sold:

Expected additional future revenues

€80 000

Expected additional future costs

Direct materials

€30 000

Direct manufacturing labour

5 000

Variable overhead (power, utilities)

15 000

Materials handling and set-up overheads

5 000

Total expected additional future costs

55 000

Expected additional operating profit

€25 000

Since Brumaire cannot make both HDS and RS, the three alternatives available to management

are as follows:

1 Make HDS and do not make RS for Ventôse.

2 Buy HDS and do not make RS for Ventôse.

3 Buy HDS and use excess capacity to make and sell RS to Ventôse.

Exhibit 10.7, Panel A, summarises the ‘total-alternatives’ approach – the incremental expected

future costs and expected future revenues for *all* alternatives. Buying HDS and using the excess

capacity to make RS and sell it to Ventôse is the preferred alternative. The incremental costs

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Chapter 10 Relevant information for decision making

Exhibit 10.7

Total-alternatives approach and opportunity-costs approach to make-or-buy decisions for Brumaire

Panel A: Total-alternatives approach to make-or-buy decisions

Choices for Brumaire

Make HDS and

Buy HDS and

Buy HDS and

Relevant items

do not make RS

do not make RS

make RS

To tal incremental costs of making/

€150 000

€160 000

€160 000

buying HDS (from Exhibit 10.6)

Ex cess of future revenues over future

0

0

(25 000)

costs from RS

Total relevant costs

€150 000

€160 000

€135 000

Panel B: Opportunity-costs approach to make-or-buy decisions

Choices for Brumaire

Relevant items

Make HDS

Buy HDS

Total incremental costs of making/buying HDS (from

€150 000

€160 000

Exhibit 10.6)

Opportunity cost: Profit contribution forgone because capacity

25 000

0

cannot be used to make RS, the next-best alternative

Total relevant costs

€175 000

€160 000

Difference in favour of buying HDS

€15 000

of buying HDS from an outside supplier are more than the incremental costs of making HDS

in-house (€160 000 to buy versus €150 000 to make). But the capacity freed up by buying HDS

from the outside supplier enables Brumaire to gain €25 000 in operating profit (expected addi-

tional future revenues of €80 000 minus expected additional future costs of €55 000) by making

RS and selling to Ventôse. The total relevant costs of buying HDS (and making and selling RS)

are €160 000 – €25 000 = €135 000.

Deciding to use a resource in a particular way causes a manager to give up the opportunity to

use the resource in alternative ways. The lost opportunity is a cost that the manager must take into

account when making a decision. Opportunity cost is the contribution to income that is forgone

(rejected) by not using a limited resource in its next-best alternative use.

Exhibit 10.7, Panel B, displays the opportunity-costs approach for analysing the alternatives

faced by Brumaire. Management focuses on the two alternatives before it: whether to make or

buy HDS. It does not explicitly include RS in the analysis. Focus first on the make HDS column

and ask what are all the costs of choosing this alternative? Certainly, Brumaire incurs €150 000

of incremental costs to make HDS. But is this the entire cost? No, because by using limited man-

ufacturing resources to make HDS, Brumaire gives up the opportunity to earn €25 000 from not

using these resources to make RS. Therefore, the relevant costs of making HDS are the incremental

costs of €150 000 plus the opportunity cost of €25 000. Next consider the buy alternative. The

incremental costs are €160 000. The opportunity cost is zero because choosing this alternative

does not require the use of a limited resource – Brumaire's manufacturing capacity is still available

to make and sell RS. Panel B leads management to the same conclusion as Panel A does – buying

HDS is the preferred alternative by an amount of €15 000.

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Panels A and B of Exhibit 10.7 describe two consistent approaches to decision making with

capacity constraints. The total-alternatives approach in Panel A includes only incremental costs

and benefits and no opportunity costs. Why? Because the incremental benefit from making RS

when HDS is bought is explicitly considered under the alternatives. Panel B does not explicitly

consider the incremental benefits from selling RS. Instead, it factors in the forgone benefit as a

cost of the make alternative. Panel B highlights the idea that when capacity is constrained, relevant

costs equal the incremental costs plus the opportunity cost.

Opportunity costs are seldom incorporated into formal financial accounting reports because

these costs do not entail cash receipts or disbursements. Accountants usually confine their system-

atic recording to costs that require cash disbursements currently or in the near future. Historical

record keeping is limited to alternatives selected rather than those rejected, because once rejected,

there are no transactions to record. For example, if Brumaire makes HDS, it would not make RS,

and it would not record any accounting entries for RS. Yet the opportunity cost of making HDS,

which equals the profit contribution that Brumaire forgoes by not making RS, is a crucial input

into the make-versus-buy decision. Consider again Exhibit 10.7, Panel B. On the basis of incre-

mental costs alone, the costs systematically recorded in the accounting system, it is less costly for

Brumaire to make rather than buy HDS. Recognising the opportunity cost of €25 000 leads to a

different conclusion. It is preferable to buy HDS.

Suppose Brumaire has sufficient excess capacity to make RS (and indeed any other part) even

if it makes HDS. Under this assumption, the opportunity cost of making HDS is zero. Why?

Because Brumaire gives up nothing even if it chooses to manufacture HDS. It follows from Panel

B (substituting opportunity costs equal to zero) that, under these conditions, Brumaire would

prefer to make HDS.

Our analysis emphasises purely quantitative considerations. The final decision, however, should

consider qualitative factors as well. For example, before deciding to buy HDS from an outside

supplier, Brumaire management will consider such qualitative factors as the supplier’s reputation

for quality and the supplier’s dependability for on-time delivery.

Carrying costs of stock

The notion of opportunity cost can also be illustrated for a direct-materials purchase-order

decision. Suppose Nøkleby, AS, has enough cash to pay for whatever quantity of direct materials

it buys.

Annual estimated direct-materials requirements for the year

120 000 kg

Cost per kg for purchase orders below 120 000 kg

€10.00

Cost per kg for purchase orders equal to or greater than 120 000 kg;

€9.80

€10.00 minus 2% discount

Alternatives under consideration:

A. Buy 120 000 kg at start of year

B. Buy 10 000 kg per month

Average investment in stock:

A. (120 000 kg × €9.80) ÷ 2*

€588 000

B. (10 000 kg × €10.00) ÷ 2*

€50 000

Annual interest rate for investment in government bonds

6%

* The example assumes that the direct materials purchased will be used up uniformly at the rate of 10 000 kg per

month. If direct materials are purchased at the start of the year (month), the average investment in stock during the

year is the cost of the stock at the beginning of the year (month) plus the cost of stock at the end of the year (month)

divided by 2.

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The following table presents the two alternatives.

Alternative A:

Alternative B:

Purchase

Purchase

120 000 kg at

10 000 kg at

beginning of

beginning of

Difference

year (1)

each month (2)

(3) = (1) – (2)

Annual purchase (incremental) costs

€1 176 000

€1 200 000

€(24 000)

(120 000 × €9.80: 120 000 × €10)

Annual interest income that could

35 280

3 000

32 280

be earned if investment in stock

were invested in government bonds

(opportunity cost) (6% × €588 000; 6

% × €50 000)

(6% × €588 000; 6% × €50 000)

Relevant costs

€1 211 280

€1 203 000

€8 280

The opportunity cost of holding stock is the income forgone from not investing this money

elsewhere. These opportunity costs would not be recorded in the accounting system because they

are not incremental or outlay costs. Column 3 indicates that, consistent with the trends towards

holding smaller stocks as in just-in-time systems (see Chapter 21), purchasing 10 000 kg per month

is preferred to purchasing 120 000 kg at the beginning of the year because the lower opportunity

cost of holding smaller stock exceeds the higher purchase cost. If other incremental benefits of

holding lower stock such as lower insurance, materials handling, storage, obsolescence and break-

age costs were considered, alternative B would be preferred even more.

Concepts in action

Outsourcing versus automation at Nike

There are six major footwear manufacturers across the world, namely Nike, Adidas, Reebok, Fila, New Balance and

Converse. In terms of market share, Nike has 47% share of the market, with Reebok coming second at 16%. Nike does

not have manufacturing facilities but instead it has been a pioneer in outsourcing production to the developing world

with contractors in the Philippines, Vietnam, China, Indonesia and Taiwan all in all across 42 countries. For all the

Nike group's products, its contracted factories employ over 1.1 million workers. The company's employees maintain

stringent quality checks on these factories and Nike reaps considerable cost savings in the process. Their sales revenues

for the year ending 28 February 2021 were $44.5 billion and operating income of $6.9 billion.

Nike follows an integrated two-step process for its shoe manufacturing. All the Nike vendors are given various

inputs at all stages of production. This results in the end product being the same, no matter in which country or

factory it is produced.

As Fashinza reports, the first step in the manufacture of Nike footwear entails sourcing the raw materials required

for the production. These come from different parts of the world and shipped to factories worldwide. Nike vendors

work with these raw materials solely for the company ensuring high quality standards are maintained. The raw material

includes cotton, leather, rubber, recycled polyester, and PVC as well as PVA foam, mesh fabric and lightweight plastic.

The next step then is the actual production of the footwear.

Why does Nike outsource to over 530 factories mostly in Asia? This is because of the low cost of wages and the

ability to produce high-quality products for a fraction of the cost that apply in more economically developed coun-

tries, like of that in North America. A firm can maximise its profit margins using this strategy. Nike's profits exceed

44% on its products but would fall to as low as 5% if manufacturing took place say in North America. Nike's running

shoes cost around £3.50 to manufacture thereby leaving a huge profit margin for the company even after incurring

operating expenses tied to shipping, packaging, marketing, and corporate expenses. The company was accused of

using 'sweatshops' paying very low wages until about 2010 but has since reshaped its working practices that are now

seen to be much more equitable. Nike's website, under *Pilot Projects for Compensation.* states: 'We know that com-

pensation systems that reward performance and attract talent will benefit all stakeholders. We are now collaborating

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internally, with our leading suppliers, and with external experts to explore the next steps on scaling the learnings from

this research pilot' (Pino, 2020).

Source: Gallimore, D. (2021) OA, 14 October (https://www.outsourceaccelerator.com/articles/nikes-approach-to-outsourcing/); Pino, G. (2020) 'Nike products are manufactured in over 41 countries', *Sourci,* 22 June (https://sourci.com.au/blog/nike-products-are-manufactured-in-over-41-countries); Fashinza (2022) 'Who manufactures Nikes? ' (https://fashinza.com/textile/fashion-industry/who-manufactures-nikes/).

Product-mix decisions under capacity constraints

Companies with capacity constraints, such as Brumaire, must also often decide which products to

make and in what quantities. When a multiple-product plant operates at full capacity, managers

must often make decisions regarding which products to emphasise. These decisions frequently

have a short-run focus. For example, BMW must continually adapt the mix of its different models

of cars to short-run fluctuations in materials costs, selling prices and demand. Throughout this

section, we assume that as short-run changes in product mix occur, the only costs that change are

those that are variable with respect to the number of units produced (and sold).

Analysis of individual product contribution margins provides insight into the product mix

that maximises operating profit. Consider Tiilikainen, a company that manufactures engines

for a broad range of commercial and consumer products. At its Helsinki plant, it assembles two

engines: a snowmobile engine and a boat engine. Information on these products is as follows:

Snowmobile engine

Boat engine

Selling price

€800

€1000

Variable costs per unit

560

625

Contribution margin per unit

€240

€375

Contribution margin ratio

30%

37.5%

At first glance, boat engines appear more profitable than snowmobile engines. The product to

be emphasised, however, is not necessarily the product with the higher individual contribution

margin per unit or contribution margin percentage. Rather, managers should aim for the *highest*

contribution margin per unit of the constraining factor – that is, the scarce, limiting or critical

factor. The constraining factor restricts or limits the production or sale of a given product. (See

also Chapter 20 on the theory of constraints.)

Assume that only 600 machine-hours are available daily for assembling engines. Additional

capacity cannot be obtained in the short run. Tiilikainen can sell as many engines as it produces.

The constraining factor, then, is machine-hours. It takes two machine-hours to produce one

snowmobile engine and five machine-hours to produce one boat engine.

Snowmobile engine

Boat engine

Contribution margin per engine

€240

€375

Machine-hours required to produce one engine

2 machine-hours

5 machine-hours

Contribution margin per machine-hour

€120

€75

(240 ÷ 2; 375 ÷ 5)

Total contribution margin for 600 machine-hours

€72 000

€45 000

(€120 × 600; €75 × 600)

Producing snowmobile engines contributes more margin per machine-hour, which is the con-

straining factor in this example. Therefore, choosing to emphasise snowmobile engines is the

correct decision. Other constraints in manufacturing settings can be the availability of direct

materials, components or skilled labour, as well as financial and sales considerations. In a retail

department store, the constraining factor may be linear metres of display space. The greatest pos-

sible contribution margin per unit of the constraining factor yields the maximum operating profit.

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Concepts in action

Slashing cost at LEGO

For decades, Denmark-based LEGO Group has delighted children of all ages with its sets of construction toys. It is one

of the largest toymaker in the world. LEGO is controlled by the Kirk Kristiansen family, descendants of founder Ole Kirk

Christiansen, a master carpenter who made the first LEGO toy – a wooden duck. Kjeld Kirk Kristiansen, grandson of

Ole, is Chairman of Kirkbi, the family holding company that owns 75% of LEGO. This has made him Denmark's richest

person. In the first half of 2017, LEGO saw a 5% decline in revenues. No sales drop occurred in the prior ten years.

Jorgen Vig Knudstorp, Chairman and former CEO of LEGO Group, then announced a 'one-off, big move' where 1400

positions would go within six months. The company did not think that the landscape of retail was the key problem,

but rather the business as a whole needed to transform: 'The way we do business, the way we do our marketing, the

way we do our market management, but also how we run the whole administration of the company unfortunately

has become too complicated as we've grown the company massively over the past 12 to 13 years'. Over the course

of 2017, sales continued to decline – overall by 8% from the prior year and profits dropped by 17%. The 85-year-old

company was 'on the brink of collapse and foreign venture capitalists were circling ready to pounce' according to

Neate (2018). The firm's new CEO, Niels Christiansen, said he could not see a 'quick fix' to the problem and decided

to focus on 'slashing costs and overhauling the company's bloated structure.'

When a firm decides to engage in a major business re-organisation, employees are often fired. This may involve

finding ways to reduce the cost of labour as well as to enable altered processes and structures and deal with perceived

inefficiencies which have set in. A new CEO taking over a company whose sales and profits are in decline, such as

Niels Christiansen, will often require detailed cost information before deciding to implement a new strategy. Extreme

cost cutting and restructuring often go hand in hand. In December 2021, the Lego group committed to a $1 billion

investment in Vietnam. The intention was to build a carbon neutral factory by 2024 enabling the company to expand

its global supply chain network with factories located closer to its major growing markets at low labour costs and

reduced expenses tied to long distance shipping.

Source: Neate, R. (2018) 'LEGO reports first sales fall in 13 years, saying "there is no quick fix"', *The Guardian,* 6 March (www.theguardian.com/lifeand-

style/2018/mar/06/lego-sales-fall-growth-job-cuts); Lego (2021) 'Group announces plans to build new factory in Vietnam to support long-term growth'

(https://www.lego.com/en-us/aboutus/news/2021/december/new-factory-in-vietnam)

As you can imagine, in many cases a manufacturer or retailer must meet the challenge of trying

to maximise total operating profit for a variety of products, each with more than one constraining

factor. The problem of formulating the most profitable production schedules and the most prof-

itable product mix is essentially that of maximising the total contribution margin in the face of

many constraints. Optimisation techniques, such as the linear-programming technique discussed

in the appendix to this chapter, help solve these complicated problems.

Customer profitability and relevant costs

In addition to making choices among products, companies must often decide whether they should

add some customers and drop others. This section illustrates relevant-revenue and relevant-cost

analysis when different cost drivers are identified for different activities. The cost object in our

example is customers. The analysis focuses on customer profitability at Imbro-Glio, the Naples

sales office of Papa-Geno Srl, a wholesaler of specialised furniture.

Imbro-Glio supplies furniture to three local retailers, Lucrezia, Borgia and Rigo-Letto.

Exhibit 10.8 presents representative revenues and costs of Imbro-Glio by customers for the com-

ing year. Additional information on Imbro-Glio's costs for different activities at various levels of

the cost hierarchy is as follows:

1 Materials handling labour costs vary with the number of units of furniture shipped to

customers.

2 Different areas of the warehouse stock furniture for different customers. Materials handling

equipment in an area and depreciation costs on the equipment are identified with individual

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Exhibit 10.8

Analysis of Imbro-Glio customer profits

Lucrezia

Borgia

Rigo-Letto

Total

Sales

€500 000

€300 000

€400 000 €1 200 000

Cost of goods sold

370 000

220 000

330 000

920 000

Materials handling labour

41 000

18 000

33 000

92 000

Materials handling equipment cost written off as depreciation

10 000

6 000

8 000

24 000

Rent

14 000

8 000

14 000

36 000

Marketing support

11 000

9 000

10 000

30 000

Purchase orders and delivery processing

13 000

7 000

12 000

32 000

General administration

20 000

12 000

16 000 48 000

Total operating costs

479 000

280 000

423 000 1 182 000

Operating profit

€21 000

€20 000

€(23 000) €18 000

customer accounts. Any equipment not used remains idle. The equipment has a one-year useful

life and zero disposal price.

3 Imbro-Glio allocates rent to each customer account on the basis of the amount of warehouse

space occupied by the products to be shipped to that customer.

4 Marketing costs vary with the number of sales visits made to customers.

5 Purchase-order costs vary with the number of purchase orders received; delivery-processing

costs vary with the number of shipments made.

6 Imbro-Glio allocates fixed general administration costs to customers on the basis of euro sales

made to each customer.

Relevant-cost analysis of dropping a customer

Exhibit 10.8 indicates a loss of €23 000 on sales to Rigo-Letto. Imbro-Glio's manager believes

this loss occurred because Rigo-Letto places many low-volume orders with Imbro-Glio, resulting

in high purchase-order and delivery processing, and materials handling and marketing activ-

ity. Imbro-Glio is considering several possible actions with respect to the Rigo-Letto account –

reducing its own costs of supporting Rigo-Letto by becoming more efficient, cutting back on some

of the services it offers Rigo-Letto, charging Rigo-Letto higher prices, or dropping the Rigo-Letto

account. The following analysis focuses on the operating profit effect of dropping the Rigo-Letto

account. Exhibit 10.8 is essentially a customer profitability analysis (this management accounting

approach is further discussed in Chapter 12).

The key question is: What are the relevant costs and relevant revenues? The following informa-

tion about the effect of reducing various activities related to the Rigo-Letto account is available.

1 Dropping the Rigo-Letto account will save cost of goods sold, materials handling labour,

marketing support, purchase-order and delivery-processing costs incurred on the Rigo-Letto

account.

2 Dropping the Rigo-Letto account will mean that the warehouse space currently occupied by prod-

ucts for Rigo-Letto and the materials handling equipment used to move them will become idle.

3 Dropping the Rigo-Letto account will have no effect on fixed general administration costs.

Exhibit 10.9 presents the relevant-revenue and relevant-cost calculations. Imbro-Glio's operating

profit will be €15 000 lower if it drops the Rigo-Letto account, so Imbro-Glio decides to keep

the Rigo-Letto account. The last column in Exhibit 10.9 shows that the cost savings from drop-

ping the Rigo-Letto account, €385 000, are not enough to offset the loss of €400 000 in revenue.

The key reason is that depreciation, rent and general administration costs will not decrease if the

Rigo-Letto account is dropped.

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Exhibit 10.9

Relevant-cost analysis for Imbro-Glio dropping the Rigo-Letto account

Amount of total revenues and total

Difference: incremental

costs

(loss in revenue) and

savings in costs from

Keep Rigo-Letto

Drop Rigo-Letto

dropping Rigo-Letto

account

account

account

Sales

€1 200 000

€800 000

€(400 000)

Cost of goods sold

920 000

590 000

330 000

Materials handling labour

92 000

59 000

33 000

Materials handling equipment cost written off

24 000

24 000

0

as depreciation

Rent

36 000

36 000

0

Marketing support

30 000

20 000

10 000

Purchase orders and delivery processing

32 000

20 000

12 000

General administration

48 000

48 000

0

Total operating costs

1 182 000

797 000

385 000

Operating profit (loss)

€18 000

€3 000

€(15 000)

Now suppose that if Imbro-Glio drops the Rigo-Letto account, it could lease the extra ware-

house space to Nessun-Dorma, which has offered €20 000 per year for it. Then the €20 000 that

Imbro-Glio would receive would be the opportunity cost of continuing to use the warehouse to

service Rigo-Letto. Imbro-Glio would gain €5000 by dropping the Rigo-Letto account (€20 000

from lease revenue minus lost operating profit of €15 000). Before reaching a final decision, how-

ever, Imbro-Glio must examine whether Rigo-Letto can be made more profitable so that supplying

products to Rigo-Letto earns more than the €20 000 from leasing to Nessun-Dorma. Imbro-Glio

must also consider qualitative factors such as the effect of the decision on Imbro-Glio's reputation

for developing stable, long-run business relationships.

Relevant-cost analysis of adding a customer

Suppose that in addition to Lucrezia, Borgia and Rigo-Letto, Imbro-Glio is evaluating the profit-

ability of adding a fourth customer, Bocca-Negra. Imbro-Glio is already paying rent of €36 000

for the warehouse and is incurring general administration costs of €48 000. These costs will not

change if Bocca-Negra is added as a customer. Bocca-Negra is a customer with a profile much

like Rigo-Letto's. Suppose Imbro-Glio predicts other revenues and costs of doing business with

Bocca-Negra to be the same as those described under the Rigo-Letto column of Exhibit 10.8.

Should Imbro-Glio add Bocca-Negra as a customer? Exhibit 10.10 shows incremental revenues

exceed incremental costs by €7000. Imbro-Glio would prefer to add Bocca-Negra as a customer.

Note that both volume and non-volume factors drive costs. This is the principle underlying

activity-based costing which is further discussed in the next chapter. The key point is that the

cost of acquiring new equipment to support the Bocca-Negra order (written off as depreciation

of €8000 in Exhibit 10.10) is included as a relevant cost. Why? Because this cost can be avoided

if Imbro-Glio decides not to do business with Bocca-Negra. Note the critical distinction here.

Depreciation cost is irrelevant in deciding whether to drop Rigo-Letto as a customer (because

it is a past cost), but the purchase cost of the new equipment that will then be written off as

depreciation in the future is relevant in deciding whether to add Bocca-Negra as a new customer.

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Exhibit 10.10

Relevant-cost analysis for adding the Bocca-Negra account

Amount of total revenues

and total costs

Difference: incremental

revenue and (incremental

Do not add Bocca- Add Bocca- Negra

costs) from adding Bocca-

Negra account

account

Negro account

Sales

€1 200 000

€1 600 000

€400 000

Cost of goods sold (variable)

920 000

1 250 000

(330 000)

Materials handling labour

92 000

125 000

(33 000)

Materials handling equipment cost

24 000

32 000

(8 000)

written off as depreciation

Rent

36 000

36 000

0

Marketing support

30 000

40 000

(10 000)

Purchase orders and delivery

32 000

44 000

(12 000)

processing

General administration

48 000

48 000

0

Total operating costs

1 182 000

1 575 000

393 000

Operating profit

€18 000

€25 000

€7 000

Irrelevance of past costs and equipment-replacement decisions

The illustrations in this chapter have shown that expected future costs that do not differ among

alternatives are irrelevant. Now we return to the idea that all past costs are irrelevant.

Consider an example of equipment replacement. The irrelevant cost illustrated here is the

book value (original cost minus total depreciation) of the existing equipment. Assume that

Bjørnstjerne is considering replacing a metal-cutting machine for kitchen parts with a more tech-

nically advanced model. The new machine has an automatic quality-testing capability and is more

efficient than the old machine. The new machine, however, has a shorter life. Bjørnstjerne uses the

straight-line depreciation method. Sales from kitchen parts (€1.1 million per year) will be unaf-

fected by the replacement decision. Summary data on the existing machine and the replacement

machine are as follows:

Existing machine Replacement machine

Original cost

€1 000 000

€600 000

Useful life in years

5 years

2 years

Current age in years

3 years

0 years

Useful life remaining in years

2 years

2 years

Total depreciation

€600 000

Not acquired yet

Book value

€400 000

Not acquired yet

Current disposal price (in cash)

€40 000

Not acquired yet

Terminal disposal price (in cash 2 years from

€0

€0

now)

Annual operating costs (maintenance, energy,

€800 000

€460 000

repairs, coolants, and so on)

To focus on the main concept of relevance, we ignore the time value of money in this

illustration.

Exhibit 10.11 presents a cost comparison of the two machines.

Exhibit 10.11

Cost comparison: replacement of machinery, including relevant and irrelevant

items for Bjørnstjerne

Two years together

Keep

Replace

Difference

Sales

€2 200 000

€2 200 000

–

Operating costs

Cash-operating costs

1 600 000

920 000

€680 000

Old machine book value

Periodic write-off as depreciation or

400 000

–

–

Lump-sum write-off

–

400 000*

Current disposal price of old machine

–

(40 000)*

40 000

New machine cost, written off periodically as depreciation

–

600 000

(600 000)

Total operating costs

2 000 000

1 880 000

120 000

Operating profit

€200 000

€320 000

€(120 000)

* In a formal income statement, these two items would be combined as ‘loss on disposal of machine’ of €360 000.

We can apply our definition of relevance to four important items in the equipment-replacement

decision facing Bjørnstjerne:

1 *Book value of old machine.* Irrelevant, because it is a past (historical) cost. All past costs

are ‘down the drain’. Nothing can change what has already been spent or what has already

happened.

2 *Current disposal price of old machine.* Relevant, because it is an expected future cash inflow

that differs between alternatives.

3 *Gain or loss on disposal.* This is the algebraic difference between items 1 and 2. It is a mean-

ingless combination blurring the distinction between the irrelevant book value and the relevant

disposal price. Each item should be considered separately.

4 *Cost of new machine.* Relevant, because it is an expected future cash outflow that will differ

between alternatives.

Exhibit 10.11 should clarify these four assertions. The difference column in Exhibit 10.11 shows

that the book value of the old machine is not an element of difference between alternatives and

could be completely ignored for decision-making purposes. No matter what the timing of the

charge against revenue, the amount charged is still €400 000 regardless of the alternative chosen

because it is a past (historical) cost (note that the advantage of replacing is €120 000 for the two

years together). In contrast, the €600 000 cost of the new machine is relevant because it can be

avoided by deciding not to replace.

Past costs that are unavoidable because they cannot be changed, no matter what action is

taken, are sometimes described as sunk costs. In our example, old equipment has a book value of

€400 000 and a current disposal price of €40 000. What are the sunk costs in this case? The entire

€400 000 is sunk and down the drain because it represents an outlay made in the past that cannot

be changed. Thus, past costs and sunk costs are synonyms.

Exhibit 10.12 concentrates on relevant items only. Note that the same answer (the €120 000 net

difference) will be obtained even though the book value is completely omitted from the calcula-

tions. The only relevant items are the cash-operating costs, the disposal price of the old machine

and the cost of the new machine (represented as depreciation in Exhibit 10.12).

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Appendix: Linear programming

Exhibit 10.12

Cost comparison: replacement of machinery, relevant items only for Bjørnstjerne

Two years together

Keep

Replace

Difference

Cash-operating costs

€1 600 000

€920 000

€680 000

Current disposal price of old machine

–

(40 000)

40 000

New machine, written off periodically as depreciation

–

600 000

(600 000)

Total relevant costs

€1 600 000

€1 480 000

€120 000

Summary

The following points are linked to the chapter's learning objectives.

1 The five steps which managers might undertake in a decision process are: (a) obtain information, (b) make predic-

tions, (c) choose alternative courses of action, (d) implement decisions, and (e) evaluate performance.

2 To be relevant to a particular decision, a revenue or cost must meet two criteria: (a) it must be an expected future

revenue or cost, and (b) it must differ among alternative courses of action.

3 The consequences of alternative actions can be quantitative and qualitative. Quantitative factors are outcomes

that are measured in numerical terms. Some quantitative factors can be easily expressed in financial terms, others

cannot. Qualitative factors, such as employee morale, organisational culture or political fallout cannot be meas-

ured in numerical terms. Due consideration must be given to both financial and non-financial factors in making

decisions.

4 There are two common problems in relevant-cost analysis: (a) assuming all variable costs are relevant, and (b)

assuming all fixed costs are irrelevant.

5 Opportunity cost is the maximum available contribution to income that is forgone (rejected) by not using a limited

resource in its next-best alternative use. The idea of an opportunity cost arises when there are multiple uses for

resources and some alternatives are not selected. Opportunity cost is often included in decision making because

it represents the best alternative way in which an organisation may have used its resources had it not made the

decision it did.

6 In choosing among multiple products when resource capacity is constrained, managers should emphasise the

product that yields the highest contribution margin per unit of the constraining or limiting factor.

7 Expected future revenues and costs are the only revenues and costs relevant in any decision model. The book

value of existing equipment in equipment-replacement decisions represents past (historical) cost and therefore is

irrelevant.

Appendix

Linear programming

Linear programming (LP) is an optimisation technique used to maximise total contribution mar-

gin (the objective function), given multiple constraints. LP models typically assume that all costs

can be classified as either variable or fixed with respect to a single driver (units of output). LP

models also require certain other linear assumptions to hold. When these assumptions fail, other

decision models should be considered.

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Exhibit 10.13

Operating data for Tiilikainen

Department capacity

(per day) in product

units

Selling

Variable

Contribution

Product

Assembly

Testing

price

cost per unit

margin per unit

Only snowmobile engines

300

120

€800

€560

€240

Only boat engines

120

240

€1 000

€625

€375

Consider the Tiilikainen example described earlier in the chapter. Suppose that both the snow-

mobile and boat engines must be tested on a very expensive machine before they are shipped to

customers. The available testing-machine time is limited. Production data are as follows:

Use of capacity in

Daily maximum

hours per unit of product

production in units

Available daily

Snowmobile

Boat

Snowmobile

Boat

Department

capacity in hours

engine

engine

engine

engine

Assembly

600 machine-hours

2.0

5.0

300*

120

Testing

120 testing-hours

1.0

0.5

120

240

* For example, 600 machine-hours ÷ 2.0 machine-hours per snowmobile engine = 300, the maximum number

of snowmobile engines that the Assembly Department can make if it works exclusively on snowmobile engines.

Exhibit 10.13 summarises these and other relevant data. Note that snowmobile engines have a

contribution margin of €240 and that boat engines have a contribution margin of €375. Material

shortages for boat engines will limit production to 110 boat engines per day. How many engines

of each type should be produced daily to maximise operating profit?

Steps in solving an LP problem

We use the data in Exhibit 10.13 to illustrate the three steps in solving an LP problem. Throughout

this discussion, *S* equals the number of units of snowmobiles produced and *B* equals the number

of units of boat engines produced.

Step 1: Determine the objective

The objective function of a linear program expresses the objective or goal to be maximised (for

example, operating profit) or minimised (for example, operating costs). In our example, the

objective is to find the combination of products that maximises total contribution margin in the

short run. Fixed costs remain the same regardless of the product mix chosen and are therefore

irrelevant. The linear function expressing the objective for the total contribution margin (TCM) is

TCM = €240S + €375B

Step 2: Specify the constraints

A constraint is a mathematical inequality or equality that must be satisfied by the variables in a

mathematical model. The following linear inequalities depict the relationships in our example:

Assembly Department constraint

$2\,S + 5\,B \leq 600$

Testing Department constraint

$1\,S + 0.5\,B \leq 120$

Material shortage constraint for boat engines

$B \leq 110$

Negative production is impossible

$S \geq 0$ and $B \geq 0$

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Exhibit 10.14

Linear programming: graphic solution for Tiilikainen

250

Testing

Department

constraint

200

Material shortage constraint

150

for boat engines

100

Equal

Optimal corner

contribution

Boat engines (units)

(75, 90)

Area

margin lines

of feasible

50

solutions

Assembly

Department

constraint

0 0

50

100

150

200

250

300

Snowmobile engines (units)

The coefficients of the constraints are often called technical coefficients. For example, in the

Assembly Department, the technical coefficient is 2 machine-hours for snowmobile engines and

5 machine-hours for boat engines.

The three solid lines on the graph in Exhibit 10.14 show the existing constraints for Assembly

and Testing and the material shortage constraint. The feasible alternatives are those combinations

of quantities of snowmobile engines and boat engines that satisfy all the constraining factors.

The shaded 'area of feasible solutions' in Exhibit 10.14 shows the boundaries of those product

combinations that are feasible, or technically possible.

As an example of how the lines are plotted in Exhibit 10.14, use equal signs instead

of inequality signs and assume for the Assembly Department that $B = 0$; then $S = 300$ (600 machine-hours ÷ 2 machine-hours per snowmobile engine) $S = 300$ (600 machine-hours ÷ 2 machine-hours per snowmobile engine). Assume that $S = 0$; then

$B = 120$ (600 machine-hours ÷ 5 machine-hours per boat engine). Connect those two points

with a straight line.

Step 3: Calculate the optimal solution

We present two approaches for finding the optimal solution: the trial-and-error approach and the

graphic approach. These approaches are easy to use in our example because there are only two

variables in the objective function and a small number of constraints. An understanding of these

two approaches provides insight into LP modelling. In most real-world LP applications, however,

managers use computer software packages to calculate the optimal solution.

Although the trial-and-error and graphic approaches can be useful for two or possibly three

variables, they are impractical when many variables exist. Standard computer software packages

rely on the *simplex method.* The simplex method is an iterative step-by-step procedure for deter-

mining the optimal solution to an LP problem. It starts with a specific feasible solution and then

tests it by substitution to see whether the result can be improved. These substitutions continue

until no further improvement is possible and the optimal solution is obtained.

Trial-and-error approach The optimal solution can be found by trial and error, by working

with coordinates of the corners of the area of feasible solutions. The approach is simple.

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First, select any set of corner points and calculate the total contribution margin. Five corner

points appear in Exhibit 10.14. It is helpful to use simultaneous equations to obtain the exact

graph coordinates. To illustrate, the point ($S = 75$; $B = 90$) can be derived by solving the two

pertinent constraint inequalities as simultaneous equations:

$$2S + 5B = 600$$

(1)

$$1S + 0.5B = 120$$

(2)

Multiplying (2) by 2, we get

$$2S + 1B = 240$$

(3)

Subtracting (3) from (1):

$$4B = 360$$

Therefore,

$$B = 360 \div 4 = 90$$

Substituting for B in (2):

$$1S + 0.51902 = 120$$

$$S = 120 – 45 = 75$$

Given $S = 75$ and $B = 90$,

TCM = €240(75) + €375(90) = €51 750

Second, move from corner point to corner point, computing the total contribution margin at

each corner point. The total contribution margin, at each corner point is as follows:

Corner point Snowmobile Boat engines

Trial

(*S*, *B*)

engines (*S*)

(*B*)

Total contribution margin

1

(0, 0)

0

0

€240(0) + €375(0) = €0

2

(0, 110)

0

110

€240(0) + €375(110) = 41 250

3

(25, 110)

25

110

€240(25) + €375(110) = 47 250

4

(75, 90)

75

90

€240(75) + €375(90) = 51 750*

5

(120, 0)

120

0

€240(120) + €375(0) = 28 800

* Indicates the optimal solution.

The optimal product mix is the mix that yields the highest total contribution: 75 snowmobile

engines and 90 boat engines.

Graphic approach Consider all possible combinations that will produce an equal total contribu-

tion margin of, say, €12 000. That is,

€240 S + €375 B = €12 000

This set of €12 000 contribution margins is a straight dashed line in Exhibit 10.14 through

(S = 50; B = 0) and (S = 0; B = 32). Other equal total contribution margins can be represented by lines parallel to this one. In Exhibit 10.14, we show three dashed lines. The equal total contribution margins increase as the lines get farther from the origin because lines drawn farther from

the origin represent more sales of both snowmobile and boat engines.

The optimal line is the one farthest from the origin but still passing through a point in the area

of feasible solutions. This line represents the highest contribution margin. The optimal solution

is the point at the corner (S = 75; B = 90). This solution will become apparent if you put a ruler

on the graph and move it outward from the origin and parallel with the €12 000 line. The idea is

to move the ruler as far away from the origin as possible (that is, to increase the total contribu-

tion margin) without leaving the area of feasible solutions. In general, the optimal solution in a

maximisation problem lies at the corner where the dashed line intersects an extreme point of the

area of feasible solutions. Moving the ruler out any further puts it outside the feasible region.

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References and further reading

Sensitivity analysis

What are the implications of uncertainty about the accounting or technical coefficients used in the

LP model? Changes in coefficients affect the slope of the objective function (the equal contribution

margin lines) or the area of feasible solutions. Consider how a change in the contribution margin

of snowmobile engines from €240 to €300 per unit might affect the optimal solution. Assume the

contribution margin for boat engines remains unchanged at €375 per unit. The revised objective

function will be

TCM = €300 S + €375 B

Using the trial-and-error approach, calculate the total contribution margin for each of the

five corner points described in the table above. The optimal solution is still (S = 75; B = 90).

What if the contribution margin falls to €160? Again, the optimal solution remains the same

($S = 75$; $B = 90$). Big changes in the contribution margin per unit of snowmobile engines have

no effect on the optimal solution in this case.

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CHAPTER 10

Assessment material

Review questions

10.1 Outline the five-step sequence in a decision process.

10.2 Define relevant cost. Why are historical costs irrelevant?

10.3 ‘All future costs are relevant.’ Do you agree? Why?

10.4 Distinguish between quantitative and qualitative factors in decision making.

10.5 ‘Variable costs are always relevant, and fixed costs are always irrelevant.’ Do you agree? Why?

10.6 ‘A component part should be purchased whenever the purchase price is less than its total unit

manufacturing cost.’ Do you agree? Why?

10.7 Define opportunity cost.

10.8 ‘Cost written off as depreciation is always irrelevant.’ Do you agree? Why?

10.9 ‘Managers will always choose the alternative that maximises operating profit or minimises costs

in the decision model.’ Do you agree? Why?

10.10 How might the optimal solution of a linear-programming problem be determined?

Exercises

Basic level

10.11 Relevant costs, contribution margin, product emphasis (20–25 minutes)

Monteagudo-Playa SA is a take-away food store at a popular beach resort. Consuelo Herreros,

owner of Monteagudo-Playa, is deciding how much refrigerator space to devote to four different

drinks. Pertinent data on these four drinks are as follows:

Cola

Lemonade

Punch

Natural orange juice

Selling price per case

€108.00

€115.20

€158.40

€230.40

Variable costs per case

€81.00

€91.20

€120.60

€181.20

Cases sold per metre of shelf-

25

24

4

5

space per day

Consuelo has a maximum front shelf-space of 12 metres to devote to the four drinks. She wants

a minimum of 1 metre and a maximum of 6 metres of front shelf-space for each drink.

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Exercises

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Required

1 What is the contribution margin per case of each type of drink?

2 A co-worker of Consuelo's recommends that she maximise the shelf-space devoted to those

drinks with the highest contribution margin per case. Evaluate this recommendation.

3 What shelf-space allocation for the four drinks would you recommend for Monteagudo-Playa?

Intermediate level

10.12 Customer profitability, choosing customers (20–25 minutes)

Jours-Daim SA operates a printing press with a monthly capacity of 2000 machine-hours. Jours-

Daim has two main customers, Harpes-à Gonds, SNC and Fourbe-Riz SA. Data on each customer

for January follow:

Harpesà-Gonds

Fourbe-Riz

Total

Revenues

€120 000

€80 000

€200 000

Variable costs

42 000

48 000

90 000

Fi xed costs (allocated on the

60 000

40 000

100 000

basis of revenues)

Total operating costs

102 000

88 000

190 000

Operating profit

€18 000

€(8 000)

€10 000

Machine-hours required

1500 hours

500 hours

2000 hours

Each of the following requirements refers only to the preceding data; there is *no connection*

between the requirements.

Required

1 Should Jours-Daim drop the Fourbe-Riz business? If Jours-Daim drops the Fourbe-Riz busi-

ness, its total fixed costs will decrease by 20%.

2 Fourbe-Riz indicates that it wants Jours-Daim to do an *additional* €80 000 worth of printing

jobs during February. These jobs are identical to the existing business Jours-Daim did for

Fourbe-Riz in January in terms of variable costs and machine-hours required. Jours-Daim

anticipates that the business from Harpes-à Gonds in February would be the same as that in

January. Jours-Daim can choose to accept as much of the Harpes-à Gonds and Fourbe-Riz

business for February as it wants. Assume that total fixed costs for February will be the same

as the fixed costs in January. What should Jours-Daim do? What will Jours-Daim's operating

profit be in February?

10.13 Relevance of equipment costs (30–40 minutes)

Jääskinen Oy has just today paid for and installed a special machine for polishing cars at one of

its several outlets. It is the first day of the company's fiscal year. The machine cost €20 000. Its

annual operating costs total €15 000, exclusive of depreciation. The machine will have a four-year

useful life and a zero terminal disposal price.

After the machine has been used for a day, a machine salesperson offers a different machine that

promises to do the same job at a yearly operating cost of €9000, exclusive of depreciation. The

new machine will cost €24 000 cash, installed. The 'old' machine is unique and can be sold out-

right for only €10 000, minus €2000 removal cost. The new machine, like the old one, will have a

four-year useful life and zero terminal disposal price.

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Sales, all in cash, will be €150 000 annually, and other cash costs will be €110 000 annually, regard-

less of this decision.

For simplicity, ignore income taxes, interest and present-value considerations.

Required

1 a Prepare a statement of cash receipts and disbursements for each of the four years under

both alternatives. What is the cumulative difference in cash flow for the four years taken

together?

b Prepare income statements for each of the four years under both alternatives. Assume

straight-line depreciation. What is the cumulative difference in operating profit for the four

years taken together?

c What are the irrelevant items in your presentations in requirements (a) and (b)? Why are

they irrelevant?

2 Suppose the cost of the ‘old’ machine was €1 million rather than €20 000. Nevertheless, the

old machine can be sold outright for only €10 000, minus €2000 removal cost. Would the net

differences in requirements 1 and 2 change? Explain.

3 ‘To avoid a loss, we should keep the old machine.’ What is the role of book value in decisions

about replacement of machines?

***10.14 Contribution approach, relevant costs** (30 minutes)

Air Calabria owns a single jet aircraft and operates between Cantazaro and Venice. Flights leave

Cantazaro on Mondays and Thursdays and depart from Venice on Wednesdays and Saturdays.

Air Calabria cannot offer any more flights between Cantazaro and Venice. Only tourist-class seats

are available on its planes. An analyst has collected the following information:

Seating capacity per plane

360 passengers

Average number of passengers per flight

200 passengers

Flights per week

4 flights

Flights per year

208 flights

Average one-way fare

€500

Variable fuel costs

€14 000 per flight

Food and beverage service cost (no charge to passenger)

€20 per passenger

Commission to travel agents paid by Air Calabria (all tickets are booked 8% of fare

by travel agents)

Fixed annual lease costs allocated to each flight

€53 000 per flight

Fixed ground services (maintenance, check in, baggage handling) cost

€7000 per flight

allocated to each flight

Fixed flight crew salaries allocated to each flight

€4000 per flight

For simplicity, assume that fuel costs are unaffected by the actual number of passengers on a flight.

Required

1 What is the operating profit that Air Calabria makes on each one-way flight between Cantazaro

and Venice?

2 The Market Research Department of Air Calabria indicates that lowering the average one-

way fare to €480 will increase the average number of passengers per flight to 212. Should Air

Calabria lower its fare?

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3 Cima-Rosa, a tour operator, approaches Air Calabria on the possibility of chartering (renting

out) its jet aircraft twice each month, first to take Cima-Rosa's tourists from Cantazaro to

Venice and then to bring the tourists back from Venice to Cantazaro. If Air Calabria accepts

Cima-Rosa's offer, Air Calabria will be able to offer only 184 (208 – 24) of its own flights each

year. The terms of the charter are as follows: (a) For each one-way flight, Cima-Rosa will pay

Air Calabria €75 000 to charter the plane and to use its flight crew and ground service staff;

(b) Cima-Rosa will pay for fuel costs; and (c) Cima-Rosa will pay for all food costs. On purely

financial considerations, should Air Calabria accept Cima-Rosa's offer? What other factors

should Air Calabria consider in deciding whether or not to charter its plane to Cima-Rosa?

10.15 Optimal production plan, computer manufacturer (Chapter appendix) (30 minutes)

Fiordi-Ligi Srl assembles and sells two products: printers and desktop computers. Customers can

purchase either (a) a computer, or (b) a computer plus a printer. The printers are not sold without

the computer. The result is that the quantity of printers sold is equal to or less than the quantity

of desktop computers sold. The contribution margins are €200 per printer and €100 per computer.

Each printer requires 6 hours assembly time on production line 1 and 10 hours assembly time on

production line 2. Each computer requires 4 hours assembly time on production line 1 only. (Many

of the components of each computer are preassembled by external suppliers.) Production line 1

has 24 hours of available time per day. Production line 2 has 20 hours of available time per day.

Let *X* represent units of printers and *Y* represent units of desktop computers. The production

manager must decide on the optimal mix of printers and computers to manufacture.

Required

1 Express the production manager's problem in an LP format.

2 Which combination of printers and computers will maximise the operating profit of

Fiordi-Ligi? Use both the trial-and-error and the graphic approaches.

10.16 Optimal sales mix for a retailer, sensitivity analysis (Chapter appendix) (30–40 minutes)

Vier-und-Zwanzig GmbH operates a chain of food stores open 24 hours a day. Each store has a

standard 4000 square metres of floor space available for merchandise. Merchandise is grouped

in two categories: grocery products and dairy products. Vier-und-Zwanzig requires each store

to devote a minimum of 1000 square metres to grocery products and a minimum of 800 square

metres to dairy products. Within these restrictions, each store manager can choose the mix of

products to carry.

The manager of the Salzburg store estimates the following weekly contribution margins per square

metre: grocery products, €100; dairy products, €30.

Required

1 Formulate the decision facing the store manager as an LP model. Use *G* to represent square

metres of floor space for grocery products and *D* to represent square metres of floor space for

dairy products.

2 Why might Vier-und-Zwanzig set minimum bounds on the floor space devoted to each line of

products?

3 Compute the optimal mix of grocery products and dairy products for the Salzburg store.

4 Will the optimal mix determined in requirement 3 change if the contribution margins per

square metre change to grocery products, €80, and dairy products, €50?

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10.17 Relevant costing (From ACCA Financial Information for Management, Part 1, June 2004)

(40 minutes)

Ennerdale Ltd has been asked to quote a price for a one-off contract. The company's manage-

ment accountant has asked for your advice on the relevant costs for the contract. The following

information is available:

Materials

The contract requires 3000 kg of material K, which is a material used regularly by the company

in other production. The company has 2000 kg of material K currently in stock which had been

purchased last month for a total cost of £19 600. Since then the price per kilogram for material K

has increased by 5%. The contract also requires 200 kg of material L. There are 250 kg of material

L in stock which are not required for normal production. This material originally cost a total of

£3125. If not used on this contract, the stock of material L would be sold for £11 per kg.

Labour

The contract requires 800 hours of skilled labour. Skilled labour is paid £9.50 per hour. There is

a shortage of skilled labour and all the available skilled labour is fully employed in the company

in the manufacture of product P. The following information relates to product P:

£ per unit

Selling price

100

Less

Skilled labour

38

Other variable costs

22

(60)

40

Required

1 Prepare calculations showing the total relevant costs for making a decision about the contract

in respect of the following cost elements:

a materials K and L; and

b skilled labour.

2 Explain how you would decide which overhead costs would be relevant in the financial appraisal

of the contract.

Advanced level

***10.18 Special-order decision** (35–40 minutes)

Fri-Flask specialises in the manufacture of one-litre plastic bottles. The plastic moulding machines

are capable of producing 100 bottles per hour. The firm estimates that the variable cost of pro-

ducing a plastic bottle is 25 øre. The bottles are sold for 55 øre each.

Management has been approached by a local toy company that would like the firm to produce a

moulded plastic toy for them. The toy company is willing to pay DKK 3.00 per unit for the toy.

The unit variable cost to manufacture the toy will be DKK 2.40. In addition, Fri-Flask would have

to incur a cost of DKK 20 000 to construct the mould required exclusively for this order. Because

the toy uses more plastic and is of a more intricate shape than a bottle, a moulding machine can

produce only 40 units per hour. The customer wants 100 000 units. Assume that Fri-Flask has a

total capacity of 10 000 machine-hours available during the period in which the toy company

wants delivery of the toys. The firm's fixed costs, excluding the costs to construct the toy mould,

during the same period will be DKK 200 000.

Exercises

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Required

1 Suppose the demand for its bottles is 750 000 units, and the special toy order has to be either

taken in full or rejected totally. Should Fri-Flask accept the special toy? Explain your answer.

2 Suppose the demand for its bottles is 850 000 units, and the special toy order has to be either

taken in full or rejected totally. Should Fri-Flask accept the special toy order? Explain your

answer.

3 Suppose the demand for its bottles is 850 000 units, and Fri-Flask can accept any quantity of

the special toy order. How many bottles and toys should it manufacture?

4 Suppose the demand for its bottles is 900 000 units, and the special toy order has to be either

taken in full or rejected totally. Should Fri-Flask accept the special toy order? Explain your

answer.

5 Suppose the demand for its bottles is 900 000 units, and Fri-Flask can accept any quantity of

the special toy order. How many bottles and toys should it manufacture?

6 Suppose the demand for its bottles is 950 000 units and Fri-Flask can accept any quantity of

the special toy order. How many bottles and toys should it manufacture?

7 The management has located a firm that has just entered the moulded plastic business. This

firm has considerable excess capacity and more efficient moulding machines, and is willing to

subcontract the toy job, or any portion of it, for DKK 2.80 per unit. It will construct its own

toy mould. Suppose the demand for its bottles is 900 000 units, and Fri-Flask can accept any

quantity of the special toy order. How many toys should it subcontract out?

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CHAPTER 11

Activity-based costing

Managers find cost information useful in making many types of decisions.

What should the selling price of a product/service be relative to the costs

Learning objectives

incurred? Does the market price allow a profit to be made? How far do

existing cost-allocation practices reflect the resource consumption of a

After studying this chapter, you

company’s different product lines? Simple costing systems often cannot should be able to:

answer such questions. Changing organisational circumstances at times

- Explain undercosting and

lead management accounting systems to lose their effectiveness in overcosting of products

providing effective costings. Investment in capital-intensive technology, for instance, can alter the material/labour/overhead cost mix of an

- Present three guidelines for

organisation’s products. Operational knowledge of how resources refining a costing system

are consumed may not tally with information reported by the costing

- Distinguish between the

system. Consequently, a difficult-to-make product may attract very traditional and the activity-based

little cost allocation under the prevailing accounting system which costing approaches to designing a

may be outdated. Likewise, the life of a product type may be getting

costing system

shorter because of more intensive competition by technologically driven

-

Describe a four-part cost hierarchy

companies. Under such situations, managers may find themselves with

-

Cost products or services using

cost information provided by an accounting system relying on product-

activity-based costing

life assumptions which are rapidly becoming inappropriate. Managers

may even reduce the selling price of a loss-making product based on

-

Use activity-based costing systems

costing information indicating that the product is very profitable. The

for activity-based management

costing approaches discussed in Chapters 3 and 4 are appropriate

-

Compare activity-based costing

starting points for tackling such questions. However, refinement is

and department-costing systems

often seen as necessary when circumstances dictate enhanced cost-

●

Appreciate the significance of

information complexity in pursuit of greater cost accuracy. Activity-based

organisational context issues

costing and activity-based management systems aim to provide such

in activity-based costing/

refinement. Activity-based accounting systems have been implemented

management system design and

in many organisations such as Siemens, Hoffman La Roche, Philips, Volvo,

implementation

Ericsson, Bank of Scotland, Coca Cola, Nike, Apple and the BBC among others. Activity-based costing/management finds widespread use; it alters managerial views of product costs and helps organisations in their decision making in many very significant ways.

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Undercosting and overcosting

We might use the term cost smoothing to describe a costing approach that uses broad averages to

uniformly assign the cost of resources to cost objects (such as products, services or customers)

when the individual products, services or customers in fact use those resources in a non-uniform

way.

Cost smoothing can lead to undercosting or overcosting of products or services:

● Product undercosting. A product consumes a relatively high level of resources but is reported

to have a relatively low total cost.

● Product overcosting. A product consumes a relatively low level of resources but is reported to

have a relatively high total cost.

Companies that undercost products may actually make sales that result in losses under the errone-

ous impression that these sales are profitable. That is, these sales bring in less revenue than the cost

of the resources they use. Companies that overcost products run the risk of losing market share

to existing or new competitors. Because these products actually cost less than what is reported

to management, the company could cut selling prices to maintain or enhance market shares and

still make a profit on each sale.

Product-cost cross-subsidisation

Product-cost cross-subsidisation means that at least one miscosted product is resulting in the mis-

costing of other products in the organisation. A classic example arises when a cost is uniformly

spread across multiple users without recognition of their different resource demands. Consider

the costing of a restaurant bill for four colleagues who meet once a month to discuss business

developments. Each diner orders separate entrées, desserts and drinks. The restaurant bill for the

most recent meeting is as follows:

Entrée

Dessert

Drinks

Total

Emmanuelle

€55

€0

€20

€75

Jean-Paul

100

40

70

210

Nathalie

75

20

40

135

Christophe

70

20

30

120

Total

€300

€80

€160

€540

Average

€75

€20

€40

€135

The €540 total restaurant bill produces a €135 average cost per dinner. This broad-average

costing approach treats each diner the same. Emmanuelle would probably object to paying €135

because her actual cost is only €75. Indeed, she ordered the lowest-cost entrée, had no dessert,

and had the lowest drink bill. When costs are averaged across all four diners, both Emmanuelle

and Christophe are overcosted, Jean-Paul is undercosted and Nathalie is accurately costed.

The restaurant example is both simple and intuitive. The amount of cost cross-subsidisation of

each diner can be readily calculated given that all cost items can be traced as direct costs to each

diner. More complex costing issues arise, however, when there are indirect costs. Then resources

are used by two or more individual diners. By definition, indirect costs require allocation – for

example, the cost of a bottle of wine shared by two or more diners.

To see the effects of cost smoothing on both direct and indirect costs, we consider the existing

costing system at Plastim Limited.

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Costing system at Plastim Limited

Plastim Limited manufactures lenses for the tail-lights of cars. The lens, made from black, red,

orange or white plastic, is the part of the lamp visible on the car's exterior. Lenses are made using

injection moulding. The moulding operation consists of injecting molten plastic into a mould to

give the lamp its desired shape. The mould is cooled to allow the molten plastic to solidify, and

the part is removed.

Under its contract with Giovanni Motors, a major car manufacturer, Plastim makes two types

of lens: a complex lens, CL5, and a simple lens, S3. The complex lens is a large lens with special

features such as multicolour moulding (where more than one colour is injected into the mould)

and complex shapes that wrap around the corner of the car. Manufacturing these lenses is more

complex because various parts in the mould must align and fit precisely. The simple lens is smaller

and has few special features.

Design, production and distribution processes

The sequence of steps to design, produce and distribute lenses, whether simple or complex, is as

follows:

1 *Design of products and processes.* Each year Giovanni Motors specifies some modifications

to the simple and complex lenses. Plastim's Design Department designs the moulds from

which the lenses will be made and defines the processes needed (details of the manufacturing

operations).

2 *Manufacturing operations.* The lenses are moulded, as described earlier, finished, cleaned and

inspected.

3 *Shipping and distribution.* Finished lenses are packed and sent to Giovanni Motors.

Plastim is operating at capacity and incurs very low marketing costs. Because of its high-quality

products, Plastim has minimal customer-service costs. Plastim's business environment is very

competitive with respect to simple lenses. At a recent meeting, Giovanni's purchasing manager

indicated that a new competitor, who makes only simple lenses, was offering to supply the S3

lens to Giovanni at a price of around €53, well below Plastim's price of €63. Unless Plastim

lowers its selling price, it will be in jeopardy of losing the Giovanni business for the simple lens,

similar to S3, for the upcoming model year. Plastim's management is very concerned about this

development. The same competitive pressures do not exist for the complex lens, which Plastim

currently sells to Giovanni at a price of €137 per lens.

Plastim's management has various alternatives available to them. Plastim can give up the Gio-

vanni business in simple lenses if it is going to be this unprofitable. It can reduce the price on the

simple lens and either accept a lower margin or aggressively seek to reduce costs. But first, man-

agement needs to understand what it costs to make and sell the S3 and CL5 lenses. To guide their

pricing and cost management decisions, Plastim's managers assign all costs, both manufacturing

and non-manufacturing, to the S3 and CL5 lenses. Had the focus been on inventory costing, they

would only assign manufacturing costs to the lenses.

Existing single indirect-cost pool system

To cost products, Plastim currently uses a job-costing system with a single indirect-cost rate,

similar to the system described in Chapter 3. The steps are as follows.

Step 1: Identify the chosen cost objects The cost objects are the 60 000 simple S3 lenses, and

the 15 000 complex CL5 lenses that Plastim makes. Plastim's goal is to calculate the *total* costs of

manufacturing and distributing these lenses. Plastim then determines unit costs of each lens by

dividing total costs of each lens by 60 000 for S3 and 15 000 for CL5.

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Step 2: Identify the direct costs of the products Plastim identifies the direct costs of the lenses

– direct materials and direct manufacturing labour – as follows:

60 000 Simple lenses (S3)

15 000 Complex lenses (CL5)

Total

Per unit

Total

Per unit

Total

(1)

(2) = (1) ÷ 60 000

(3)

(4) = (3) ÷ 15 000 (5) = (1) + (3)

Direct materials

€1 125 000

€18.75

€675 000

€45.00

€1 800 000

Direct manuf acturing labour

600 000

10.00

195 000

13.00

795 000

Total direct costs

€1 725 000

€28.75

€870 000

€58.00

€2 595 000

Step 3: Select the cost-allocation bases to use for allocating indirect costs to the products

Most of the indirect costs consist of salaries paid to supervisors, engineers, manufacturing sup-

port and maintenance staff that support direct manufacturing labour. Hence, Plastim uses direct

manufacturing labour-hours as the only allocation base to allocate all indirect costs to S3 and

CL5. In the current year, Plastim used 39 750 actual direct manufacturing labour-hours.

Step 4: Identify the indirect costs associated with each cost-allocation base Plastim groups all

indirect costs totalling €2 385 000 into a single overhead cost pool.

Step 5: Compute the rate per unit of each cost-allocation base used to allocate indirect costs

to the products

Actual total costs in indirect-cost pool

Actual indirect-cost rate = Actual total quantity of cost-allocation base

€2 385 000

=

= €60 per direct manufacturing labour-hour

39 750 hours

Exhibit 11.1, Panel A, shows an overview of Plastim's existing costing system.

Step 6: Compute the indirect costs allocated to the products Plastim uses 30 000 total direct

manufacturing labour-hours to make the simple S3 lenses and 9750 direct manufacturing

labour-hours to make the complex CL5 lenses. Exhibit 11.1, Panel B, shows indirect costs of

€1 800 000 (€60 per direct manufacturing labour-hour × 30 000) allocated to the simple lens

and €585 000 (€60 per direct manufacturing labour-hour × 9750) allocated to the complex

lens.

Step 7: Compute the total cost of the products by adding all direct and indirect costs assigned

to them Exhibit 11.1, Panel B, presents the product costs for the simple and complex lenses. The

direct costs are calculated in step 2 and the indirect costs in step 6. Note the correspondence

between the costing system overview diagram (Exhibit 11.1, Panel A) and the costs calculated in

step 7. Panel A shows two direct-cost categories and one indirect-cost pool. Hence the cost of

each type of lens in step 7 (Panel B) has three line items: two for direct costs and one for allocated

indirect costs.

Plastim's management begins investigating why the S3 lens costs €58.75, well above the €53

price quoted by Plastim's competitor. Are Plastim's technology and processes inefficient in man-

ufacturing and distributing the simple S3 lens? Further analysis indicates that such inefficiency

is not the reason. Plastim has years of experience in manufacturing and distributing lenses like

S3. Because Plastim often makes process improvements, management is confident that their

technology and processes for making simple lenses are not inferior to their competitors. How-

ever, management is less certain about Plastim's capabilities in manufacturing and distributing

complex lenses. Indeed, Plastim has only recently started making this type of lens. Management

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is pleasantly surprised to learn that Giovanni Motors considers the prices of CL5 lenses to be

very competitive. It is puzzling that, even at these prices, Plastim earns very large margins on

the CL5 lenses:

60 000 Simple lenses (S3)

15 000 Complex lenses (CL5)

Total

Per unit

Total

Per unit

Total

(1)

(2) = (1) ÷ 60 000

(3)

(4) = (3) ÷ 15 000

(5) = (1) + (3)

Revenues

€3 780 000

€63.00

€2 055 000

€137.00

€5 835 000

Costs

3 525 000

58.75

1 455 000

97.00

4 980 000

Operating profit

€255 000

€4.25

€600 000

€40.00

€855 000

Operating profit ÷ Revenues

6.75%

29.20%

Exhibit 11.1

Product costs at Plastim Ltd using existing single overhead cost pool

Panel A: Overview of Plastim's existing costing system

Indirect-cost

All indirect costs

pool

€2 385 000

39

Indirect

750

direct

cost-allocation

manufacturing

base

labour-hours

€60 per direct

manufacturing

labour-hour

Cost object:

Indirect costs

S3 and CL5

Direct costs

lenses

Direct

Direct

costs

Direct

manufacturing

materials

labour

Panel B: Product costs using the existing costing system

60 000 Simple lenses (S3)

15 000 Complex lenses (CL5)

Total

Per unit

Total

Per unit

Total

(1)

(2) = (1) ÷ 60 000

(3)

(4) = (3) ÷ 15 000 (5) = (1) + (3)

Direct materials

€1 125 000

€18.75

€675 000

€45.00

€1 800 000

Direct manufacturing labour 600 000

10.00

195 000

13.00

795 000

Total direct costs

1 725 000

28.75

870 000

58.00

2 595 000

Indirect costs allocated

1 800 000

30.00

585 000

39.00

2 385 000

Total costs

€3 525 000

€58.75

€1 455 000

€97.00

€4 980 000

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Plastim's managers are surprised that the margins are low on the S3 product where the com-

pany has strong capabilities, whereas the margins are quite high on the newer, less-established

CL5 product. Since they are not deliberately charging a low price for S3, they wonder whether

the costing system overcosts the simple S3 lens (assigning excessive costs to it) and undercosts the

complex CL5 lens (assigning too little costs to it).

Plastim's management is quite confident about the direct materials and direct manufacturing

labour costs of the lenses. Why? Because these costs can be traced to the lenses in an economi-

cally feasible way. They are less certain about the accuracy of the costing system in measuring the

overhead resources used by each type of lens. The key question then is: How might the system of

allocating overhead costs to lenses be refined?

Refining a costing system

A refined costing system reduces the use of broad averages for assigning the cost of resources to

cost objects (such as jobs, products, and services) and provides better measurement of the costs

of indirect resources used by different cost objects – no matter how differently the different cost

objects use indirect resources. Refining costing systems requires gathering, validating, analysing,

and storing vast quantities of data. Advances in information technology have drastically reduced

the costs of performing these activities.

Many organisations – such as ABB, the Swiss-Swedish power company; the Antwerp Port

Authority; Kanthal, the Swedish manufacturer of heating elements; the Barcelona City Council;

and the NatWest bank in the United Kingdom – have refined their costing systems. What has

caused such diverse companies operating in different parts of the world, to do so? There are three

principal reasons:

● **Increase in product diversity.** Customers are demanding more customised products and, to

differentiate themselves from competitors, companies are producing and selling many more

products than in the past. Kanthal, for example, produces more than 10 000 different types of

electrical heating wires and thermostats. Hospitals carry out a multitude of health services.

Banks offer a large range of accounts and services: premium customer accounts, ATM and

credit cards, electronic payments, and investment and insurance services. These different prod-

ucts make different demands on the resources needed to produce them because of differences

in volume, process and complexity. The resources demanded by these different products cannot

be measured by a simple costing system that allocates indirect costs on the basis of, say, direct

manufacturing labour-hours. Using such a simple costing system will result in inaccurate and

misleading product costs.

● **Increase in indirect costs.** Advances in product and process technology have led to increases

in indirect costs and decreases in direct costs, particularly direct manufacturing labour costs.

For example, flexible organisational technologies such as computer-integrated manufacturing

(CIM), robots and 3-D Printing have significantly reduced the direct manufacturing labour

costs of products. Computers on the manufacturing floor give instructions to set-up and run

equipment quickly and automatically. The computers accurately measure hundreds of pro-

duction parameters and directly control the manufacturing processes to achieve high-quality

output. Managing more complex technology and producing very diverse products requires

committing an increasing amount of resources for various support functions, such as produc-

tion scheduling and product and process design and engineering. Because direct manufacturing

labour is not a direct driver of these costs, allocating indirect costs using direct manufacturing

labour as a proxy often does not accurately measure how resources are being used by dif-

ferent products. Naturally, service-based organisations also make extensive use of advanced

computer technologies and intelligent automation. Costing system refinements require more

data gathering and more analysis and make the costing system more detailed. Improvements

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in information technology and the accompanying decline in the costs of tracking data make

it more cost-effective to implement refinements in costing systems. It is more practical now to

create systems that have multiple pools of indirect costs for allocating costs to products.

● **Competition in product markets.** As markets have become more competitive managers have

felt the need to obtain more-accurate cost information to help them make important strategic

decisions, such as how to price products and which products to sell. Making correct pricing and

product-mix decisions is critical in competitive markets because competitors quickly capitalise

on a company's mistakes.

This chapter describes three guidelines for refining a costing system:

● **Direct-cost tracing.** Classify as many of the total costs as direct costs of the cost object as is

economically feasible. This guideline aims to reduce the amount of costs classified as indirect.

● **Indirect-cost pools.** Expand the number of indirect-cost pools until each pool is more homo-

geneous. In a *homogeneous cost pool,* all of the costs have the same or a similar cause-and-

effect (or benefits-received) relationship with the cost-allocation base. For example, a single

indirect-cost pool containing both indirect machining costs and indirect distribution costs

that are allocated to products using machine-hours is not homogeneous because machining

costs and distribution costs do not have the same cause-and-effect relationship with machine-

hours. Increases in machine-hours – the cause – have the effect of increasing machining costs

but not distribution costs. Now, suppose machining costs and distribution costs are subdi-

vided into two separate indirect-cost pools using machine-hours as the cost-allocation base

for the machining cost pool and the number of shipments as the cost-allocation base for the

distribution-cost pool. Each indirect-cost pool would now be homogeneous, which means that

within each cost pool, all costs have the same cause-and-effect relationship with their respective

cost-allocation base.

● **Cost-allocation bases.** Use the cause-and-effect criterion, when possible, to identify the cost-

allocation base (the cause) for each indirect-cost pool (the effect).

Activity-based costing systems

One often-used approach for refining a costing system is *activity-based costing.* Activity-based

costing (ABC) systems refine costing systems by focusing on individual activities as the fundamental

cost objects. An activity is an event, task, or unit of work with a specified purpose, for example

designing products, setting up machines, operating machines and distributing products. ABC

systems calculate the costs of individual activities and assign costs to cost objects such as products

and services on the basis of the activities undertaken to produce each product or service.

We describe key ideas of an ABC system in the context of our Plastim example. ABC systems

focus on indirect costs because direct costs can be traced to products and jobs relatively easily. A

key step in implementing ABC at Plastim is to identify activities that help explain why Plastim

incurs the costs that it currently classifies as indirect. To define these activities, Plastim organises

a cross-functional team from design, manufacturing, distribution, and accounting and adminis-

tration. The team identifies key activities using a flowchart of all the steps and processes needed

to design, manufacture and distribute lenses.

Assignments to

Fundamental cost objects

other cost objects

Costs of

Activities

Cost of

activities

• Product

• Service

• Customer

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Plastim’s team identifies seven major activities:

1 Design products and processes.

2 Set-up moulding machine to ensure the mould is properly held in place and parts are properly

aligned before manufacturing starts.

3 Operate machines to manufacture lenses.

4 Maintain and clean the mould after lenses are manufactured.

5 Set-up batches of finished lenses for shipment.

6 Distribute lenses to customers.

7 Administer and manage all processes at Plastim.

By defining activities and identifying the costs of performing each activity, ABC systems seek

a greater level of detail in understanding how an organisation uses its resources. As we describe

ABC systems, keep in mind three features:

1 ABC systems create smaller cost pools linked to the different activities. Plastim partitions its

original single overhead cost pool into seven activity-related cost pools.

2 For each activity-cost pool, a measure of the activity performed serves as the cost-allocation

base. For example, Plastim defines set-up hours as a measure of set-up activity and cubic

metres of packages moved as a measure of distribution activity. Because each activity-cost pool

pertains to a narrow and focused set of costs (e.g. set-up or distribution), the cost pools are

homogeneous – over time, the costs in each cost pool have a cause-and-effect relationship with

the cost-allocation base. At Plastim, over the long run, set-up hours is a cost driver of set-up

costs, and cubic metres of packages moved is a cost driver of distribution costs.

3 In some cases, costs in a cost pool can be traced directly to products. In the Plastim example,

the cleaning and maintenance activity consists of salaries and wages paid to workers responsi-

ble for cleaning the mould. Following guideline 1 of refining a costing system, these costs can be

traced directly to the specific mould used to produce the lens. Direct tracing of costs improves

cost accuracy because it makes no assumptions about the cause-and-effect relationship between

the cost pool and the cost-allocation base.

The logic of ABC systems is that more finely structured activity-cost pools with activity-

specific cost-allocation bases, which are cost drivers for the cost pool, are considered to lead to

more accurate costing of activities. Allocating costs to products by measuring the cost-allocation

bases of different activities used by different products leads to more accurate product costs. In

contrast, consider the case when the cause-and-effect relationship between overhead costs and

the cost-allocation base(s) is weak. For example, in its existing costing system, Plastim uses direct

manufacturing labour-hours as the cost-allocation base for all overhead costs, whether in set-up

or distribution. Direct manufacturing labour-hours do not drive the costs in these activity-cost

pools. Consequently, measuring the direct manufacturing labour-hours used by various products

does not capture the overhead costs demanded by the different products.

By focusing on the set-up activity, we illustrate the effect of allocating all overhead costs to

products using direct manufacturing labour-hours versus an ABC system with its emphasis on

individual activities. Set-ups frequently entail trial runs, fine-tuning and adjustments. Improper

set-ups cause quality problems such as scratches on the surface of the lens. The resources needed

for each set-up depend on the complexity of the manufacturing operation: complex lenses require

more set-up resources per set-up than do simple lenses. Furthermore, complex lenses can be

produced only in small batches because the mould needs to be cleaned more often. Relative to

simple lenses, complex lenses not only use more resources per set-up, they also need more frequent

set-ups.

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Set-up data for the simple S3 lens and the complex CL5 lens are as follows:

Simple S3 Complex

lens

CL5 lens

Total

1

Quantity of lenses produced

60 000

15 000

2

Number of lenses produced per batch

240

50

3 = (1) ÷ (2)

Number of batches

250

300

4

Set-up time per batch

2 hours

5 hours

5 = (3) × (4)

Total set-up-hours

500 hours 1500 hours

2000 hours

Plastim identifies the total costs of set-ups (consisting mainly of allocated costs of process

engineers, supervisors and set-up equipment) of €300 000. The following table shows how set-up

costs are allocated to the simple and complex lenses using direct manufacturing labour-hours

and set-up-hours, respectively, as the allocation bases. The set-up cost per direct manufacturing

labour-hour equals €7.54717 (€300 000 ÷ 39 750). The set-up cost per set-up-hour equals €150

(€300 000 ÷ 2000 set-up-hours).

Simple

Complex

S3 lens

CL5 lens

Total

Cost allocated using direct manufacturing

labour-hours

€7.54717 × 30 000; €7.54717 × 9750

€226 415

€73 585

€300 000

Cost allocated using set-up-hours

€150 × 500; €150 × 1500

€75 000

€225 000

€300 000

Which allocation base should Plastim use? Plastim should allocate set-up costs on the basis of

set-up-hours. Why? Because, following guidelines 2 and 3, there is a strong cause-and-effect rela-

tionship between set-up-related overhead costs and set-up-hours, but there is almost no relationship

between set-up-related overhead costs and direct manufacturing labour-hours. ABC systems that

use available time (set-up-hours in our example) to calculate the cost of a resource and to allocate

costs to cost objects are sometimes called time-driven activity-based costing (TDABC) systems. Fol-

lowing guidelines 2 and 3, we see that the CL5 lens uses substantially more set-up-hours than the S3

lens (1500 hours, 2000 hours = 75% of the total set-up-hours) because the CL5 requires a greater

number of set-ups (batches) and each set-up is more challenging and requires more set-up-hours.

The ABC system therefore allocates significantly more set-up costs to CL5 than to S3. When direct

manufacturing labour-hours rather than set-up-hours are used to allocate set-up costs in the simple

costing system, the S3 lens is allocated a very large share of the set-up costs because the S3 lens uses a

larger proportion of direct manufacturing labour-hours (30 000 hours, 39 750 hours = 75.47%).

As a result, the simple costing system overcosts the S3 lens with regard to set-up costs.

We will see later in the chapter that ABC systems provide valuable information to managers

beyond more-accurate product costs. For example, identifying set-up-hours as the cost driver

correctly orients managers' cost-reduction efforts on reducing set-up-hours and cost per set-up-

hour. Note that set-up-hours are related to batches (or groups) of lenses made, not the number of

individual lenses. Activity-based costing attempts to identify the most relevant cause-and-effect

relationship for each activity pool without restricting the cost driver to be units of output or var-

iables related to units of output (such as direct manufacturing labour-hours). As our discussion

of set-ups illustrates, limiting cost-allocation bases to only units of output weakens the cause-

and-effect relationship between the cost-allocation base and the costs in a cost pool. Broadening

cost drivers to batches (or groups) of lenses, not just individual lenses, leads us to *cost hierarchies.*

Set-up costs depend on the number of batches and the complexity of the set-ups and hence set-

up-hours drive set-up costs. The simple S3 lens attracts more of the set-up costs when costs are

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allocated on the basis of direct manufacturing labour-hours. This occurs because more direct

manufacturing labour-hours are needed to produce S3 lenses. However, direct manufacturing

labour-hours required by the S3 and CL5 lenses bear no relationship to the set-up-hours demanded

by the S3 and CL5 lenses. The *cost hierarchy* distinguishes costs by whether the cost driver is a

unit of output (or variables such as machine-hours or direct manufacturing labour-hours that are

a function of units of output), or a *group* of units of a product (such as a batch in the case of

set-up costs), or the *product itself* (such as the complexity of the mould in the case of design costs).

Cost hierarchies

A cost hierarchy categorises costs into different cost pools on the basis of the different types of cost

driver (or cost-allocation base) or different degrees of difficulty in determining cause-and-effect

(or benefits-received) relationships.

ABC systems commonly use a four-part cost hierarchy – output-unit-level costs, batch-level

costs, product-sustaining costs and facility-sustaining costs – to identify cost-allocation bases that

are preferably cost drivers of costs in activity-cost pools.

Output-unit-level costs are resources sacrificed on activities performed on each individual unit

of a product or service. Manufacturing operations costs (such as energy, machine depreciation,

and repair) that are related to the activity of running the automated moulding machines are

output-unit-level costs. Why? Because the cost of this activity increases with each additional unit

of output produced (or machine-hour run).

Suppose that in our Plastim example, each S3 lens requires 0.15 moulding machine-hours.

Then S3 lenses require a total of 9000 moulding machine-hours (0.15 hour × 60 000 lenses).

Similarly, suppose CL5 lenses require 0.25 moulding machine-hours. Then the CL5 lens requires

3750 moulding machine-hours (0.25 hour × 15 000 lenses) The *total* moulding machine costs

allocated to S3 and CL5 depend on the quantity of each type of lens produced, regardless of the

number of batches in which the lenses are made. Plastim's ABC system uses machine-hours, an

output-unit-level cost-allocation base, to allocate manufacturing operation costs to products.

Batch-level costs are resources sacrificed on activities that are related to a group of units

of product(s) or service(s) rather than to each individual unit of product or service. In the

Plastim example, set-up costs are batch-level costs. Set-up resources are used each time

moulding machines are set-up to produce a batch of lenses. The S3 lens requires 500 set-

up-hours (2 hours per set-up × 250 batches). The CL5 lens requires 1500 set-up-hours

(5 hours per set-up × 300 batches). The total set-up costs allocated to S3 and CL5 depend on

the total set-up-hours required by each type of lens, not on the number of units of S3 and CL5

produced. Plastim's ABC system uses set-up-hours, a batch-level cost-allocation base to allocate

set-up costs to products.

In companies that purchase many different types of direct materials (Plastim purchases mainly

plastic pellets), procurement costs can be significant. Procurement costs include the costs of plac-

ing purchase orders, receiving materials, and paying suppliers. These costs are batch-level costs

because they are related to the number of purchase orders placed rather than to the quantity or

value of materials purchased.

Product-sustaining (or service-sustaining) costs are resources sacrificed on activities undertaken to

support individual products or services. In the Plastim example, design costs are product-sustaining

costs. Design costs for each type of lens depend largely on the time spent by designers on designing

and modifying the product, mould and process. These costs are a function of the complexity of the

mould, measured by the number of parts in the mould multiplied by the area (in square metres)

over which the molten plastic must flow (12 parts × 2.5 square metres or 30 parts-square metres

for the S3 lens, and 14 parts × 5 square metres or 70 parts-square metres for the CL5 lens). The

total design costs allocated to S3 and CL5 depend on the complexity of the mould, regardless of the

number of units or batches in which the units are produced. Design costs cannot be linked in any

cause-and-effect way to individual units of products or to individual batches of products. Plastim's

ABC system uses parts-square metres, a product-sustaining cost-allocation base, to allocate design

costs to products. Another example of product-sustaining costs is engineering costs incurred to

change product designs, although such changes are infrequent at Plastim.

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Facility-sustaining costs are resources sacrificed on activities that cannot be traced to individual

products or services but which support the organisation as a whole. In the Plastim example, the

general administration costs (including rent and building security) are facility-sustaining costs.

It is usually difficult to find good cause-and-effect relationships between these costs and a cost-

allocation base. This lack of a cause-and-effect relationship causes some companies not to allocate

these costs to products and instead to deduct them from operating income. Other companies,

such as Plastim, allocate facility-sustaining costs to products on some basis – for example,

direct manufacturing labour-hours – because management believes all costs should be allocated

to products. Allocating all costs to products or services becomes particularly important when

management wants to set selling prices on the basis of a cost number that seeks to include all costs.

Implementing activity-based costing

Now that we understand the basic concepts of ABC, we use it to refine Plastim's existing costing

system. We again follow the seven-step approach to costing presented at the beginning of the

chapter and the three guidelines for refining costing systems (increasing direct-cost tracing, cre-

ating homogeneous indirect-cost pools, and identifying cost-allocation bases that have a cause-

and-effect relationship with costs in the cost pool).

Step 1: Identify the chosen cost objects The cost objects are the S3 and CL5 lenses. That is,

the cost objects are the 60 000 S3 and the 15 000 C5 lenses that Plastim will produce. Platim's

managers want to know the *total* costs of designing, manufacturing, and distributing these lenses

and then the per-unit costs.

Step 2: Identify the direct costs of the products Plastim identifies direct materials costs, direct

manufacturing labour costs, and mould-cleaning and maintenance costs as direct costs of the

lenses. In its existing costing system, Plastim classified mould-cleaning and maintenance costs as

indirect costs and allocated them to products using direct manufacturing labour-hours. However,

these costs can be traced directly to a lens because each type of lens can only be produced from

a specific mould. Note that because mould-cleaning and maintenance costs consist of workers'

wages for cleaning moulds after each batch of lenses is produced, cleaning and maintenance costs

are direct batch-level costs. Complex lenses incur more cleaning and maintenance costs than

simple lenses because Plastim produces more batches of complex lenses than simple lenses and

because the moulds of complex lenses are more difficult to clean. Direct manufacturing labour-

hours do not capture the demand that complex and simple lenses place on mould-cleaning and

maintenance resources.

Plastim's direct costs are as follows:

60 000 Simple

15 000 Complex

lenses (S3)

lenses (CL5)

Cost hierarchy

Total

Per unit

Total

Per unit

Total

Description

category

(1)

(2) + (3) ÷ 60 000

(3)

(4) = (3) ÷ 15 000 (5) = (1) + (3)

Direct materials Output-unit €1 125 000

€18.75

€675 000

€45.00

€1 800 000

level

Direct mfg.

Output-unit

600 000

10.00

195 000

13.00

795 000

labour

level

Cleaning and

Batch level

maintenance

120 000

2.00

150 000

10.00

270 000

Total direct

€1 845 000

€30.75

€1 020 000

€68.00

€2 865 000

costs

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Exhibit 11.2

Activity-cost rates for Plastim's indirect-cost pools

Brief explanation of

(Step 3) Quantity (Step 5) Overhead the cause-and-effect

Cost hierarchy (Step 4) Total of cost-allocation allocation rate

relationship that motivates the

Activity

category

costs

base

(5) = (3) ÷ (4)

choice of the allocation base

(1)

(2)

(3)

(4)

(6)

(6)

Design

Product-

€450 000

100 parts-square €4500 per parts-

Complex moulds (more

sustaining

metres

square metres

parts and larger surface

area) require greater Design

Department resources

Set-ups of

Batch level

€300 000

2000 set-up-hours €150 per

Overhead costs of the

moulding

set-up-hour

set-up activity increase as

machines

set-up-hours increase

Manufacturing Output-unit

€637 500

12 750 moulding €50 per moulding Plastim has mostly

operations

level

machine-hours

machine-hour

automated moulding

machines.

Manufacturing overhead

costs support automated

moulding machines and

hence increase with

moulding machine usage

Shipment

Batch level

€81 000

200 shipments

€405 per shipment Costs incurred to prepare

set-up

batches for shipment

increase with the number of

shipments

Distribution

Output-unit

€391 500

67 500 cubic

€5.80 per cubic

Overhead costs of the

level

metres

metre

distribution activity increase

with cubic metres of

packages shipped

Administration Facility-

€255 000

39 750 direct

€6.4151 per direct Administration Department

sustaining

manufacturing

manufacturing

resources support direct

labour-hours

labour-hour

manufacturing labour-hours

because the demand for

these resources increases

with direct manufacturing

labour-hours

Step 3: Select the cost-allocation bases to use for allocating indirect costs to the products

Plastim identifies six activities – design, moulding machine set-ups, manufacturing operations,

shipment set-up, distribution and administration – for allocating indirect costs to products.

Exhibit 11.2, column 4, shows the cost-allocation base and the quantity of the cost-allocation

base for each activity.

The cost-allocation base is pivotal in defining the number of activity pools in an ABC system. For

example, rather than define the design activities of product design, process design and prototyp-

ing as separate activities, Plastim defines these activities as part of a combined design activity.

Why? Because the complexity of the mould is an appropriate cost driver for costs incurred in all

three design subactivities.

A second consideration in choosing a cost-allocation base is the availability of reliable data and

measures. Consider, for example, the problem of choosing a cost-allocation base for the design

activity. The driver of design cost, a product-sustaining cost, is the complexity of the mould –

more complex moulds take more time to design. In its ABC system, Plastim measures complexity

in terms of the number of parts in the mould and the surface area of the mould. If these data are

difficult to obtain, or if measurement errors are large, Plastim may be forced to use some other

measure of complexity, such as the amount of material flowing through the mould. The problem

then is that the quantity of material flow may not adequately represent the complexity of the

design activity.

Step 4: Identify the indirect costs associated with each cost-allocation base In this step, over-

head costs incurred by Plastim are assigned to activities, to the extent possible, on the basis of

a cause-and-effect relationship between the costs of an activity and the cost-allocation base for

the activity. For example, costs in the distribution-cost pool have a cause-and-effect relationship

to cubic metres of packages moved. Of course, the strength of the cause-and-effect relationship

between costs of an activity and its respective cost-allocation base varies across cost pools. For

example, the cause-and-effect relationship between administration activity costs and direct man-

ufacturing labour-hours is not as strong as the relationship between set-up activity costs and

set-up-hours.

Some costs can be directly identified with a particular activity. For example, salaries paid to

design engineers are directly identified with the design activity. Other costs need to be allocated

across activities. For example, on the basis of interviews or time records, manufacturing engineers

and supervisors identify the time spent on design activities, moulding machine set-up activity

and manufacturing operations. The time spent on these activities serves as a basis for allocating

manufacturing engineers' and supervisors' salary costs to various activities. So, if a manufacturing

engineer spends 15% of their time on design, 45% of her time managing moulding machine set-

ups, and 40% of their time on moulding operations, the company will allocate the manufacturing

engineer's salary to each of these activities in proportion to the time spent. Similarly, other costs

are allocated to activity-cost pools using allocation bases that best describe the costs incurred for

the different activities. For example, space costs are allocated on the basis of square metres used

for different activities. However, the allocation base chosen may sometimes be constrained by the

availability of reliable data.

The key point here is that all costs do not fit neatly into activity categories. Often, costs may

first need to be allocated to activities before the costs of the activities can be allocated to products.

Step 5: Compute the rate per unit of each cost-allocation base used to allocate indirect costs

to the products Exhibit 11.2 summarises the calculation of the activity-cost rates using the

cost-allocation bases selected in step 3 and the indirect costs of each activity calculated in step 4.

Exhibit 11.3, Panel A, presents an overview of the ABC system.

Step 6: Compute the indirect costs allocated to the products Exhibit 11.3, Panel B, shows

indirect costs of €1 153 953 allocated to the simple lens and €961 047 allocated to the complex

lens. To calculate indirect costs of each lens, the total quantity of the cost-allocation base used

for each activity by each type of lens (using data provided by Plastim's operations personnel)

is multiplied by the cost-allocation rate calculated in step 5 (see Exhibit 11.2, column 5). For

example, of the 2000 hours of the set-up activity (Exhibit 11.2, column 4), the S3 lens uses 500

set-up-hours and the CL5 lens uses 1500 set-up-hours. Hence the total costs of the set-up activ-

ity allocated to the S3 lens is €75 000 (500 set-up-hours × €150, the set-up rate calculated in

Exhibit 11.2, column 5) and to the CL5 lens is €225 000 (1500 set-up-hours × €150). The set-up

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cost per unit can then be calculated as €1.25 (€75 000 ÷ 60 000 units) for the S3 lens and as €15

(€225 000 ÷ €15 000 units) for the CL5 lens.

Step 7: Compute the total costs of the products by adding al direct and indirect costs assigned

to them Exhibit 11.3, Panel B, presents the product costs for the simple and complex lenses. The

direct costs are calculated in step 2 and the indirect costs in step 6. The activity-based costing

system overview in Exhibit 11.3, Panel A, shows three direct-cost categories and six indirect-cost

pools. Hence, the cost of each lens type in Exhibit 11.3, Panel B, has nine line items, three for

direct costs and six for indirect costs. The differences in the ABC product costs of S3 and CL5

calculated in Exhibit 11.3, Panel B, highlight how these products use different amounts of direct

costs and different amounts of resources in each activity area.

We emphasise two key features of ABC systems. First, these systems identify all costs used by

products, whether the costs are variable or fixed in the short run. Why? Because the focus of

ABC systems is on longer-run decisions when more of the costs can be managed and fewer costs

are regarded as fixed and given. Hence, ABC systems identify all resources used by products

regardless of how individual costs behave in the short run. Second, as we have already described,

recognising the hierarchy of costs is critical when allocating costs to products. It is easiest to use

the cost hierarchy to calculate *total* costs. For this reason, we recommend calculating total costs

first. The per-unit costs can then be easily calculated by dividing total costs by the number of

units produced.

Exhibit 11.3

Product costs at Plastim Ltd using activity-based costing

Panel A: Overview of Plastim's activity-based costing

Manufacturing

Shipping

Design

Set-up

Distribution

Administration

Indirect-cost

operations

set-up

activity

activity

activity

activity

pool

activity

activity

€450 000

€300 000

€391

€637

500

€255 000

500

€81 000

Indirect

39

100

12

750

750

67 500

cost-allocation

2000

200

direct

parts-

moulding

cubic

base

set-up-hours

shipments

manufacturing

square metres

machine-hours

metres

labour-hours

€4500

€50 per

€6.4151 per

€150 per

€405 per

€5.80 per

per parts-

moulding

direct manufacturing

set-up-hour

shipment

cubic foot

square metre

machine-hour

labour-hour

Cost object:

Indirect costs

S3 and CL5

Direct costs

lenses

Direct

costs

Direct

Mould

Direct

manufacturing

cleaning and

materials

labour

maintenance

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Exhibit 11.3

continued

Panel B: Product costs using the activity-based costing system

60 000

15 000

Simple lenses (S3)

Complex lenses (CL5)

Description of Cost and

the Quantity of Activity

Total

Per unit

Total

Per unit

Total

Used by Each Type of Lens

(1)

(2) = (1) ÷ 60 000

(3)

(4) = (3) ÷ 15 000 (5) = (1) + (3)

Direct costs

Direct materials

€1 125 000

€18.75

€675 000

€45.00

€1 800 000

Direct manufacturing labour

600 000

10.00

195 000

13.00

795 000

Direct mould-cleaning and

maintenance costs

120 000

2.00

150 000

10.00

270 000

Total direct costs

1 845 000

30.75

1 020 000

68.00

2 865 000

Indirect costs

Design activity costs

⌋

S3, 30 parts-square

||

metres × €4500

135 000

2.25

⎨

450 000

CL5, 70 parts-square

⎪

metres × €4500

315 000

21.00

⎪⌋

Set-up activity costs

S3, 500 set-up-

⎫

hours × €150

75 000

1.25

⎪

300 000

CL5, 1500 set-up-hours

⎨⎪

× €150

225 000

15.00

⌋

Manufacturing operations

activity costs

S3, 9000 moulding

⌉

machine-hours × €50

450 000

7.50

⌊

637 500

CL5, 3750 moulding

⌉⌊

machine-hours × €50

187 500

12.50

⌋

Shipping set-up activity

S3, 100 shipment

⎫

× €405

40 500

0.67

⎪

81 000

CL5, 100 shipments

⎬⎪

× €405

40 500

2.70

⎭

Distribution activity

S3, 45 000 cubic

⎫

metres × €5.80

261 000

4.35

⎪

391 500

CL5, 22 500 cubic

}|

metres × €5.80

130 500

8.70

ȷ

Administration activity

S3, 30 000 direct

⌉

manufacturing

||

labour-hours

|

× €6.4151

192 453

3.21

|

255 000

⌇

CL5, 9750 direct

|

manufacturing

||

labour-hour

|

× €6.4151

_____

_____

62 547

4.17

J _____

Total indirect costs

1 153 953

19.23

961 047

64.07

2 115 000

Total costs

€2 998 953

€49.98

€1 981 047

€132.07

€4 980 000

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Comparing alternative costing systems

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Comparing alternative costing systems

Exhibit 11.4 compares key features of and differences resulting from Plastim's existing single

indirect-cost pool system (Exhibit 11.1) and the ABC system (Exhibit 11.3). We emphasise

three points in Exhibit 11.4: (1) ABC systems trace more costs as direct costs; (2) ABC systems

create more cost pools linked to different activities; and (3) for each activity-cost pool, ABC

systems seek a cost-allocation base that has a cause-and-effect relationship with costs in the

cost pool.

The homogeneous cost pools and the choice of cost-allocation bases, tied to the cost hierarchy,

gives Plastim's managers greater confidence in the activity and product-cost numbers from the

ABC system. Allocating costs to lenses using only an output-unit-level allocation base, direct

manufacturing labour-hours, as in the existing single indirect-cost pool system, overcosts the

Exhibit 11.4

Comparing alternative costing systems

Existing single

indirect-cost pool

ABC system

Difference

system (1)

(2)

(3) = (2) − (1)

Direct-cost categories

2

3

1

Direct materials

Direct materials

Direct manufacturing labour Direct manufacturing labour

Direct cleaning and maintenance

labour

Total direct costs

€2 595 000

€2 865 000

€270 000

Indirect-cost pools

1

6

5

Single indirect-cost pool

Design cost pool allocated using

allocated using direct

parts-square metres

manufacturing labour-hours Moulding machine set-up-cost

pool allocated using set-up-hours

Manufacturing operations-cost

pool allocated using machine-

hours

Shipment set-up-cost pool allocated using number of shipments

Distribution-cost pool allocated using cubic metres of packages shipped

Administration-cost pool allocated using direct manufacturing labour-hours

Total indirect costs

€2 385 000

€2 115 000

(€270 000)

Total costs assigned to simple (S3) lens

€3 525 000

€2 998 953

(€526 047)

Cost per unit of simple (S3) lens

€58.75

€49.98

(€8.77)

Total costs assigned to

complex (CL5) lens

€1 455 000

€1 981 047

€526 047

Cost per unit of

complex(CL5) lens

€97.00

€132.07

€35.07

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simple S3 lens and undercosts the complex CL5 lens. The CL5 (S3) lens uses a disproportionately

larger (smaller) amount of output-unit-level, batch-level and product-sustaining costs than is

represented by the direct manufacturing labour-hour cost-allocation base.

The benefits of ABC systems arise in part from using ABC information in seeking to make

decisions that are different from those in the absence of ABC. But these benefits must be traded

off against the measurement and implementation costs and challenges of these systems. We focus

on these issues next.

Concepts in action

Mayo Clinic uses time-driven activity-based costing to reduce costs and

improve care

About 17% of gross domestic product in the United States is spent on health care. In Germany, France and the UK,

this ranges between 10–12%, and in China, India and Russia the range is 3–6%. Across nations, healthcare costs are

rising. Costing healthcare delivery is therefore of significance at the national and organisational level. Several medical

centres, such as the Mayo Clinic in Rochester, Minnesota, are using time-driven activity-based costing (TDABC) to

help bring accurate cost and value measurement practices into the health care delivery system.

TDABC assigns all of the organisation's resource costs to cost objects using a framework that requires two sets of

estimates. TDABC first calculates the cost of supplying resource capacity, such as a doctor's time. The total cost of

resources – including personnel, supervision, insurance, space occupancy, technology and supplies – is divided by

the available capacity – the time available for doctors to do their work – to obtain the capacity cost rate. Next, TDABC

uses the capacity cost rate to drive resource costs to cost objects, such as the number of patients seen, by estimating

the demand for resource capacity (time) that the cost object requires.

Medical centres implementing TDABC have succeeded in reducing costs. For orthopaedic procedures at the Mayo

Clinic, the TDABC-modified process resulted in shorter stays for patients, a 24% decrease in patients discharged to

expensive skilled nursing facilities, and a 15% decrease in cost. Follow-on improvements have included obtaining

patient-reported outcomes from tablets and smartphones and eliminating major variations in the cost of prostheses

and other supplies.

More broadly, healthcare providers implementing TDABC have found that better outcomes for patients often go

hand in hand with lower total costs. For example, spending more on early detection and better diagnosis of disease

reduces patient suffering and often leads to less-complex and less-expensive care. With the insights from TDABC,

healthcare providers can utilise medical staff, equipment, facilities and administrative resources far more efficiently;

streamline the path of patients through the system; and select treatment approaches that improve outcomes while

eliminating services that do not.

Sources: Haas, D. A., Helmers, R. A., Rucci, M., Brady, M. and Kaplan, R. S. (2015) 'The Mayo Clinic model for running a value-improvement program', *Harvard Business Review,* 22 October (https://hbr.org/2015/10/the-mayo-clinic-model-for-running-a-value-improvement-program); Mangan, D. (2015) '$1

of every $5 spent in US will be on health care', CNBC, 28 July (www.cnbc.com/2015/07/28/1-of-every-5-spent-in-us-will-be-on-health-care.html); Kaplan, R. S. and Porter, M. E. (2011) 'How to solve the cost crisis in health care', *Harvard Business Review,* September (https://hbr.org/2011/09/how-to-solve-the-

cost-crisis-in-health-care); Kaplan, R. S. and Anderson, S. R. (2007) 'The innovation of time-driven activity-based costing', *Journal of Cost Management,* 21(2) (March–April): 5–15; Statista (2022) 'Health expenditure as a % of GDP in select countries' (https://www.statista.com/statistics/268826/health-

expenditure-as-gdp-percentage-in-oecd-countries/).

From activity-based costing to activity-based management

The emphasis of this chapter so far has been on the role of ABC systems in obtaining altered

activity and product costs. Companies use ABC information for pricing, product mix, and cost

management decisions. Activity-based management (ABM) describes management decisions that

use activity-based costing information to satisfy customers and manage profitability. Although

ABM has many definitions, we define it broadly to include pricing and product-mix decisions,

cost reduction and process improvement decisions, and product design decisions.

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From activity-based costing to activity-based management

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Pricing and product-mix decisions

An ABC system gives management particular insights into the cost structures for making and

selling diverse products. As a result, management can make pricing and product-mix decisions.

For example, the ABC system indicates that Plastim can reduce the price of S3 to the €53 range

and still make a profit, because the ABC cost of S3 is €49.98. Without this ABC information,

Plastim management might erroneously conclude that they would incur an operating loss on the

S3 lens at the €53 price. This incorrect conclusion might cause Plastim to reduce its business in

simple lenses and focus instead on complex lenses, where its existing single indirect-cost pool

system indicates it is very profitable.

Focusing on complex lenses would be a mistake. The ABC system indicates that the cost of

making the complex lens is much higher (€132.07 versus €97 under Plastim's existing direct man-

ufacturing labour-based costing system). As Plastim's operations staff had thought all along,

Plastim has no comparative advantage in making CL5 lenses. At a price of €137 per lens for CL5,

the margins look very small. As Plastim reduces prices on simple lenses, it will probably have to

negotiate a higher price for the complex lenses.

Cost reduction and process improvement decisions

Manufacturing and distribution personnel use ABC systems to focus cost-reduction efforts. Man-

agers set cost reduction targets in terms of reducing the cost per unit of the cost-allocation base

in different activity areas. For example, the supervisor of the distribution activity area at Plastim

could have a performance target of decreasing the distribution cost per cubic metre of products

shipped from €5.80 to €5.40 by reducing distribution labour and warehouse rental costs.

Doing an analysis of the cost of important activities (activity-cost pools) and the factors that

cause these costs to be incurred (cost drivers and cost-allocation bases) reveals many opportunities

for improving efficiency. Management can evaluate whether particular activities can be reduced or

eliminated by improving processes. Each of the indirect-cost-allocation bases in the ABC system is

a non-financial variable (number of hours of set-up time, cubic metres shipped, and so on). Con-

trolling physical items such as set-up-hours or cubic metres shipped is often the most fundamental

way that operating personnel manage costs. For example, Plastim can decrease distribution costs

by packing the lenses in a way that reduces the bulkiness of the shipment.

The following table shows the reduction in distribution costs of the S3 and CL5 lenses as a

result of process and efficiency improvements that lower the cost per cubic metre (from €5.80

to €5.40) and the total cubic metres of shipments (from 45 000 to 40 000 for S3 and 22 500 to

20 000 for CL5).

60 000 S3 lenses

15 000 CL5 lenses

Total

Per unit

Total

Per unit

(1)

(2) = (1) ÷ 60 000

(3)

(4) = (3) ÷ 15 000

Distribution cost per unit (from

€261 000

€4.35

€130 500

€8.70

Exhibit 11.3, Panel B)

Distribution costs as a result of

216 000

3.60

process improvements

S3, 40 000 cubic metres × €5.40

CL5, 20 000 cubic metres × €5.40

108 000

7.20

Savings in distribution cost from

_____

_____

_____

_____

process improvements

€45 000

€0.75

€22 500

€1.50

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Design decisions

Management can identify and evaluate new designs to improve performance by evaluating how

product and process designs affect activities and costs. Companies can then work with their cus-

tomers to evaluate the costs and prices of alternative design choices. For example, creative design

decisions that decrease the complexity of the mould reduce costs of design, materials, labour,

set-ups, moulding machine operations, and mould-cleaning and maintenance.

If Plastim uses its existing direct manufacturing labour-hour-based system to choose among alter-

native designs, which design choices will Plastim favour? Those designs that reduce direct manufac-

turing labour-hours the most. Why? Because the cost system would erroneously signal that reducing

direct manufacturing labour-hours reduces overhead costs. However, as our discussion of ABC

systems indicates, direct manufacturing labour-hours have little impact on Plastim's overhead costs.

Planning and managing activities

As was the case with Plastim, most companies implementing ABC systems for the first time analyse

actual costs to identify activity-cost pools and activity-cost rates. Many companies then use ABC

systems for planning and managing activities. They specify budgeted costs for activities and use

budgeted cost rates to cost products using normal costing. At year-end, budgeted and actual costs are

compared in order to provide feedback on how well activities were managed. Adjustments are also

made for under- or overallocated indirect costs for each activity area using the methods described in

Chapter 3 (adjusted allocation-rate approach, proration or write-off to cost of goods sold).

ABC and department-costing systems

Companies often use costing systems that have features of ABC systems – such as multiple cost pools

and multiple cost-allocation bases – but that do not emphasise individual activities. Many companies

have broadened their costing systems from using a single indirect-cost rate system, to using separate

indirect-cost rates for each department (for example, design, manufacturing, distribution, and so

on) or sub-department (for example, machining and assembly departments within manufacturing).

Why? Because the cost drivers of resources in each department or sub-department differ from the

single, company-wide, cost-allocation base. ABC systems are a further refinement of department-

costing systems. In this section, we compare ABC systems and department-costing systems.

Reconsider our Plastim illustration. The indirect-cost rate for the design activity is, in fact, a

Design Department indirect-cost rate. Plastim calculates the design activity rate by dividing total

Design Department costs by a measure of the complexity of the mould (the driver of Design

Department costs). Plastim does not find it worthwhile to calculate separate activity rates within the

Design Department. Why? Because the complexity of the mould is an appropriate cost-allocation

base for costs incurred for all design activities – the Design Department costs are homogeneous.

In contrast, in the Manufacturing (also in the Distribution) Department, Plastim identifies

two activity-cost pools – a set-up-cost pool and a manufacturing operations-cost pool – instead

of using a single Manufacturing Department indirect-cost pool. Why? For two reasons. First,

each of these activities within manufacturing incurs significant costs and has a different driver

of costs. Second, the S3 and CL5 lenses do not use resources from these two activity areas in

the same proportion. For example, CL5 uses 75% (1500 ÷ 2000) of the set-up-hours but only

29.4% (3750 ÷ 12 750) of the machine-hours. Using only machine-hours, say, to allocate all Man-

ufacturing Department costs at Plastim would result in CL5 being undercosted because it would

not be charged for the significant set-up resources it actually uses.

The preceding discussion suggests the following. Using department indirect-cost rates to allo-

cate costs to products results in the same product costs as activity-cost rates if (1) a single activity

accounts for a sizeable fraction of the department's costs, or (2) significant costs are incurred on

different activities within a department but each activity has the same cost-allocation base, or (3) sig-

nificant costs are incurred on different activities with different cost-allocation bases within a depart-

ment but different products use resources from the different activity areas in the same proportions.

Where any one of these three conditions holds, using department indirect-cost rates rather than

activity rates is often adequate. In companies where none of these conditions hold, department-

costing systems can be refined using ABC. Emphasising activities leads to more focused and

homogeneous cost pools, and aids in identifying activity-cost-allocation bases that have a better

cause-and-effect relationship with the costs in activity-cost pools. But the benefits of an ABC

system must be balanced against its costs and limitations.

Implementing ABC systems

Managers choose the level of detail in their costing systems by evaluating the costs of the sys-

tem against the benefits that accrue from using these systems while also taking into account the

context in which such systems are to operate. There are ‘tell-tale’ signs that indicate when ABC

systems are likely to provide benefits. We list some signals here:

1 Significant amounts of indirect costs are allocated using only one or two cost pools.

2 All or most indirect costs are identified as output-unit-level costs (i.e. few indirect costs are

described as batch-level, product-sustaining or facility-sustaining costs).

3 Products make diverse demands on resources because of differences in volume, process steps,

batch size or complexity.

4 Products that a company is well suited to make and sell show small profits, whereas products

that a company is less suited to produce and sell show large profits.

5 Complex products appear to be very profitable, and simple products appear to be losing money.

6 Operations staff have significant disagreements with the accounting staff about the costs of

manufacturing and marketing products and services.

When a company decides to implement ABC, it must make important choices about the level

of detail. Should it choose many finely specified activities, cost drivers and cost pools, or would

a few suffice? For example, Plastim could define a different moulding machine-hour rate for each

different type of moulding machine. In making such choices, managers consider the context, costs

and limitations of refining costing systems.

ABC systems require management to estimate costs of activity pools and to identify and meas-

ure cost drivers for these pools to serve as cost-allocation bases. Even basic ABC systems require

many calculations to determine costs of products and services. These measurements are costly.

Activity-cost rates also need to be updated regularly. Very detailed ABC systems are costly to

operate and difficult to understand.

In very detailed ABC systems, the allocations necessary to calculate activity costs often result

in activity-cost pools being measured with error. At times, companies are also forced to use

substitute allocation bases for which data are readily available rather than preferred allocation

bases. For example, a company might be forced to use the number of loads moved, instead of the

complexity and distance of different loads moved as the allocation base for material handling

costs because the former is easier to measure. When measurement errors are large, activity-cost

information can be misleading. For example, if the cost per load moved decreases, a company may

conclude that it has become more efficient in its materials-handling operations. In fact, the lower

cost per load moved may have resulted solely from moving lighter loads over shorter distances.

Managers always trade off the expected benefits of designing a more detailed and accurate

ABC system against the expected measurement and implementation costs of the system. Improve-

ments in information technology and accompanying declines in technology costs have enabled

ABC to be a practical costing system in many organisations. Consider for instance, an enterprise

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Exhibit 11.5

How digitalisation alters the value of activity based costing

Value of Activity

Based Costing

Products or Processes or Agents

Digital

Physical

Source: Adapted from Bhimani, A. (2021) *Accounting Disrupted: How Digitalization is Changing Finance* (New Jersey: Wiley/AICPA).

which is digitalizing its activities and business hypotheses. It would likely witness alterations in its

cost structure as it transforms, and the usage of cost information would also change. Digitalisa-

tion is likely to reduce the value of activity-based costing for most organisations. See Exhibit 11.5.

Cultural factors, management style and organisational characteristics are all important to

consider prior to mobilising any accounting systems change. This is discussed next.

Concepts in action

Do banks provide ‘free’ services?

A major source of profitability in retail banks is the interest

rate spread (the difference between the rate at which a bank

lends or invests money and the rate it pays its depositors).

Banks use this interest rate spread to cover the costs of the many ‘free’ services provided to customers, such as ‘free’ cheques and ‘free’ overdrafts. Many banks use activity-based costing (ABC) to determine the costs of their many individual services. This involves examining how each service (such as a current account) uses the resources of the bank. Some banks believe that they have been losing money on customers who hold small balances and make frequent use of the many ‘free’

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services. In contrast, customers holding large balances and making limited use of the ‘free’ services are highly profitable to banks. These customers cross-subsidise those with small-balance accounts. This situation has particularly affected banks with a physical high-street retail presence. Likewise, e-banking services require fewer resources than the provision of off-line banking services. Banks offering both may also experience some level of cross-subsidisation.

Many banks have responded to increased competition by instituting a detailed set of charges for services such as the

following:

● non-approved overdraft over a preset limit

● banker's draft preparation

● special statement requests

● cheque stop-payment request

● cheque returned because of insufficient funds in account.

These charges may be derived following an analysis of the activities underlying each service. For example, returning

a cheque because of lack of funds uses up more resources than putting a stop-payment on a cheque into effect.

ABC information enables the magnitude of costs (and cross-subsidisation) to be known. This is useful to managers in

understanding the effects of flat-fee pricing.

In 2018, Accenture reported that pricing was the foremost reason why consumers switch banks. About 40% of

customers said they switched financial institutions because of pricing reasons. Principato (2021) notes however that

'protection of data' has become the most important factor on consumers' decision to switch banks. Pricing and fees

come second. Very importantly, Millennials (those born between 1980 and 1994) and Generation Zers (born between

1995 and 2010) are the most likely to switch. They also place much less emphasis on physical branch location than

older generations since their bank is their phone. We consider pricing at more length in Chapter 12. For now, it is

important to know that for a bank or any enterprise, an understanding of product costs is useful as this usually feeds

into pricing decisions.

Sources: www.hsbc.co.uk/1/2/savings-accounts/online-bonus-saver/apply-online-savings; Accenture (2018) 'The Financial Brand' (https://thefinancialbrand.

com/69957/personalization-dynamic-pricing-ai-banking-analytics/). Principato, C. (2021) 'Here's why customers switch their primary bank', *Morning Consult,* 13 July (https://morningconsult.com/2021/07/13/heres-why-customers-switch-their-primary-bank/).

ABC and the organisational context

Throughout this book we have emphasised the need to consider technical management accounting

issues in the light of organisational context. Organisations are subject to a variety of social and

behavioural influences. One manager's aspirations will differ from the pursuits of another at the

personal level. Different individuals tend to be motivated in different ways by common reward

criteria. Moreover, individuals behave differently when working in teams as opposed to operating

individually. Organisations have distinct cultures and sub-cultures and, often, political influence

at the corporate level is tied to ‘belonging’ to particular groups or cliques or is simply deter-

mined by functional specialism. It is important to recognise that the implementation of a novel

cost management approach can, in part, be the outcome of pressure for change as articulated

by influential groups within the enterprise who show a preference for more financially oriented

approaches to managerial control.

It is often the case that relations between management accountants and operational manag-

ers improve significantly following the implementation of activity-based costing. Perhaps this

is due partly to ABC systems’ requiring the management accountant to integrate operational

information based on first-hand observation and discussions with individuals across different

departments, functions and activities within the enterprise. Nevertheless, resistance to accounting

systems change is often present. The cure is not always management education.

Aside from organisational culture and related contextual factors, it is likely that attitudes

towards and preferences for cost management practices are influenced by wider factors which can

be nationally rooted (Bhimani et al., 2005). For instance, the traditional French full costing method is

very similar to ABC. Therefore, many French managers perceive little or no incremental benefit from

introducing ABC in their companies. Language also may be an obstacle, especially since there is no

precise translation in French for ABC concepts. Activity-based costing has been developed in the USA

and is based on a contractual system that clearly sets out the performances expected of each manager

in each department. This system is consistent with the traditional ‘managing by numbers’ style that is

prevalent in many American business organisations. The logic of this style of management stipulates

that each person responsible for a budget must be assessed according to clearly defined objectives

that were negotiated beforehand. As ABC identifies activities and cost drivers, it also defines activities

in which managers have complete freedom to manoeuvre and the progress for which managers are

individually or jointly responsible. It is possible that French cultural specificities may explain why

the implementation of the ABC method has been slower in France than in Anglo-Saxon countries.

Sometimes, the intended objectives of an ABC or ABM system do not fully materialise and,

indeed, a variety of unanticipated consequences arise. Changes in accounting systems rarely pro-

duce effects which are fully anticipated at the outset. Accounting systems changes tend to become

enmeshed with interactions between individuals, processes, technologies, markets and other insti-

tutional factors, in often unpredictable ways. A good accounting system implementation is one

which recognises the organisational state of flux within which it operates. What is clear is that the

many experiences of ABC systems in use in organisations indicate that successful implementation

requires more than an understanding of ABC technicalities. What then are some of the behavioural

issues that the management accountant must be sensitive to? The following gives some pointers:

1 **Gain the support of top management:** this requires management accountants to lay out the

vision for the ABC project and to clearly communicate its strategic benefits (for example, the

resulting improvements in product and process design). It also requires selling the managers

in the various areas affected by the ABC the idea to end-users and working with members of

other departments as business partners of project.

2 **Create a coalition of supportive managers through the value chain:** systems measure how the

resources of an organisation are used. Managers responsible for these resources have the best

knowledge about activities and cost drivers. Getting managers to cooperate and take the initia-

tive for implementing ABC is essential for gaining the required expertise, the proper credibility,

and the necessary leadership. Gaining wider participation among managers has other benefits.

Managers who feel more involved in the process are likely to commit more time to and be less

sceptical of the ABC effort. Engaging managers throughout the value chain also creates greater

opportunities for coordination and cooperation across the different functions, for example,

design and manufacturing.

3 **Disseminating information about ABC throughout the organisation:** this allows workers in all

areas of a business to use their knowledge of ABC to make improvements. Some firms share

ABC information with its workers and also establish an incentive plan that give employees a

percentage of the cost savings. The results can be dramatic because employees become empow-

ered and motivated to implement numerous cost-saving projects.

4 **Look for small improvements initially:** too often, managers and management accountants seek

big results and major changes far too quickly. In many situations, achieving a significant change

overnight is difficult. However, showing how ABC information helps improve a process and

save costs, even if only in small ways, motivates the team to stay on course and build momen-

tum. The credibility gained from small victories leads to additional and bigger improvements

involving larger numbers of people and different parts of the organisation. Eventually, ABC

and ABM become rooted in the culture of the organisation. Sharing short-term successes may

also help motivate employees to be innovative.

5 **Don't oversell ABC:** management accountants must help managers to recognise both the value

and the limitations of ABC and not oversell it. Open and honest communication about ABC

ensures that managers use ABC thoughtfully to make good decisions. Critical judgements can

then be made without being adversarial, and tough questions can be asked to help drive better

decisions about the system.

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Summary

The following points are linked to the chapter's learning objectives.

1 Product undercosting (or overcosting) occurs when a product or service consumes a relatively high (low) level

of resources, but is reported to have a relatively low (high) cost. Cost smoothing, a common cause of under- or

overcosting, is the result of using broad averages that uniformly assign (spread) the cost of resources to products

when the individual products use those resources in a non-uniform way. Product-cost cross-subsidisation exists

when one or more undercosted (overcosted) products results in one or more other products being overcosted

(undercosted).

2 Refining a costing system means making changes that result in cost numbers that better measure the way cost

objects (such as jobs) differentially use the resources of the organisation. These changes can require additional

direct-cost tracing, the choice of more indirect-cost pools, or the use of different cost-allocation bases.

3 An ABC approach differs from the traditional approach by its fundamental focus on activities. An ABC approach

typically results in (a) more indirect-cost pools than the traditional approach, (b) more cost drivers used as cost-

allocation bases, and (c) more frequent use of non-financial variables as cost-allocation bases.

4 A cost hierarchy is a categorisation of costs into different cost pools on the basis of different classes of cost drivers

or different degrees of difficulty in determining cause-and-effect (or benefits-received) relationships. Four levels

of costs are output-unit-level costs, batch-level costs, product-sustaining costs and facility-sustaining costs.

5 In ABC, costs of activities are used to assign costs to other cost objects such as products or services.

6 Activity-based management (ABM) describes management decisions that use ABC information to satisfy customers

and improve profits. ABM information can assist in decisions concerning pricing, product mix, costs reductions,

process improvement, process or product redesign, and planning or managing activities.

7 Department-costing systems approximate ABC systems only when each department has a single activity or a

single allocation base for different activities or when different products use departmental activities in the same

proportions.

8 Extent of digitalization as well as organisational issues, cultural factors and employee behaviour affect the value of

ABC adoption as well as its consequences and perceived success.

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CHAPTER 11

Assessment material

Review questions

11.1 Define cost smoothing, and explain how managers can determine whether it occurs with their

costing system.

11.2 Why should managers worry about product over- or undercosting?

11.3 What is costing system refinement? Describe three guidelines for such refinement.

11.4 What is an activity-based approach to designing a costing system?

11.5 'Increasing the number of indirect-cost pools is guaranteed to sizably increase the accuracy of

product, service or customer costs.' Do you agree? Why?

11.6 The accountant of a retailer has just had a €50 000 request to implement an activity-based

costing system quickly turned down. A senior vice-president, in rejecting the request, noted,

'Given a choice, I will always prefer a €50 000 investment in improving things a customer sees or

experiences, such as our shelves or our store layout. How does a customer benefit by our spending

€50 000 on a supposedly better accounting system?' How should the accountant respond?

11.7 What are the most frequently used allocation bases for manufacturing overhead costs?

11.8 Describe four levels of a manufacturing cost hierarchy.

11.9 'The existence of non-output-unit-level costs means that managers should not calculate unit

product costs based on total manufacturing costs in all levels of the cost hierarchy.' Do you agree?

Explain.

11.10 How is an activity-based approach different from a traditional approach to designing a job-costing

system?

Exercises

Intermediate level

***11.11 ABC, product-cost cross-subsidisation** (30 minutes)

McCarthy Potatoes processes potatoes into chips at its highly automated Longford plant. For

many years, it processed potatoes for only the retail consumer market where it had a superb

reputation for quality. Recently, it started selling chips to the institutional market that includes

hospitals, cafeterias and university halls of residence. Its penetration into the institutional market

has been slower than predicted. McCarthy's existing costing system has a single direct-cost cat-

egory (direct materials, which are the raw potatoes) and a single indirect-cost pool (production

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support). Support costs are allocated on the basis of kilograms of chips processed. Support costs

include packaging material. This year's total actual costs for producing 1 000 000 kg of chips

(900 000 for the retail market and 100 000 for the institutional market) are:

Direct materials used

€150 000

Production support

€983 000

The existing costing system does not distinguish between chips produced for the retail or the

institutional markets.

At the end of the year, McCarthy unsuccessfully bid for a large institutional contract. Its bid was

reported to be 30% above the winning bid. This came as a shock as McCarthy included only a

minimum profit margin on its bid. Moreover, the Longford plant was widely acknowledged as

the most efficient in the industry.

As part of its lost contract bid review process, McCarthy decided to explore several ways of

refining its costing system. First, it identified that €188 000 of the €983 000 pertains to packaging

materials that could be traced to individual jobs (€180 000 for retail and €8000 for institutional).

These will now be classified as a direct material. The €150 000 of direct materials used were clas-

sified as €135 000 for retail and €15 000 for institutional. Second, it used activity-based costing

(ABC) to examine how the two products (retail chips and institutional chips) used the support

area differently. The finding was that three activity areas could be distinguished and that different

usage occurred in two of these three areas. The indirect cost per kilogram of finished product at

each activity area is as follows:

Activity area

Retail chips

Institutional chips

Cleaning

€0.120

€0.120

Cutting

0.240

0.150

Packaging

0.480

0.120

There was no opening or closing amount of any stock (materials, work in progress or finished

goods).

Required

1 Using the current costing system, what is the cost per kilogram of chips produced by McCarthy?

2 Using the refined costing system, what is the cost per kilogram of (a) retail market chips, and

(b) institutional market chips?

3 Comment on the cost differences shown between the two costing systems in requirements 1

and 2. How might McCarthy use the information in requirement 2 to make better decisions?

***11.12 ABC, activity area cost driver rates** (continuation of Exercise 11.11) (30 minutes)

Exercise 11.11 reports ABC data for the three activity areas (cleaning, cutting and packaging)

on a per output-unit basis (per kilogram of chips). This format emphasises product costing. An

alternative approach that emphasises the costs of individual processes (activities) is to identify

(a) the costs at each activity area, and (b) the rate per unit of the cost driver at each activity area.

The following information pertains to (a) and (b):

● Cleaning activity area: McCarthy used 1.2 million kilograms of raw potatoes to yield 1 million

kilograms of chips. No distinction is made as to the end-product when cleaning potatoes. The

cost driver is kilograms of raw potatoes cleaned.

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● Cutting activity area: McCarthy processes raw potatoes for the retail market independently of

those processed for the institutional market. The production line produces (a) 250 kg of retail

chips per cutting-hour, and (b) 400 kg of institutional chips per cutting-hour. The cost driver

is cutting-hours on the production line.

● Packaging activity area: McCarthy packages chips for the retail market independently of those

packaged for the institutional market. The packaging line packages (a) 25 kg of retail chips

per packaging-hour, and (b) 100 kg of institutional chips per packaging-hour. The cost driver

is packaging-hours on the production line.

Required

1 What are the total activity costs in the (a) cleaning, (b) cutting and (c) packaging activity areas?

2 What is the cost rate per unit of the cost driver in the (a) cleaning, (b) cutting and (c) packaging

activity areas?

3 How might McCarthy Potatoes use information about the cost driver rates calculated in

requirement 2 to better manage the Longford plant?

11.13 Activity-based costing, product-cost cross-subsidisation (30–40 minutes)

Starkuchen GmbH has been in the food-processing business for three years. For its first two years

(2021 and 2022), its sole product was raisin cake. All cakes were manufactured and packaged in

1 kg units. A normal costing system was used by Starkuchen. The two direct-cost categories were

direct materials and direct manufacturing labour. The sole indirect manufacturing cost category –

manufacturing overhead – was allocated to products using a units of production allocation base.

In its third year (2023) Starkuchen added a second product – layered carrot cake – that was pack-

aged in 1 kg units. This product differs from raisin cake in several ways:

● more expensive ingredients are used

● more direct manufacturing labour time is required

● more complex manufacturing is required.

In 2023, Starkuchen continued to use its existing costing system where a unit of production of

either cake was weighted the same.

Direct materials costs in 2023 were €0.60 per kg of raisin cake and €0.90 per kg of layered carrot

cake. Direct manufacturing labour cost in 2023 was €0.14 per kg of raisin cake and €0.20 per kg

of layered carrot cake.

During 2023, Starkuchen sales people reported greater-than-expected sales of layered carrot cake

and less-than-expected sales of raisin cake. The budgeted and actual sales volumes for 2023 were

as follows:

Budgeted

Actual

Raisin cake

160 000 kg

120 000 kg

Layered carrot cake

40 000 kg

80 000 kg

The budgeted manufacturing overhead for 2023 was €210 800.

At the end of 2023, Wolfgang Iser, the accountant of Starkuchen, decided to investigate how use

of an activity-based costing system would affect the product-cost numbers. After consultation

with operating personnel, the single manufacturing overhead cost pool was subdivided into five

activity areas. These activity areas, their driver, their 2023 budgeted rate and the driver units used

per kilogram of each cake are as follows:

Budgeted 2023

Driver units per kg

cost per driver Driver units per kg of layered carrot

Activity

Driver

unit

of raisin cake

cake

1 Mixing

Labour time

€0.04

5

8

2 Cooking

Oven time

€0.14

2

3

3 Cooling

Cool room time

€0.02

3

5

4 Creaming/icing Machine time

€0.25

0

3

5 Packaging

Machine time

€0.08

3

7

Required

1 Calculate the 2023 unit product cost of raisin cake and layered carrot cake with the normal

costing system used in the 2021 to 2022 period.

2 Calculate the 2023 unit product cost per cake under the activity-based normal costing system.

3 Explain the differences in unit product costs calculated in requirements 1 and 2.

4 Describe three uses Starkuchen might make of the activity-based cost numbers.

11.14 Activity-based costing, under- or overallocated indirect costs (continuation of Exercise

11.13) (40 minutes)

Wolfgang Iser, the accountant of Starkuchen, wants to further examine the relative profitability

of raisin cake and layered carrot cake. He questions the accuracy of the activity-based normal

costing numbers. He notes that the 2021 actual manufacturing indirect cost was €256 256. This

differs sizably from the €210 800 budgeted amount. The 2021 actual indirect costs per activity

area were as follows:

Activity area	**2021 actual costs**
Mixing	€62 400
Cooking	83 840
Cooling	12 416
Creaming/icing	36 000

Packaging

61 600

€256 256

Required

1 Calculate the under- or overallocated manufacturing indirect costs in 2021 for:

a Each of the five activity area indirect-cost pools.

b The *aggregate* of individual activity area indirect costs.

2 Assume that Starkuchen allocates under- or overallocated indirect costs to individual accounts

based on the allocated overhead component in that account. What are the pros and cons of

using:

a Five separate under- or overallocated adjustments (one for each activity area)?

b One under- or overallocated adjustment for the aggregate of all activity area indirect costs?

3 Calculate the 2021 actual unit product cost for raisin cake and layered carrot cake using the

information calculated in requirement 1a.

4 Comment on the implications of the product-cost numbers in requirement 3 for Starkuchen's

pricing decisions in 2022.

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11.15 ABC and Budgets (From CIMA Management Accounting Pillar Managerial Level Paper, November

2006) (25 minutes)

CJD Ltd manufactures plastic components for the car industry. The following budgeted infoma-

tion is available for three of their key plastic components:

	W	**X**	**Y**
	£ per unit	**£ per unit**	**£ per unit**
Selling price	200	183	175
Direct material			

50

40

35

Direct labour

30

35

30

Units produced and sold

10 000

15 000

18 000

The total number of activities for each of the three products for the period is as follows:

W

X

Y

Number of purchase requisitions

1 200

1 800 2 000

Number of set-ups

240

260

300

Overhead costs have been analysed as follows:

Receiving/inspecting quality assurance

£ 1 400 000

Production scheduling/machine set-up

£ 1 200 000

Required

1 Calculate the budgeted profit per unit for each of the three products using activity-based

budgeting.

Advanced level

11.16 Activity-based job-costing system (40 minutes)

Henriksen AS manufactures and sells packaging machines. It recently used an activity-based

approach to refine the job-costing system at its Vejle plant. The resulting job-costing system has

one direct-cost category (direct materials) and four indirect manufacturing cost pools. These

four indirect-cost pools and their allocation bases were chosen by a team of product designers,

manufacturing personnel and marketing personnel:

Indirect manufacturing cost pool

Cost-allocation base

Budgeted cost-allocation rate

1 Materials handling

Component parts

DKr 8 per part

2 Machining

Machine-hours

DKr 68 per hour

3 Assembly

Assembly-line-hours

DKr 75 per hour

4 Inspection

Inspection-hours

DKr 104 per hour

Langeland recently purchased 50 can-packaging machines from Henriksen AS. Each machine has

direct materials costs of DKr 3000, requires 50 component parts, 12 machine-hours, 15 assembly-

hours and 4 inspection-hours.

Henriksen's prior costing system had one direct-cost category (direct materials) and one indirect-

cost category (manufacturing overhead, allocated using assembly-hours).

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Required

1 Present overview diagrams of the prior job-costing system and the refined activity-based

job-costing system.

2 Calculate the unit manufacturing costs (using ABC) of each machine and the total manufac-

turing cost of the Langeland job.

3 The activity-based job-costing system of Henriksen has only one manufacturing direct-cost

category: direct materials. A competitor of the Henriksen Company has two direct-cost cate-

gories at its manufacturing plant: direct materials and direct manufacturing labour. Why might

Henriksen not have a direct manufacturing labour costs category in its job-costing system?

Where are the manufacturing labour costs included in the Henriksen costing system?

4 What information might members of the team that refined the prior costing system find useful

in the activity-based job-costing system?

11.17 Activity-based job costing (15 minutes)

Baden-Möbel GmbH manufactures a variety of prestige boardroom chairs. Its job-costing sys-

tem was designed using an activity-based approach. There are two direct-cost categories (direct

materials and direct manufacturing labour) and three indirect-cost pools. These three cost pools

represent three activity areas at the plant:

Manufacturing

Budgeted costs

Cost driver used as

Cost-allocation

activity area

for 2022

allocation base

rate

Materials handling

200 000

Parts

€0.25

Cutting

2 160 000

Parts

2.50

Assembly

2 000 000

Direct manufacturing

25.00

labour-hours

Two styles of chairs were produced in March, the executive chair and the chairman chair. Their

quantities, direct material costs and other data for March 2022 are as follows:

Units

Direct material Number of

Direct manufacturing

produced

costs

parts

labour-hours

Executive chair

5 000

€600 000

100 000

7 500

Chairman chair

100

25 000

3 500

500

The direct manufacturing labour rate is €20 per hour. Assume no opening or closing stock.

Required

1 Calculate the March 2022 total manufacturing costs and unit costs of the executive chair and

the chairman chair.

2 Suppose that the upstream activities to manufacturing (R&D and design) and the downstream

activities (marketing, distribution and customer service) were analysed. The unit costs in 2022

were budgeted to be as follows:

Upstream activities

Downstream activities

Executive chair

€60

€110

Chairman chair

146

236

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Calculate the full product costs per unit of each line of chairs. (Full product costs are the sum

of the costs in all business function areas.)

***11.18 Activity-based job costing, unit-cost comparisons** (30 minutes)

Aircomposystèmes SA has a machining facility specialising in work for the aircraft components

market. The prior job-costing system had two direct-cost categories (direct materials and direct

manufacturing labour) and a single indirect-cost pool (manufacturing overhead, allocated using

direct labour-hours). The indirect-cost-allocation rate of the prior system for the year would have

been SFr 115 per direct manufacturing labour-hour. Recently, a team with members from product

design, manufacturing and accounting used an activity-based approach to refine its job-costing

system. The two direct-cost categories were retained. The team decided to replace the single

indirect-cost pool with five indirect-cost pools. These five cost pools represent five activity areas

at the facility, each with its own supervisor and budget responsibility. Pertinent data are as follows:

Cost driver used

Cost-allocation

Activity area

as allocation base

rate

Materials handling

Parts

SFr 0.40

Lathe work

Turns

0.20

Milling

Machine-hours

20.00

Grinding

Parts

0.80

Testing

Units tested

15.00

Information-gathering technology has advanced to the point where all the data necessary for budg-

eting in these five activity areas are automatically collected. Two representative jobs processed

under the new system at the facility in the most recent period had the following characteristics:

Job 410

Job 411

Direct materials cost per job

SFr 9 700

SFr 59 900

Direct manufacturing labour cost per job

750

11 250

Direct manufacturing labour-hours per job

25

375

Parts per job

500

2 000

Turns per job

20 000

60 000

Machine-hours per job

150

1 050

Units per job

10

200

Required

1 Calculate the per-unit manufacturing costs of each job under the prior job-costing system.

2 Calculate the per-unit manufacturing costs of each job under the activity-based job-costing

system.

3 Compare the per-unit cost figures for Jobs 410 and 411 calculated in requirements 1 and 2.

Why do the prior and the activity-based costing systems differ in their job cost estimates for

each job? Why might these differences be important to Aircomposystèmes?

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11.19 Question from the Association of Chartered Certified Accountants, Pilot Paper 2.4,

Financial Management and Control (45 minutes)

1 Discuss the conditions under which the introduction of ABC is likely to be most effective,

paying particular attention to:

- product mix;
- the significance of overheads and the ABC method of charging costs;
- the availability of information collection procedures and resources; and
- other appropriate factors.

2 Explain why ABC might lead to a more accurate assessment of management performance than

absorption costing.

11.20 Question from the Association of Chartered Certified Accountants Performance

Management, section B, June 2015 (40 minutes)

Beckley Hill (BH) is a private hospital carrying out two types of procedures on patients. Each type

of procedure incurs the following direct costs:

Procedure

A (€)

B (€)

Surgical time and materials

1200

2640

Anaesthesia time and materials

800

1620

BH currently calculates the overhead cost per procedure by taking the total overhead cost and

simply dividing it by the number of procedures, then rounding the cost to the nearest 2 decimal

places. Using this method, the total cost is €2 475.85 for Procedure A and €4735.85 for Procedure

B. Recently, another local hospital has implemented activity-based costing (ABC). This has led

the finance director at BH to consider whether this alternative costing technique would bring any

benefits to BH. He has obtained an analysis of BH's total overheads for the last year and some

additional data, all of which is shown below:

Cost

Cost driver

€

Administrative costs

Administrative time per procedure

1 870 160

Nursing costs

Length of patient stay

6 215 616

Catering costs

Number of meals

966 976

General facility costs

Length of patient stay

8 553 600

Total overhead costs

17 606 352

Procedure

A

B

No. of procedures

14 600

22 400

Administrative time per procedure (hours)

1

1.5

Length of patient stay per procedure (hours)

24

48

Average number of meals required per patient

1

4

Required

1 Calculate the full cost per procedure using activity-based costing.

2 Making reference to your findings in part (a), advise the finance director as to whether activity-

based costing should be implemented at BH.

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11.21 Question from Association of Chartered Certified Accountants Performance

Management, June 2014, (45 minutes)

Duff Co manufactures three products, X, Y and Z. Demand for products X and Y is relatively

elastic while demand for product Z is relatively inelastic. Each product uses the same materials

and the same type of direct labour but in different quantities. For many years, the company has

been using full absorption costing and absorbing overheads on the basis of direct labour hours.

Selling prices are then determined using cost plus pricing. This is common within this industry,

with most competitors applying a standard mark-up. Budgeted production and sales volumes

for X, Y and Z for the next year are 20 000 units, 16 000 units and 22 000 units respectively. The

budgeted direct costs of the three products are shown below:

Product

X (£ per unit)

Y (£ per unit) Z (£ per unit)

Direct materials

25

28

22

Direct labour (£12 per hour)

30

36

24

In the next year, Duff Co also expects to incur indirect production costs of £1 377 400, which are

analysed as follows:

Cost pools

£

Cost drivers

Machine set-up costs

280 000

Number of batches

Material ordering costs

316 000

Number of purchase orders

Machine running costs

420 000

Number of machine-hours

General facility costs

361 400

Number of machine-hours

1 377 400

The following additional data relate to each product:

Product

X

Y

Z

Batch size (units)

500

800

400

No of purchase orders per batch

4

5

4

Machine-hours per unit

1.5

1.25

1.4

Duff Co wants to boost sales revenue in order to increase profits but its capacity to do this is

limited because of its use of cost plus pricing and the application of the standard mark-up. The

finance director has suggested using activity-based costing (ABC) instead of full absorption cost-

ing, since this will alter the cost of the products and may therefore enable a different price to be

charged.

Required

1 Calculate the budgeted full production cost per unit of each product using Duff Co's current

method of absorption costing. All workings should be to two decimal places.

2 Calculate the budgeted full production cost per unit of each product using activity-based

costing. All workings should be to two decimal places.

3 Discuss the impact on the selling prices and the sales volumes *of each product* which a change

to activity-based costing would be expected to bring about.

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CHAPTER 12

Pricing issues and customer profitability analysis

Learning objectives

Pricing decisions are concerned with what to charge for the products and services delivered by organisations. For brevity, we use the term 'pricing decision' in this chapter to include decisions about the profitability of products. These decisions impact upon the revenues a company earns, which must exceed total costs if profits are to be achieved. Consequently, determining product costs is important for pricing decisions. There is, however, no single way of computing a product cost that is universally relevant for all pricing decisions. Why? Because pricing decisions differ greatly in both their time horizons and their contexts. For instance,

After studying this chapter, you should be able to:

- Discuss the three major influences on pricing decisions

- Distinguish between short-run and long-run pricing decisions
- Describe the target-costing approach to pricing
- Distinguish between cost incurrence and locked-in costs
- Describe the cost-plus approach to pricing

McDonald's may set a price of £2.99 for a hamburger. This is a 'take it or leave it' price. A house-seller may set an asking price of €495 000 for her villa in Faro and expect potential buyers to negotiate downwards from this price. We emphasise how an understanding of cost-behaviour patterns and cost drivers can lead to more informed pricing decisions and we apply the relevant-revenue and relevant-cost framework described in Chapter 10 in choosing between options. Proper pricing can heighten a company's profits yet surveys on pricing practices reveal that companies

often fail to engage in the best pricing approaches. A recent study asked

- Explain how life-cycle product

consumers to identify approaches they thought are commonly used by budgeting and costing assist in

businesses in communicating aspects of a brand or a product (Bertini et pricing decisions

al., 2022). The study indicated that in 24% of cases price was mentioned

- Discuss why revenues can differ

and, in fact, price was ranked as the most effective tool or activity by half across customers purchasing the

the respondents. When executives from different industries were asked same product

the same question, over 60% regarded conventional or digital advertising

- Apply the concept of cost

as the most important, with ‘price’ not being mentioned at all!

hierarchy to customer costing

You may have searched for a particular product or service online and

●

Show how customer profitability

faced a price that alters rapidly. The online seller may be using ‘dynamic

reports can be prepared to highlight

pricing’, where as more and more data captured in real time is analysed,

differences across customers in

the price for the product you want to purchase is recalculated. Here, data

their profitability

analytics on the product’s demand, supply and customer characteristics

feed into a dynamic of continuous price determination and revenue man-

agement (Bhimani 2021).

Economic theory indicates that companies acting optimal y should pro-

duce and sell units until the marginal revenue (the additional revenue from

sel ing an additional unit based on the demand for a product) equals the mar-

ginal or variable cost (the additional cost of supplying an additional unit). The

market price is the price that creates a demand for these optimal numbers

of units. This chapter describes how managers evaluate demand at different

prices, manage their costs to influence supply, and earn a profit. We also

consider the analysis of customer revenues and customer costs. Customer

profitability analysis provides important information on profits generated by

different customers rather than generic profits by product types.

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Major influences on pricing

There are three major influences on pricing decisions: customers, competitors and costs.

Customers

Managers must always examine pricing problems through the eyes of their customers. A price

increase may cause customers to reject a company's product and choose a competing or substitute

product. Understanding customers' price and product characteristic preferences is a core compet-

itive strength for business today. As noted above many organisations use dynamic pricing where

firms price in response to demand, to create demand, to learn from its customers' sensitivity to

price, to make certain customers loyal, and so on. Many businesses use customer profiling and

targeted pricing to refine product offerings to match individual customers' characteristics.

Competitors

Competitors' reactions influence pricing decisions. Companies such as Carrefour or Tesco, which

face alternative or substitute products of competitors, can see their demand being affected, caus-

ing them to lower prices. Other companies such as Apple and Porsche have distinctive products

and limited competition and are free to set higher prices. So, at one extreme, a rival's prices and

products may force a business to lower its prices in order to be competitive. At the other extreme,

a business without a rival in a given situation, can set higher prices. A business with knowledge

of its rivals' technology, plant capacity and operating policies can estimate its rivals' costs, which

is valuable information in setting competitive prices.

Competitor analysis takes different forms. Many companies across the globe have established

departments to search out information on their competitors' financial performance, patents,

technologies, revenue and cost structures, and strategic alliances. Competitors themselves and

their customers, suppliers and former employees are important sources of information. Another

form of obtaining information is via reverse engineering – a process of analysing and tearing

down competitors' products – to incorporate the best features, materials and technology in a

company's own designs.

Competition spans international borders. For example, when companies have excess capacity

in their domestic markets, they often take an aggressive pricing policy in their export markets.

Today, managers often take a global viewpoint, and it is increasingly common for them to consider

both domestic and international rivals in making pricing decisions.

Costs

Companies generally price products to exceed the costs of making them. The study of cost- behav-

iour patterns gives insight into the income that results from different combinations of price and

output quantities sold for a particular product.

Surveys and corporate case studies of how executives make pricing decisions reveal that com-

panies weigh customers, competitors and costs differently. Companies selling commodity-type

products in highly competitive markets must accept the price determined by market forces. For

example, sellers of wheat, rice and soya beans have many competitors, each offering the identical

product at the same price. The market sets the price, but cost data can help these sellers to decide,

say, on the output level that best meets a company's particular objective.

In less competitive markets, such as for televisions or mobile phones, products are differenti-

ated, and all three factors affect price. The pricing decision depends on how much customers value

the product, the pricing strategies of competitors, and the costs of the product. As competition

lessens even more, the key factor affecting pricing decisions is the customer's willingness to pay;

costs and competitors become less important in the pricing decision.

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When reducing costs, a company must consider costs across all its value-chain business func-

tions, from R&D to customer service. In computing the costs within these functions that are

relevant in a pricing decision, the time horizon of the decision is critical. Most pricing decisions

are either short run or long run. Short-run decisions include (1) pricing for a one-off special order

with no long-term implications, and (2) adjusting product mix and output volume in a competitive

market. The time horizon used to calculate those costs that differ among the alternatives for short-

run decisions is typically six months or less but sometimes as long as a year. Long-run decisions

include pricing a product in a major market where price setting has considerable leeway. A time

horizon of a year or longer is used when computing relevant costs for these long-run decisions.

Many pricing decisions have both short-run and long-run implications. We next examine short-

run pricing decisions.

Costing and pricing for the short run

A one-off special order

Consider a one-off special order from a customer to supply products for the next four months.

Acceptance or rejection of the order will not affect the revenues (units sold or the selling price

per unit) from existing sales outlets. The customer is unlikely to place any future sales orders.

The English Tea Company (ETC) operates a plant with a monthly capacity of 1 million cases

(each case consisting of 200 cans) of iced tea. Current production and sales are 600 000 cases

per month. The selling price is €90 per case. Costs of R&D and product and process design at

ETC are negligible. Customer-service costs are also small and are included in marketing costs.

All variable costs vary with respect to output units (cases), and production is equal to sales. The

variable cost per case and the fixed cost per case (based on a production quantity of 600 000 cases

per month) are as follows:

Variable cost Fixed cost per Variable and fixed

per case

case

cost per case

Manufacturing costs

Direct materials costs

€7

–

€7

Packaging costs

–

18

Direct manufacturing labour costs

4

–

4

Manufacturing overhead costs

6

€13

19

Manufacturing costs

35

13

48

Marketing costs

5

16

21

Distribution costs

9

8

17

Full product costs

€49

€37

€86

Variable manufacturing overhead of €6 per case is the cost of heating, cooling and lighting.

Details of the fixed manufacturing overhead costs and their per-case unitised costs (based on a

production quantity of 600 000 cases per month) are as follows:

Total fixed

Fixed manufacturing

manufacturing

overhead cost

overhead costs

per case

Depreciation and production support costs

€3 000 000

€5

Materials procurement costs

600 000

1

Salaries paid for process changeover

1 800 000

3

Product and process engineering costs

2 400 000

4

Total fixed manufacturing overhead costs

€7 800 000

€13

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Chapter 12 Pricing issues and customer profitability analysis

Uganda Tea (UT) is constructing a new plant to make iced tea in Kampala. The plant will not

open for 4 months. UT's management, however, wants to start selling 250 000 cases of iced tea

each month for the next 4 months in Uganda. UT has asked ETC and two other companies to

bid on this special order. From a manufacturing-cost viewpoint, the iced tea to be made for UT

is identical to that currently made by ETC.

If ETC makes the extra 250 000 cases, the existing total fixed manufacturing overhead

(€7 800 000 per month) would continue to be incurred. In addition, ETC would incur a further

€300 000 in fixed manufacturing overhead costs (materials procurement costs of €100 000 and

process-changeover costs of €200 000) each month. No additional costs will be required for R&D,

design, marketing, distribution or customer service. The 250 000 cases will be marketed by UT

in Uganda, where ETC does not sell its iced tea.

A senior manager of UT notifies each potential bidder that a bid above €45 per case will prob-

ably be non-competitive. ETC knows that one of its competitors, with a highly efficient plant,

has sizeable idle capacity and will definitely bid for the contract. What price should ETC bid for

the 250 000-case contract?

To calculate the relevant costs for the price-bidding decision, ETC systematically analyses the

costs in each business function of the value chain. In this example, only manufacturing costs are

relevant. All other costs in the value chain will be unaffected if the special order is accepted, so

they are irrelevant.

Exhibit 12.1 presents an analysis of the relevant costs. They include all manufacturing costs

that will change in total if the special order is obtained: all direct and indirect variable manu-

facturing costs plus materials procurement costs and process-changeover salaries related to the

special order. *Existing* fixed manufacturing overhead costs are irrelevant. Why? Because these

costs will not change if the special order is accepted. But the *additional* materials procurement

and process-changeover salaries of €300 000 per month for the special order are relevant because

these additional fixed manufacturing costs will only be incurred if the special order is accepted.

Exhibit 12.1 shows the total relevant costs of €9 050 000 per month (or €36.20 per case) for

the 250 000-case special order. Any bid above €36.20 per case will improve ETC's profitability.

For example, a successful bid of €40 per case, well under UT's ceiling of €45 per case, will add

€950 000 to ETC's monthly operating profit: 250 000 × (€40 − €36.20) = €950 000. Note again

how unit costs can mislead. The first table in this example reports total manufacturing costs to

be €48 per case. The €48 cost might erroneously suggest that a bid of €45 per case for the UT

special order will result in ETC sustaining a €3 per case loss on the contract. Why erroneous?

Because total manufacturing cost per case includes €13 of fixed manufacturing cost per case that

will not be incurred on the 250 000-case special order. These costs are hence irrelevant for the

special-order bid.

Exhibit 12.1

Monthly relevant costs for ETC: the 250 000-case one-off

special order

Direct materials (250 000 cases × €7)

€1 750 000

Packaging (250 000 cases × €18)

4 500 000

Direct manufacturing labour (250 000 cases × €4)

1 000 000

Variable manufacturing overhead (250 000 cases × €6)

1 500 000

Fixed manufacturing overhead

Materials procurement

€100 000

Salaries paid for process changeover

200 000

Total fixed manufacturing overhead

300 000

Total relevant costs

€9 050 000

Per case relevant costs: (€9 050 000 , 250 000 cases = €36.20)

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Cost data, though key information in ETC’s decision on the price to bid, are not the only

inputs. ETC must also consider business rivals and their likely bids. For example, if ETC knows

that its under-capacity rival plans to bid €39 per case, ETC will bid €38 per case instead of €40

per case.

Costing and pricing for the long run

Many pricing decisions are made for the long run. Buyers – whether a person buying a bar of

chocolate, a construction company, such as Tarmac, buying a fleet of tractors, or Lloyd's bank

buying audit services – prefer stable prices over an extended time horizon. A stable price reduces

the need for continuous monitoring of suppliers' prices. Greater price stability also improves

planning and builds long-run buyer–seller relationships. But to charge a stable price and earn the

target long-run return, managers must know and manage long-run costs of supplying products

to customers, which includes *all* future direct and indirect costs. Recall that *indirect costs* of a

particular cost object are costs that are related to that cost object, but cannot be traced to it in

an economically feasible (cost-effective) way. These costs often comprise a large percentage of

the overall costs assigned to cost objects such as products, customers, and distribution channels.

Calculating product costs

Obtaining appropriate product-cost information is useful to a manager making a pricing deci-

sion. In industries such as oil and gas and mining, competitive forces set the price for a product,

and knowledge of long-run product costs can guide decisions about entering or remaining in the

market. In other industries such as specialised machines, appliances and motor vehicles, managers

have some control over the price charged for a product, and long-run product costs can be used

as a base for setting that price.

Consider the Astel Computer Company. Astel manufactures two brands of personal comput-

ers (PCs): Deskpoint and Provalue. Deskpoint is Astel's top-of-the-range product using the Intel

Core i5-12600K processor sold through computer dealers to large organisations and government

accounts. Our analysis focuses on pricing Provalue, a less powerful Intel Core i3-7100-based

machine sold through catalogues and mass merchandisers to individual consumers and small

organisations.

The manufacturing costs of Provalue are calculated using the activity-based costing (ABC)

approach described in Chapter 11. Astel has three direct manufacturing cost categories (direct

materials, direct manufacturing labour and direct machining costs) and three indirect manufactur-

ing cost pools (materials handling, testing and inspection, and rework) in its accounting system.

Astel treats machining costs as a direct cost of Provalue because it is manufactured on machines

that are used for no other products. The following table summarises the activity-cost pools, the

cost driver for each activity, and the cost per unit of the cost driver Astel uses to allocate manu-

facturing overhead costs to products.

Cost per unit of

Manufacturing activity

Description of activity

Cost driver

cost driver

1 Materials handling

Placing orders, receiving and Number of

€80 per order

paying for components

orders

2

Testing and

Testing components and final Testing-hours

€2 per testing-hour

inspection

product

3 Rework

Correcting and fixing errors

Units reworked €100 per unit

and defects

reworked

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Astel uses a long-run time horizon to price Provalue. Over this horizon, Astel's management

views direct materials costs and direct manufacturing labour costs as variable with respect to the

units of Provalue produced, and manufacturing overhead costs as variable with respect to their

chosen cost drivers. For example, ordering and receiving costs vary with the number of orders.

Staff members responsible for placing orders can be reassigned or laid off in the long run if fewer

orders need to be placed. Direct machining costs (rent paid on leased machines) do not vary over

this time horizon for the relevant range of production; they are fixed long-run costs.

Astel has no opening or closing stock of Provalue in 2022 and manufactures and sells 150 000

units. How does Astel calculate Provalue's manufacturing costs? It uses the following information,

which indicates the resources used to manufacture Provalue in 2022:

1 Direct materials costs per unit of Provalue are €460.

2 Direct manufacturing labour costs per unit of Provalue are €64.

3 Direct fixed costs of machines used exclusively for the manufacture of Provalue are €11 400 000.

4 Number of orders placed to purchase components required for the manufacture of Provalue

is 22 500. (We assume for simplicity that Provalue has 450 components supplied by different

suppliers, and that 50 orders are placed for each component to match Provalue's production

schedule.)

5 Number of testing-hours used for Provalue is 4 500 000 (150 000 Provalue units are tested for

30 hours per unit).

6 Number of units of Provalue reworked during the year is 12 000 (8% of the 150 000 units

manufactured).

The detailed calculations underlying each of these numbers are shown in Exhibit 12.2. This

exhibit indicates that the total costs of manufacturing Provalue are €102 million, and the manu-

facturing cost per unit of Provalue is €680. Manufacturing, however, is just one business function

in the value chain. For setting long-run prices and for managing costs, Astel determines the full

product costs of Provalue.

Exhibit 12.2

Manufacturing costs of Provalue in 2022 using activity-based

costing

Total manufacturing

Manufacturing

costs for 150 000 units

cost per unit

(1)

(2) = (1) , 150 000

Direct manufacturing costs

Direct materials costs (150 000 units * €460)

€69 000 000

€460

Direct manufacturing labour costs

9 600 000

64

(150 000 units * €64)

Direct machining costs (fixed costs of

11 400 000

76

€11 400 000)

Direct manufacturing costs

90 000 000

600

Manufacturing overhead costs

Ordering and receiving costs

1 800 000

12

(22 500 orders * €80)

Testing and inspection costs

9 000 000

60

(4 500 000 hours * €2)

Rework costs (12 000 units * €100)

1 200 000

8

Manufacturing overhead costs

12 000 000

80

Total manufacturing costs

€102 000 000

€680

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Exhibit 12.3

Product profitability of Provalue in 2022 based on value-chain activity-based costing

Total for 150 000 units

Per unit

(1)

(2) = (1) , 150 000

Revenues

€150 000 000

€1000

Cost of goods sold*

(from Exhibit 12.2)

Direct materials costs

69 000 000

460

Direct manufacturing labour costs

9 600 000

64

Direct machining costs

11 400 000

76

Manufacturing overhead costs

12 000 000

80

Cost of goods sold

102 000 000

680

Operating costs

R&D costs

5 400 000

36

Design costs of products and processes

6 000 000

40

Marketing costs

15 000 000

100

Distribution costs

3 600 000

24

Customer-service costs

3 000 000

20

Operating costs

33 000 000

220

Full product costs

135 000 000

900

Operating profit

€15 000 000

€100

* Cost of goods sold = Total manufacturing costs since there is no opening or closing stock of Provalue in 2022.

For brevity, we do not present any detailed analyses or calculations for the other value-chain

functions. Astel chooses cost drivers and cost pools in each value-chain function to measure the

cause-and-effect relationship between the activities and costs within each activity's cost pool.

Costs are allocated to Provalue on the basis of the quantity of cost driver units that Provalue

requires. Exhibit 12.3 summarises the product operating profit statement for Provalue for the year

2022 based on an activity analysis of costs in its value-chain functions (supporting calculations for

non-manufacturing value-chain functions are not given). Astel earned €15 million from Provalue,

or €100 per unit sold. We next consider the role of costs in long-run pricing decisions.

Alternative long-run pricing approaches

The starting point for pricing decisions can be:

1 market-based

2 cost-based (also called cost-plus).

The market-based approach to pricing *starts* by asking: Given what our customers want and how

our competitors will react to what we do, what price should we charge? The cost-based approach

to pricing *starts* by asking: What does it cost us to make this product, and hence what price should

we charge that will recoup our costs and produce a desired profit? Both approaches consider

customers, competitors and costs. Only their starting points differ.

In very competitive markets (for example, oil and gas, and airlines) the market-based approach

is logical. The items produced or services provided by one company are very similar to those pro-

duced or provided by others, so companies have no influence over the prices to charge. In other

industries, where there is more product differentiation (for example, motor vehicles, manage-

ment consulting and legal services) firms have some discretion over prices, products and services.

Companies choose prices and product and service features on the basis of anticipated customer

and competitor reactions. A final decision on price, product and service is made after evaluating

these external influences on pricing along with the costs to produce and sell the product.

Under the cost-plus approach, price is first calculated on the basis of the costs to produce and

sell a product. Typically, a mark-up, representing a reasonable return, is added to cost. Often,

the price is then modified on the basis of anticipated customer reaction to alternative price levels

and the prices charged by competitors for similar products. In short, market forces dictate the

eventual size of the mark-up and thus the final price. Recent surveys of pricing practices report

widespread use of cost-plus pricing.

Concepts in action

Pricing and digitalisation at H&M

The Swedish-based company H&M is the world's second biggest fashion retailer. It employs over 125 000 people

working at more than 4800 stores across 74 countries. H&M has been an innovator in that when it decides to pro-

duce an item, members of its 160 in-house team of designers set out to strike the right balance between fashion,

quality and price. Concept teams of designers, buyers, pattern makers and a controller work together to set a target

price. H&M outsources to suppliers throughout Europe and Asia to manufacture the item. High-volume items such

as basics and children's wear are ordered far in advance to ensure volume-based cost efficiencies. Trendy items in

small quantities are produced at shorter notice. Once produced, the items are shipped to H&M's logistics centres for

distribution to stores. H&M stores carry no backup stocks. Stores are replenished directly from the logistic centres,

allowing stores to be restocked quickly with only the best-selling products. H&M has incorporated sustainability into

its target pricing and cost management practices. Around 90% of H&M's products are transported from suppliers to

distribution centres via sea or rail to avoid fossil-fuel-intensive air and road shipping. H&M achieved high growth

through aggressive target pricing, coupled with 'cost-consciousness' across the company and fast-fashion concepts.

The COVID-19 pandemic caused losses. The first quarter of 2021 showed losses of $140 million but the fashion retailer

was back in profit during the first quarter of 2022 with pretax profit of $30 million. H&M CEO Helena Helmersson

noted that: 'We are increasing digital investments, accelerating store consolidation, and making the channels further

integrated.' This reflected the trend that, 'More and more customers started shopping online during the pandemic,

and they are making it clear that they value a convenient and inspiring experience in which stores and online interact

and strengthen each other.' The company had profits exceeding $250 million in the first pre-pandemic quarter of

2020 and analysts had forecasted a profit of about $100 million for 2022 quarter 1. CEO Helmersson's strategy is to

focus on pricing: 'Looking at inflation it's primarily raw material and transportation costs that affect us and we see,

as do many others, that we need to adjust our prices . . . We'll raise different product types in different countries

depending on competition and demand.'

Sources: Andrew Hoffman et al. (2014) 'H&M's global supply chain management sustainability: factories and fast fashion', University of Michigan Erb Institute No. 1-429-373 (Ann Arbor, MI: University of Michigan); 'Sales development in 2015', H&M AB press release (Stockholm, Sweden, 15 December 2015)

(https://hmgroup.com/wp-content/uploads/2020/11/1624199_en.pdf); H&M AB, 'From idea to store' (https://hmgroup.com/investors/five-year-summary/);

Clara Lu (2014), 'Behind H&M's fashion forward retail inventory control', *TradeGecko* blog, 12 August (www.tradegecko.com/blog/hm-retail-inventory-control);

Investopedia (2021) (https://www.investopedia.com/articles/investing/041216/hm-secret-its-success.asp); 'H&M flags higher prices after profit falls short of expectations' (31 March 2022) (https://www.reuters.com/business/retail-

consumer/hm-profit-lags-expectations-pandemic-investments-weigh-2022-03-31/).

Target costing for target pricing

An important form of market-based price is the *target price.* A target price is the estimated price

for a product (or service) that potential customers will be willing to pay. This estimate is based

on an understanding of customers' perceived value for a product and competitors' responses.

A target operating profit per unit is the operating profit that a company wants to earn on each

unit of a product (or service) sold. The target price leads to a *target cost.* A target cost per unit is

the estimated long-run cost per unit of a product (or service) that, when sold at the target price,

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enables the company to achieve the target operating profit per unit. Target cost per unit is derived

by subtracting the target operating profit per unit from the target price.

What relevant costs should we include in the target cost calculations? *All* costs, both variable

and fixed. Why? Because in the long run, a company's prices and revenues must recover all its

costs. If not, the company's best alternative is to shut down. Relative to the shutting-down alter-

native, all costs, whether fixed or variable, are relevant.

Target cost per unit is often lower than the existing full product cost per unit. To achieve the

target cost per unit and the target operating profit per unit, the organisation must improve its

products and processes. Target costing is widely used among different industries around the

world. General Motors, Renault, Toyota, Daimler-Chrysler, Fiat and Volvo in the motor vehicle

industry, and Siemens, Panasonic, Sharp and HP in the electronics and personal computer indus-

tries, are examples of companies that use target pricing and target costing.

Implementing target pricing and target costing

Developing target prices and target costs typically entails the following steps:

● Step 1: Develop a product that satisfies the needs of potential customers.

● Step 2: Choose a *target price* based on customers' perceived value for the product and the prices

competitors charge, and a *target operating profit per unit.*

● Step 3: Derive a *target cost per unit* by subtracting the target operating profit per unit from the

target price.

● Step 4: Perform *value engineering* to achieve target costs. Value engineering is a systematic

evaluation of all aspects of the value-chain business functions, with the objective of reducing

costs while satisfying customer needs. Value engineering can result in improvements in product

designs, changes in materials specifications or modifications in process methods.

We illustrate the above steps for target pricing and target costing using the Astel Computer

example introduced earlier in the chapter.

Step 1: Product planning for Provalue Astel is in the process of planning design modifications

for Provalue. Astel is very concerned about severe price competition from several competitors.

Step 2: Target price of Provalue Astel expects its competitors to lower the prices of PCs that

compete against Provalue by 15%. Astel's management believes that it must respond aggressively

by reducing Provalue's price by 20%, from €1000 per unit to €800 per unit. At this lower price,

Astel's marketing manager forecasts an increase in annual sales from 150 000 to 200 000 units.

Step 3: Target cost per unit of Provalue Astel's management wants a 10% target operating profit

on sales revenues.

Total target sales revenues

= €800 × 200 000 units = €160 000 000

Total target operating profit

= 10% × €160 000 000 = €16 000 000

Target operating profit per unit

= €16 000 000 ÷ 200 000 units = €80 per unit

Target cost per unit

= Target price – Target operating profit per unit

= €800 − €80 = €720

Total current costs of Provalue

= €135 000 000 (from Exhibit 12.3)

Current cost per unit of Provalue

= €135 000 000 ÷ 150 000 units = €900 per unit

The target cost per unit of €720 is substantially lower than Provalue's existing unit cost of €900.

The goal is to find ways to reduce the cost per unit of Provalue by €180, from €900 to €720. The

challenge in step 4 is to achieve the target cost through value engineering.

Step 4: Value engineering for Provalue An important element of Astel's value engineering is

determining the kind of low-end PC that will meet the needs of potential customers. For example,

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the existing Provalue design accommodates various upgrades that can make the PC run faster and

perform calculations more quickly. It also comes with special audio features. An essential first step

in the value-engineering process is to determine whether potential customers are willing to pay

the price for these features. Customer feedback indicates that customers do not value Provalue's

extra features. They want Astel to redesign Provalue into a no-frills PC and sell it at a much lower

price. Value engineering at Astel then proceeds with cross-functional teams consisting of market-

ing managers, product designers, manufacturing engineers and production supervisors making

suggestions for design improvements and process modifications. Cost accountants estimate the

savings in costs that would result from the proposed changes.

Managers often find the distinction between value-added and non-value-added activities and

costs introduced in Chapter 2 useful in value engineering. A *value-added cost* is a cost that cus-

tomers perceive as adding value, or utility (usefulness), to a product or service. Determining

value-added costs requires identifying attributes that customers perceive to be important. For

Provalue, these attributes include the PC's features and its price. Activities undertaken within the

company (such as the manufacturing line) influence the attributes that customers value. Astel

assesses whether each activity adds value or not. Activities and the costs of these activities do not

always fall neatly into value-added or non-value-added categories. Some costs fall in the grey area

in between, and include both value-added and non-value-added components. The following clas-

sification typifies value-added and non-value-added categories in a manufacturing organisation:

Category

Examples

Value-added costs

Costs of assembly, design, tools and machinery

Non-value-added costs

Costs of rework, expediting, special delivery and obsolete stock

Grey area

Costs of testing, materials movement and ordering

In the Provalue example, direct materials, direct manufacturing labour and machining costs

are value-added costs, ordering and testing costs fall in the grey area (customers perceive some

portion but not all of these costs as necessary for adding value), while rework costs are non-

value-added costs.

Value engineering seeks to reduce or eliminate non-value-added activities and hence non-

value-added costs by reducing the cost drivers of the non-value-added activities. For example, to

reduce rework costs, Astel must reduce rework-hours. Value engineering also focuses on achieving

greater efficiency in value-added activities to reduce value-added costs. For example, to reduce direct

manufacturing labour costs, Astel must reduce the time it takes to make Provalue. But how should

Astel reduce rework time and direct manufacturing labour time? We focus on these issues next.

Cost incurrence and locked-in costs

Two key concepts in value engineering and in managing value-added and non-value-added costs

are cost *incurrence* and *locked-in costs*. Cost incurrence occurs when a resource is sacrificed or used

up. Costing systems emphasise cost incurrence. They recognise and record costs only when costs

are incurred. Astel's costing system, for example, recognises the direct materials costs of Provalue

as each unit of Provalue is assembled and sold. But Provalue's direct materials costs per unit are

determined much earlier when designers finalise the components that will go into Provalue. Direct

materials costs per unit of Provalue are *locked in* (or *designed in*) at the product- design stage.

Locked-in costs (designed-in costs) are those costs that have not yet been incurred but that will be

incurred in the future on the basis of decisions that have already been made. They are committed

but mostly not yet incurred costs.

Why is it important to distinguish between when costs are locked in and when costs are

incurred? Because it is difficult to alter or reduce costs that have already been locked in. For exam-

ple, if Astel experiences quality problems during manufacturing, its ability to improve quality and

reduce scrap may be limited by Provalue's design. Scrap costs are incurred during manufacturing,

but they may be locked in by a faulty design. Similarly, in the software industry, costs of producing

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software are often locked in at the design and analysis stage. Costly and difficult-to-fix errors that

appear during coding and testing are frequently locked in by bad designs.

Exhibit 12.4 illustrates how the locked-in cost curve and the cost incurrence curve might appear

in the case of Provalue. (The numbers underlying the graph are assumed.) The bottom curve plots

the cumulative costs per unit incurred in different business functions. The top curve plots the

cumulative costs locked in. Both curves deal with the same total cumulative costs per unit. The

graph emphasises the wide divergence between the time when costs are locked in and the time

when those costs are incurred. In our example, once the product and processes are designed, more

than 86% (say, €780 ÷ €900) of the unit costs of Provalue are locked in when only about 8% (say,

€76 ÷ €900) of the unit costs are actually incurred. For example, at the end of the design stage,

costs such as direct materials, direct manufacturing labour, direct machining, and many manufac-

turing, marketing, distribution and customer-service overheads are all locked in. To reduce total

costs, Astel must act to modify the design before costs get locked in.

We caution that it is not always the case that costs are locked in early in the design stage as

was the case with Provalue. In some industries, such as mining, costs are locked in and incurred

at about the same time. When costs are not locked in early, cost-reduction activities can be suc-

cessful right up to the time that costs are incurred. In these industries, the key to lowering costs

is improved operational efficiency and productivity rather than better design.

When a sizeable fraction of the costs is locked in at the design stage, as in the Provalue example,

the focus of value engineering is on making innovations and modifying designs at the product-

design stage. The best way to evaluate the effect of alternative design decisions on the target cost

per unit is to organise a cross-functional value-engineering team consisting of marketing manag-

ers, product designers, manufacturing engineers, production supervisors, purchasing managers,

suppliers and cost accountants. Why a cross-functional team? Because only a cross-functional

team can evaluate the impact of design decisions on all value-chain functions.

The cross-functional team generates cost-reduction ideas and tests them. The management

accountant's challenge is to estimate cost savings and explain cost implications of alternative

design decisions. To do so, the management accountant must develop a solid understanding of

Exhibit 12.4

Pattern of cost incurrence and locked-in costs for Provalue

900

840

780

Locked-in

€) 720

cost curve

660

600

540

480

420

360

Cost-

incurrence

300

curve

Cumulative costs per unit (240

180

120

60

0

R&D

Manufacturing

Marketing, distribution

Value-

and

and

chain

design

customer service

functions

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the technical and business aspects of the entire value chain and interact knowledgeably with other

team members. A cross-functional team makes it easier to choose and implement new designs.

Why? Because all parts of the organisation have ‘bought into’ the new design.

Achieving the target cost per unit for Provalue

Astel’s value-engineering teams focus their cost-reduction efforts on analysing the Provalue design.

Their goal? To design a high-quality, highly reliable machine with fewer features that meets cus-

tomers’ price expectations and achieves target cost.

Provalue is discontinued. In its place, Astel introduces Provalue II. Provalue II has fewer com-

ponents than does Provalue and is easier to manufacture and test. The following tables compare

the direct costs and the manufacturing overhead costs and cost drivers of Provalue and Provalue

II. In place of the 150 000 Provalue units manufactured and sold in 2022, Astel expects to make

and sell 200 000 Provalue II units in 2023.

Direct costs

Costs per unit

Cost category

Provalue

Provalue II

Explanation of costs for Provalue II

1

Direct

€460

€385

The Provalue II design will use a simplified

materials

main printed circuit board, fewer

components and no audio features

2

Direct

€64

€53

Provalue II will require less assembly time

manufacturing

labour

3

Direct

€76

€57

Machining costs are fixed at €11 400 000.

machining

Astel can use the machine capacity to

costs

produce 200 000 units of Provalue II.

The new design will enable Astel to

manufacture each unit of Provalue II in

less time than a unit of Provalue. Direct

machining costs per unit of Provalue II

will equal €57 (€11 400 000 ÷ 200 000)

Manufacturing overhead costs

Quantity of cost driver

Explanation for quantity of cost

Cost driver

Provalue* Provalue II

driver used by Provalue II

1

Number of

22 500

21 250 Astel will place 50 orders for each of the

orders

425 components in Provalue II. Total orders for

Provalue II will equal 21 250 (425 × 50)

2 Testing-hours

4 500 000

3 000 000 Provalue II is easier to test and will require

15 testing-hours per unit. Total number of

expected testing-hours will equal 3 000 000

(15 × 200 000)

3 Units reworked

12 000

13 000 Provalue II will have a lower rework rate of 6.5%

because it is easier to manufacture. Total units

reworked will equal 13 000 (6.5% × 200 000)

* From Exhibit 12.2.

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Note that value-engineering activities reduce both value-added and non-value-added costs. For

example, direct manufacturing labour cost per unit, a value-added cost, is reduced by designing

a product that requires fewer direct manufacturing labour-hours (the cost driver for direct man-

ufacturing labour costs). Rework cost per unit, a non-value-added cost, is reduced by simplifying

the design to reduce defects during manufacturing and hence rework-hours (the cost driver for

rework costs).

Exhibit 12.5 presents the target manufacturing costs of Provalue II, assuming no change in the

cost per unit of the cost drivers. For comparison, Exhibit 12.5 also reproduces the manufacturing

costs per unit of Provalue from Exhibit 12.2. Exhibit 12.5 shows that the new design is expected

to reduce the manufacturing cost per unit by €140 to €540 from €680. A similar analysis (not

presented) estimates the expected effect of the new design on costs in other value-chain business

functions. Exhibit 12.6 shows that the estimated full product cost per unit equals €720 – the target

cost per unit for Provalue II. Astel's goal is to sell Provalue II at the target price, achieve target

cost, and earn the target operating profit.

Unless managed properly, value engineering and target costing can have undesired conse-

quences (see also Cooper and Slagmulder 1997):

● The cross-functional team may add too many features in an attempt to accommodate the

different wishes of team members.

● Long development times may result as alternative designs are evaluated endlessly.

● Organisational conflicts may develop as the burden of cutting costs falls unequally on different

parts of the organisation.

To avoid these pitfalls, target-costing efforts should always focus on the customer, pay attention

to schedules, and build a culture of teamwork and cooperation across business functions.

Exhibit 12.5

Target manufacturing costs of Provalue II

Provalue II

Provalue

Estimated

Manufacturing

manufacturing

Estimated

costs per unit

costs for

manufacturing

(Exhibit 12.2,

200 000 units

costs per unit

column 2)

(1)

(2) = (1) , 200 000

(3)

Direct manufacturing costs

Direct material costs (200 000 units

€77 000 000

€385.00

€460.00

* €385)

Direct manufacturing labour costs

10 600 000

53.00

64.00

(200 000 units * €53)

Direct machining costs (fixed costs

11 400 000

57.00

76.00

of €11 400 000)

Direct manufacturing costs

99 000 000

495.00

600.00

Manufacturing overhead costs

Ordering and receiving costs

1 700 000

8.50

12.00

(21 250 000 orders * €80)

Testing and inspection costs

6 000 000

30.00

60.00

(3 000 000 hours * €2)

Rework costs (13 000 units * €100)

1 300 000

6.50

8.00

Manufacturing overhead costs

9 000 000

45.00

80.00

Total manufacturing costs

€108 000 000

€540.00

€680.00

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Exhibit 12.6

Target product profitability of Provalue II in 2023

Total for 200 000 units

Per unit

(1)

(2) = (1) , 200 000

Revenues

€160 000 000

€800

Cost of goods sold* (from Exhibit 12.5)

Direct materials costs

77 000 000

385

Direct manufacturing labour costs

10 600 000

53

Direct machining costs

11 400 000

57

Manufacturing overhead costs

9 000 000

45

Cost of goods sold

108 000 000

540

Operating costs

R&D costs

4 000 000

20

Design of products and processes costs

6 000 000

30

Marketing costs

18 000 000

90

Distribution costs

5 000 000

25

Customer-service costs

3 000 000

15

Operating costs

36 000 000

180

Full product costs

144 000 000

720

Operating profit

€16 000 000

€80

* Cost of goods sold = Total manufacturing costs (since we assume no opening or closing stock

for Provalue II in 2023).

Cost-plus pricing

As illustrated in the last section, Astel uses an external market-based approach in its long-run

pricing decisions. An alternative approach is to determine a cost-based price. Managers can turn

to numerous pricing formulas based on cost. The general formula for setting a price adds a

mark-up to the cost base:

Cost base

€X

Mark-up component

Y

Prospective selling price

€X + Y

Concepts in action

Target pricing for the Indian car market

Despite India's rapid economic growth and growing market for consumer goods, transport options in the world's

most populous country remain limited. Historically, Indians relied on public transport, bicycles and motorcycles

to get around. Today, about 7.5% of Indian people own cars (in Germany, France, Italy and the US more than 80%

of households own one or more cars). For many Indians, foreign-made cars traditionally had unnecessary product

features and were priced too high. But Ratan Tata, ex-chairman of India's Tata Motors, saw India's dearth of cars as an

opportunity and set a challenge for his company to build a ‘people’s car’ for the Indian market with three requirements:

it should (1) adhere to existing regulatory requirements, (2) achieve certain performance targets for fuel efficiency and

acceleration, and (3) cost only 1 lakh rupees (approx. £1250).

The task was daunting: the target price was about half the price of the cheapest Indian car. One of Tata’s suppliers

said, ‘It’s basically throwing out everything the auto industry has thought about cost structures in the past and taking

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a clean sheet of paper and asking, ‘What’s possible?’ Mr Tata and his managers responded with what some analysts

have described as ‘Gandhian engineering’ principles: deep frugality with a willingness to challenge conventional

wisdom. At a fundamental level, Tata Motors’ engineers created a new category of car by doing more with less.

Extracting costs from traditional car development, Tata eschewed traditional long-term supplier relationships, and

instead forced suppliers to compete for its business using internet-based auctions. Engineering innovations led to a

hollowed-out steering-wheel shaft, a smaller diameter drive shaft, a trunk with space for a briefcase, one windshield

wiper instead of two, and a rear-mounted engine not much more powerful than a high-end ride-on lawnmower.

Moreover, Tata's car has no radio, no power steering, no power windows and no air conditioning – features that are

standard on most vehicles.

Tata Motors introduced the 'Nano' in 2008 as a one-lakh-rupee entry-level car that was fuel efficient; did 100 kilo-

metres on 5.6 litres; reached 100 kilometre per hour speed; and met all Indian emission, pollution and safety stand-

ards. Today, a much improved Nano can be purchased for under £2500. Sales of the Nano have been low – perhaps

because of its low price! The price of a product signals something about the buyer. It is often the case that consumers

do not like to be seen to purchase the lowest priced product especially in relation to high ticket items such as cars.

To a consumer this displays lack of social standing. This may be why the Nano has lost money for Tata according to

analysts. How managers evaluate demand at different prices and manage costs across the value chain and over a

product's life cycle to achieve profitability is important. Target pricing must take care to take account of social aspects

of purchases. Target pricing applied in India and indeed in any company, is in principle market-focused but in practice

integrates also a company-specific twist.

Today, Ratan Tata remains a supporter of the Nano. Aged 84 years, in May 2022, he went out for a dinner at the Taj

Hotel in a small Tata Nano car. He is actively refining an electric variant of the Nano: the 72V Nano EV.

Sources: Giridharadas, A. (2008) 'Four wheels for the masses: the $2,500 car', *New York Times,* 9 January (www.nytimes.com/2008/01/08/business/

worldbusiness/08indiacar.html); Kripalani, M. (2008) 'Inside the Tata Nano factory', *Business Week,* 9 May (https://www.bloomberg.com/news/arti-

cles/2008-05-09/inside-the-tata-nano-factorybusinessweek-business-news-stock-market-and-financial-advice#xj4y7vzkg); Torchinsky, J. (2018) 'The Tata Nano is way better than the world's cheapest car has any right to be' (https://jalopnik.com/the-tata-nano-is-way-better-than-the-worlds-

cheapest-ca-1823653663); *The Economic Times* (2022) 'The "moment of truth": Ratan Tata takes his white, bespoke electric 72C Nano for a drive' (https://

economictimes.indiatimes.com/magazines/panache/the-moment-of-truth-ratan-tata-takes-his-white-bespoke-electric-nano-for-a-drive/article-

show/89478080.cms?
utm_source=contentofinterest&utm_medium=text&utm_campaign=cppst); BBC News (2022) 'Ratan Tata: Tycoon's ride in India's cheapest car wins internet', 19 May (https://www.bbc.com/news/world-asia-india-61503989).

Cost-plus target rate of return on investment

Consider a cost-based pricing formula that Astel could use for Provalue II. Assume that Astel's

engineers have redesigned Provalue into Provalue II as described earlier and that Astel uses a 12%

mark-up on the full product cost per unit in developing the prospective selling price.

Cost base (full product cost per unit, from Exhibit 12.6)

€720.00

Mark-up component (12% × €720)

86.40

Prospective selling price

€806.40

How is the mark-up percentage of 12% determined? One approach is to choose a mark-up

to earn a *target rate of return on investment.* The target rate of return on investment is the target

operating profit that an organisation must earn divided by invested capital. Invested capital can

be defined in many ways. In this chapter, we define it as total assets (long-term or fixed assets

plus current assets). Companies usually specify the target rate of return required on investments.

Suppose Astel's (pre-tax) target rate of return on investment is 18%. Assume that the capital

investment needed for Provalue II is €96 million. The target operating profit that Astel must earn

from Provalue II can then be calculated as follows:

Invested capital

€96 000 000

Target rate of return on investment

18%

Total target operating profit (18% × €96 000 000)

€17 280 000

Target operating profit per unit of Provalue II (€17 280 000 ÷ 200 000 units)

€86.40

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The calculation indicates that Astel would like to earn a target operating profit of €86.40 on

each unit of Provalue II. What mark-up does this return amount to? Expressed as a percentage

of the full product cost per unit of €720, the mark-up is equal to 12% (€86.40 ÷ €720). Do not

confuse the 18% target rate of return on investment with the 12% mark-up percentage. The 18%

target rate of return on investment expresses Astel's expected operating profit as a percentage

of investment. The 12% mark-up expresses operating profit per unit as a percentage of the full

product cost per unit. Astel first calculates the target rate of return on investment, and then

determines the mark-up percentage.

Companies sometimes find it difficult to determine the capital invested to support a product.

Computing invested capital requires allocations of investments in equipment and buildings (used

for design, production, marketing, distribution and customer service) to individual products – a

difficult and sometimes arbitrary task. Some companies therefore prefer to use alternative cost

bases and mark-up percentages that do not require calculations of invested capital to set price.

We illustrate these alternatives using the Astel example. Exhibit 12.7 separates the cost per unit

for each value-chain business function into its variable and fixed components (without provid-

ing details of the calculations). The following table illustrates some alternative cost bases and

mark-up percentages:

Estimated

Mark-up

Prospective

cost per unit

Mark-up component for

selling price

of Provalue II

percentage

Provalue II

for Provalue II

Cost base

(1)

(2)

(3) = (1) × (2) (4) = (1) + (3)

Variable manufacturing

€483.00

65%

€313.95

€796.95

costs

Variable product costs

547.00

45

246.15

793.15

Manufacturing function

540.00

50

270.00

810.00

costs

Full product cost

720.00

12

86.40

806.40

To illustrate the mark-up calculations, we have assumed (but not derived) the mark-up per-

centages in the table. The different cost bases and mark-up percentages that we use in the table

give prospective selling prices that are relatively close to one another. In practice, a company

will choose a cost base that it regards as reliable, and a mark-up percentage on the basis of its

Exhibit 12.7

Estimated cost structure for Provalue II

Variable cost

Fixed cost

Business function

Business function

per unit

per unit*

cost per unit

R&D

€8.00

€12.00

€20.00

Design of product/process

10.00

20.00

30.00

Manufacturing

483.00

57.00

540.00

Marketing

25.00

65.00

90.00

Distribution

15.00

10.00

25.00

Customer service

6.00

9.00

15.00

Product costs

€547.00

€173.00

€720.00

Variable product

Fixed product

Full product

cost per unit

cost per unit

cost per unit

* Based on budgeted annual production of 200 000 units.

experience in pricing products to recover its costs and earn a desired return on investment. For

example, a company may choose a full product cost base if it is unsure about variable- and fixed-

cost distinctions.

The mark-up percentages in the table vary a great deal, from a high of 65% on variable man-

ufacturing costs to a low of 12% on full product costs. Why? Because the mark-up based on

variable manufacturing costs takes into account the need to earn a profit, and to recoup fixed

manufacturing costs and other business function costs such as R&D, marketing and distribution.

The greater these costs relative to variable manufacturing costs, the higher the mark-up percent-

age. The mark-up percentage on full product costs is much lower. Why? Because full product

costs already include all costs incurred to sell the product. The precise mark-up percentage also

depends on the competitiveness of the product market. Mark-ups and profit margins tend to be

lower the more competitive the market.

The advantages cited by many companies for including fixed costs per unit for pricing decisions

include the following:

1 *Full product cost recovery.* For long-run pricing decisions, full product costs inform managers

of the bare minimum costs they need to recover to continue in business rather than shut down.

Using variable costs as a base does not give managers this information. There is then a tempta-

tion to engage in excessive long-run price cutting as long as prices give a positive contribution

margin. Long-run price cutting, however, may result in long-run revenues being less than long-

run (full product) costs, resulting in the company going out of business.

2 *Price stability.* Managers believe that full-cost formula pricing promotes price stability, because

it limits the ability of managers to cut prices. Managers prefer price stability because it facili-

tates planning.

3 *Simplicity.* A full-cost formula for pricing does not require a detailed analysis of cost-behaviour

patterns to separate costs into fixed and variable components for each product. Calculating

variable costs for each product is expensive and prone to errors. For these reasons, many man-

agers believe that full-cost formula pricing meets the cost–benefit test.

Including unit fixed costs when pricing is not without its problems. Allocating fixed costs

to products can be somewhat arbitrary. Calculating fixed cost per unit requires an estimate of

expected future sales quantities. If actual sales fall short of this estimate, the actual full product

cost per unit could exceed price. There are instances where non-cost factors are relevant in price

setting.

Price discrimination is the practice of charging some customers a higher price than is charged

to other customers. Peak-load pricing is the practice of charging a higher price for the same prod-

uct or service when demand approaches physical capacity limits. Under price discrimination and

peak-load pricing, prices differ among market segments even though the outlay costs of providing

the product or service are approximately the same. For instance, airlines often charge business

travellers higher fares than pleasure travellers. This is possible because business travellers tend to

return home within the same week. Likewise, telephone companies can charge higher prices for

telephone calls made during business hours. There are illustrations of price discrimination and

peak-load pricing.

Life-cycle product budgeting and costing

The product life cycle spans the time from initial R&D to the time at which support to customers

is withdrawn. For motor vehicles, this time span may range from 5 to 10 years. For some pharma-

ceutical products, the time span may be 3–5 years. For fashion clothing products, the time span

may be less than 1 year.

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Using life-cycle budgeting, managers estimate the revenues and costs attributable to each prod-

uct from its initial R&D to its final customer servicing and support in the marketplace. Life-cycle

costing tracks and accumulates business function costs across the entire value chain from a prod-

uct's initial R&D to its final customer service and support. Life-cycle budgeting and life-cycle

costing span several years.

There are, according to Baker et al. (2010), two essential points ‘to price effectively throughout

the life of a product or service. First, companies should actively manage the trade-off between

price and volume or profit and market share to maximise returns [. . .]. Second, companies must

make pricing decisions in the context of their broader product portfolios.’ We consider here and

in later chapters both volume and portfolio-mix issues.

Life-cycle budgeting and pricing decisions

Life-cycle budgeted costs can provide important information for pricing decisions. For some prod-

ucts, the development period is relatively long, and many costs are incurred prior to manufactur-

ing. Consider Fjalar AS, a computer software company developing a new accounting package,

‘General Ledger’. Assume the following budgeted amounts for General Ledger over a six-year

product life cycle:

Years 1 and 2

R&D costs

€240 000

Design costs

€60 000

Years 3 to 6

One-time

Costs per

set-up costs

package

Production costs

€100 000

€25

Marketing costs

70 000

24

Distribution costs

50 000

16

Customer-service costs

80 000

30

To be profitable, Fjalar must generate revenues to cover costs in all six business functions.

A product life-cycle budget highlights the importance of setting prices and budgeting reve-

nues to recover costs in *all* the value-chain business functions rather than costs in only some

of the functions (such as production). The life-cycle budget also indicates the costs to be

incurred over the life of the product. Exhibit 12.8 presents the life-cycle budget for General

Ledger.

Three combinations of the selling price per package and predicted demand are shown. The

high non-production costs at Fjalar are readily apparent in Exhibit 12.8. For example, R&D

and product-design costs constitute over 30% of total costs for each of the three combina-

tions of selling price and predicted sales quantity. Fjalar should put a premium on having as

accurate a set of revenue and cost predictions for General Ledger as possible, given the high

percentage of total life-cycle costs incurred before any production begins and before any rev-

enue is received.

Exhibit 12.8 assumes that the selling price per package is the same over the entire life cycle.

For strategic reasons, however, Fjalar may choose to ‘skim the market’ by charging higher prices

to customers eager to try General Ledger when it first comes out, and lower prices to customers

who are willing to wait. The life-cycle budget will then express this strategy.

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Exhibit 12.8

Budgeted life-cycle revenues and costs for 'general ledger' software package of Fjalar AS*

Alternative selling price/sales-quantity combinations

1

2

3

Selling price per package:

€400

€480

€600

Sales quantity in units:

5000

4000

2500

Life-cycle revenues (€400 * 5000);

€2 000 000

€1 920 000

€1 500 000

(€480 * 4000; €600 * 2500)

Life-cycle costs

R&D costs

240 000

240 000

240 000

Design costs of product/process

160 000

160 000

160 000

Production costs

€100 000 + (€25 * 5000);

€100 000 + (€25 * 4000);

€100 000 + (€25 * 2500)

225 000

200 000

162 500

Marketing costs

€70 000 + (€24 * 5000);

€70 000 + (€24 * 4000);

€70 000 + (€24 * 2500)

190 000

166 000

130 000

Distribution costs

€50 000 + (€16 * 5000);

€50 000 + (€16 * 4000);

€50 000 + (€16 * 2500)

130 000

114 000

90 000

Customer-service costs

€80 000 + (€30 * 5000);

€80 000 + (€30 * 4000);

€80 000 + (€30 * 2500)

230 000

200 000

155 000

Total life-cycle costs

1 175 000

1 080 000

937 500

Life-cycle operating profit

€825 000

€840 000

€562 500

* This exhibit does not take into consideration the time value of money when computing life-cycle revenues or life-cycle costs.

Chapter 13 outlines how this important factor can be incorporated into such calculations.

Developing life-cycle reports

Most accounting systems emphasise reporting on a calendar basis – monthly, quarterly and annu-

ally. In contrast, product life-cycle reporting does not have this calendar-based focus. Consider

the life spans of four Fjalar products:

Year 1

Year 2

Year 3

Year 4

Year 5

Year 6

General Ledger Package

Law Package

Payroll Package

Engineering Package

Each product spans more than one calendar year.

Developing life-cycle reports for each product requires tracking costs and revenues on a

product-by-product basis over several calendar periods. For example, the R&D costs included in

a product life-cycle cost report are often incurred in different calendar years. When R&D costs

are tracked over the entire life cycle, the total magnitude of these costs for each individual product

can be calculated and analysed.

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A product life-cycle reporting format offers at least three important benefits:

1 The full set of revenues and costs associated with each product becomes visible. Manufactur-

ing costs are highly visible in most accounting systems. However, the costs associated with

upstream areas (for example, R&D) and downstream areas (for example, customer service)

are frequently less visible on a product-by-product basis.

2 Differences among products in the percentage of their total costs incurred at early stages in the

life cycle are highlighted. The higher this percentage, the more important it is for managers to

develop, as early as possible, accurate predictions of the revenues for that product.

3 Interrelationships among business function cost categories are highlighted. For example, com-

panies that cut back their R&D and product-design costs may experience major increases in

customer-service costs in subsequent years. Those costs arise because products fail to meet

promised quality-performance levels. A life-cycle revenue and cost report prevents such caus-

ally related changes among business function costs from being hidden (buried) as they are in

calendar profit statements.

Life-cycle costs further reinforce the importance of locked-in costs, target costing and value

engineering in pricing and cost management. For products with long life cycles, a very small

fraction of the total life-cycle costs are actually incurred at the time when costs are locked in. But

locked-in costs will determine how costs will be incurred over several years. Motor vehicle man-

ufacturers combine target costing with life-cycle budgeting. For example, Ford, General Motors,

Nissan and Volvo determine target prices and target costs for their car models on the basis of

estimated costs and revenues over a multi-year horizon.

Where managers apply life-cycle costing and value engineering, environmental costs can be a

critical area of concern. Environmental laws now increasingly affect companies and the cost of

their activities. There are a variety of regulations which impose increasingly stricter standards

affecting, for instance, clean-up requirements, with severe penalties for polluting the air and con-

taminating subsurface soil and groundwater. The European Union use a ‘cap-and-trade’ system,

where the government puts a limit or cap on the overall level of carbon pollution and conducts a

market auction for pollution quotas. Companies pay for the right to pollute and can then either

sell (or buy) these rights to (or from) other companies if they pollute less (or more) than their

quotas. The carbon tax acts as a fee or surcharge on carbon-based fuels and other sources of

pollution outing a monetary price on greenhouse gas emissions.

Environmental costs that are incurred over several years of the product's life cycle are often

locked in at the product- and process-design stage. To avoid environmental liabilities or reduce

carbon taxes, managers in industries such as oil refining, chemical processing, and automobile

manufacturing value engineer and design products and processes to prevent and reduce pollution

over the product's life cycle. For example, laptop computer manufacturers like Hewlett-Packard

and Apple have introduced recycling programmes to ensure that chemicals from nickel-cadmium

batteries do not leak hazardous chemicals into the soil. The carbon tax has spurred innovation

in the design of energy-efficient products and clean energy solutions, such as solar and wind

power. What is the effect of sustainability investments on overall financial performance in sub-

sequent periods? The Sustainability Accounting Standards Board (SASB) defines standards for

environmental, social, and governance (ESG) performance for different industries. The relevant

(or material) ESG standards vary across industries based on financial impact and interest of user

groups. For example, the relevant ESG standards in the oil and gas industry include greenhouse

gas emissions and water and wastewater management, while the relevant ESG standards in the

technology and communications industry include life-cycle impacts of products and services and

energy management. When measured over multiple periods, companies that have higher relevant

ESG ratings have higher future profitability and financial performance, perhaps because of cus-

tomer loyalty and satisfaction, employee engagement, or brand and reputation (Khan et al. 2016).

Data protection regulations, like environmental laws need to be factored into product costs. For

instance, in May 2018 the European Union made it a requirement for any business that processes

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Customer revenues

the personal information of European citizens to comply with the General Data Protection Reg-

ulation (GDPR). A firm that breaks the GDPR rules will incur maximum fines of €20 million

or 4 per cent of its global annual turnover, whichever is largest. To ensure effective compliance,

many companies costed the resources that are essential in terms of hiring lawyers, data protec-

tion consultants and educating employees about the new data framework. For a medium-size UK

company, this is estimated to cost over £75 000, and for FTSE100 firms, implementation costs to

comply can run at £15 million to £19 million for energy, commodities and utilities, retail goods

and technology and telecommunications companies, with other sector enterprises looking at

spending approximately £5 million to £11 million (Coolegem, 2022; Khan, 2017). These are costs

which companies need to build into their costing estimates.

Customer profitability analysis

Customer profitability analysis refers to the reporting and analysis of customer revenues and cus-

tomer costs. Managers need to ensure that customers contributing sizably to the profitability of an

organisation receive a comparable level of attention from the organisation. An accounting system

that reports customer profitability helps managers in this task. See Bhimani (2022) and Smith

(1997) for discussions and further examples of the application of customer profitability analysis.

The marketing efforts of companies aim to attract and retain profitable customers. This section

examines the reporting and analysis of customer revenues and customer costs. We will discuss the

Spring Distribution Company, a distributor of water bottled by Spring Products. Spring Distribu-

tion buys bottled water from Spring Products at €0.50 a bottle. It sells to wholesale customers at

a list price of €0.60 a bottle. Customers range from large supermarkets, hospitals and university

canteens to small corner shops. It does not sell to final end-point consumers.

Customer revenues

Customer revenues are inflows of assets from customers received in exchange for products or

services being provided to those customers. More accurate customer revenues can likewise be

obtained by tracing as many revenue items (such as sales returns and coupons) as possible to

individual customers.

The analysis of customer profitability is enhanced by retaining as much detail as possible about

revenue. A key concern here is price discounting, which is the reduction of selling prices below

listed levels in order to encourage an increase in purchases by customers. Accounting systems

differ with respect to how details on discounting are recorded. Spring Distribution offers price dis-

counts below its €0.60 list price per bottle to key customers. Individual sales representatives have

discretion as to the amount of discounting. Its largest customer is SuperMart, to which it sold 1

million bottles at €0.56 per bottle in November 2022. The two main revenue recording options are:

Option A.

Recognise the list price (€0.60 per bottle) and the discount (€0.04 per bottle)

from this list price as separate line items.

Revenues at list prices, €0.60 × 1 000 000

€600 000

Deduct revenue discounting, €0.04 × 1 000 000

40 000

Reported revenues

€560 000

Option B.

Record only the actual price when reporting revenues.

Reported revenues, €0.56 × 1000 000

€560 000

Option A has the benefit of highlighting the extent of price discounting. It facilitates further anal-

ysis that could examine which customers had price discounting and which sales representatives at

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Spring Distribution most frequently resorted to price discounting. Option B effectively precludes

such systematic analysis of price discounting.

Studies on customer profitability in companies have found large price discounting to be an

important explanation for a subset of customers being below their expected profitability. Sales

representatives may have given these customers large price discounts that are unrelated to their

current or potential future value to a company.

Customer costs

Chapters 5 and 11 discussed the *cost-hierarchy* concept. Here we apply this concept to customers.

A customer cost hierarchy categorises costs related to customers into different cost pools on the

basis of different types of cost drivers (or cost-allocation bases) or different degrees of difficulty

in determining cause-and-effect (or benefits received) relationships. Spring Distribution has an

activity-based costing (ABC) system that focuses on customers rather than products.

Spring's ABC system has one direct cost, the cost of bottles, and multiple indirect-cost pools.

The indirect costs belong to different categories of the customer cost hierarchy. Spring identifies

five categories in its customer cost hierarchy:

1 *Customer output-unit-level costs* – resources sacrificed on activities performed to sell each unit

(bottle) to a customer. An example is product-handling costs of each bottle sold.

2 *Customer batch-level costs* – resources sacrificed on activities that are related to a group of units

(bottles) sold to a customer. Examples are costs incurred to process orders or to make deliveries.

3 *Customer-sustaining costs* – resources sacrificed on activities undertaken to support individual

customers, regardless of the number of units or each batch of product delivered to customers.

Examples are costs of customer visits or costs of displays at customer sites.

4 *Distribution-channel costs* – resources sacrificed on activities that are related to a particular

distribution channel rather than to each unit of product, batches of product, or specific cus-

tomers. An example is the salary of the manager of Spring's retail distribution channel.

5 *Corporate-sustaining costs* – resources sacrificed on activities that cannot be traced to individ-

ual customers or distribution channels. Examples are senior management and general admin-

istration costs.

Spring has one additional cost-hierarchy category, distribution-channel costs, for the costs it

incurs to support each of its distribution channels. We now consider decisions made at the indi-

vidual customer level.

Customer-level costs

Customer-level costs include cost of goods sold and costs incurred in the first three categories

of the customer cost hierarchy: customer output-unit-level costs, customer batch-level costs and

customer-sustaining costs. The following table shows five activities (in addition to cost of goods

sold) that Spring identifies as resulting in customer-level costs. The table indicates the cost drivers

and cost driver rates for each activity as well as the cost-hierarchy category for each activity.

Activity

Cost driver and rate

Cost-hierarchy category

Order taking

€100 per purchase order

Customer batch-level costs

Customers visits

€80 per customer visit

Customer-sustaining costs

Delivery vehicles

€2 per delivery mile travelled

Customer batch-level costs

Product handling

€0.02 per bottle sold

Customer output-unit-level costs

Expedited deliveries

€300 per expedited delivery

Customer batch-level costs

Exhibit 12.9 shows a customer profitability analysis for four customers. Data underlying this

exhibit are as follows:

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Customer costs

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Exhibit 12.9

Customer profitability analysis for four retail channel customers of Spring

Distribution for June 2022

Customer

A

B

G

J

Revenues at list prices

€600 000

€480 000

€42 000

€36 000

€0.60 × 1000 000; 800 000; 70 000; 60 000

Discount €0.04 × 1000 000; €0.01× 800 000; €0.05 ×

70 000

; €0 ×

40 000 60 000 8 000

3 500

0

€0.04 × 1000 000; €0.01× 800 000; €0.05 × 70 000; €0 × 60 000

Revenues (at actual prices)

560 000

472 000

38 500

36 000

Cost of goods sold

500 000

400 000

35 000

30 000

€0.50 × 1000 000; 800 000; 70 000; 60 000

Gross margin

60 000

72 000

3 500

6 000

Customer-level operating costs

Order taking €100 × 30; 25; 15; 10

3 000

2 500

1 500

1 000

Customer visits €80 × 6; 5; 4; 3

480

400

320

240

Delivery vehicles €2 × (5 × 60); (12 × 30)

600

720

800

180

(20 × 20); (6 × 15)

Product handling

20 000

16 000

1 400

1 200

€0.02 × 1000 000; 800 000; 70 000; 60 000

Expedited deliveries €300 × 1; 0; 2; 0

300

0

600

0

Total

24 380

19 620

4 620

2 620

Customer-level operating profit

€35 620

€52 380

€(1 120)

€3 380

Customer

A

B

G

J

Bottles sold

1 000 000

800 000

70 000

60 000

List selling price

€0.60

€0.60

€0.60

€0.60

Actual selling price

€0.56

€0.59

€0.55

€0.60

Number of purchase orders

30

25

15

10

Number of sales visits

6

5

4

3

Number of deliveries

60

30

20

15

Kilometres travelled per delivery

5

12

20

6

Number of expedited deliveries

1

0

2

0

Spring Distribution can use the information underlying Exhibit 12.9 to persuade its customers

to reduce usage of the cost drivers. For example, consider customer G, which is only 7% the size

of customer A (in terms of bottles purchased – G purchased 70 000 while A purchased 1 000 000).

Yet, G uses 50% of purchase orders, 662/3% of sales visits, 332/3% of deliveries, and twice the

number of expedited deliveries in comparison to customer A. Spring Distribution could seek to

have customer G make fewer purchase orders, require fewer customer visits, have fewer deliveries

and reduce expedited deliveries, while preserving opportunities for higher sales to customer G

in the future.

The ABC system underlying Exhibit 12.9 provides a road map that facilitates less use of cost

drivers by individual customers in order to promote cost reduction. Another advantage of ABC is

that it highlights a second way cost reduction can be promoted by Spring Distribution. Spring can

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Exhibit 12.10

Income statement of Spring Distribution for June 2022

Customer distribution channels

Wholesale customers

Retail customers

Total

Total

A1

A2

. . . . . .

Total

A*

B*

. . . . . .

(1)

(2)

(3)

(4)

(5) (6)

(7)

(8)

(9)

(10) (11)

Revenues

€12 470 000 €10 470 000 €1 946 000 €1 476 000

€2 000 000 €560 000 €472 000

Customer-level 11 939 000 10 073 000 1 868 000 1 416 000

1 866 000 524 380 419 620

costs

Customer-level

531 000

397 000 €78 000 €60 000

134 000 €35 620 €52 380

operating

profit

Distribution-

190 000 132 000

58 000

channel

costs

Distribution-

341 000 €265 000

€76 000

channel-

level

operating

income

Corporate-

263 000

sustaining

costs

Operating

€78 000

profit

* Full details are presented in Exhibit 12.9.

take actions to reduce the costs in each of its own activities. For example, order taking currently

is estimated to cost €100 per purchase order. By making its own ordering process more efficient

(such as having its customers order electronically), Spring can reduce its costs even if its customers

place the same number of orders.

Exhibit 12.10 shows the monthly operating income for Spring Distribution. The customer-level

operating profit of customers A and B in Exhibit 12.9 are shown in columns 8 and 9 of

Exhibit 12.10. The format of Exhibit 12.10 is structured on Spring Distribution's cost hierarchy.

This format dovetails with the different levels at which Spring Distribution makes decisions.

Customer profitability profiles

Exhibit 12.11 shows two approaches to presenting customer profitability profiles. For simplicity,

we assume Spring Distribution has only 10 customers. Panel A ranks customers on operating

profit. Column 4 shows the cumulative operating profit for these customers. This column is

calculated by cumulatively adding up the individual customer profits. For example, row three for

customer C has a cumulative profit of €108 650 in column 4. This is the sum of €52 380 for cus-

tomer B, €35 620 for customer A, and €20 650 for customer C. Column 5 shows what percentage

this €108 650 amount is of the total operating profit of €134 000. Thus, the three most profitable

customers contribute 81% of total operating profit. This high percentage contribution by a small

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Exhibit 12.11

Customer profitability analysis for Spring Distribution

Panel A: Customers ranked on 2022 operating profit

Percentage of

Customer

Cumulative

cumulative

Customer

operating

Customer

operating

operating profit to

code

profit

revenue*

profit

total operating profit

(1)

(2)

(3)

(4)

(5)

B

€52 380

€480 000

€52 380

39%

A

35 620

600 000

88 000

66

C

20 650

247 000

108 650

81

D

16 840

227 000

125 490

94

F

6 994

99 000

132 484

99

J

3 380

36 000

135 864

101

E

3 176

193 000

139 040

104

G

−1120

42 000

137 920

103

H

−1760

39 000

136 160

102

I

−2 160

37 000

134 000

100

€134 000

€2 000 000

Panel B: Customers ranked on 2022 revenues

Customer

Operating

Percentage of

Customer

Customer

operating

profit

Cumulative

cumulative revenue

code

revenue*

profit

revenues

revenues

to total revenues

(1)

(2)

(3)

(4)

(5)

(6)

A

€600 000

€35 620

0.059

€600 000

30%

B

480 000

52 380

0.109

1 080 000

54

C

247 000

20 650

0.084

1 327 000

66

D

227 000

16 840

0.074

1 554 000

78

E

193 000

3 176

0.016

1 747 000

87

F

99 000

6 994

0.071

1 846 000

92

G

42 000

- 1 120

(0.027)

1 888 000

94

H

39 000

- 1 760

(0.045)

1 927 000

96

I

37 000

- 2 160

(0.058)

1 964 000

98

J

36 000

3 380

0.094

2 000 000

100

€2 000 000

€134 000

* Customer revenue is gross revenue prior to price offset items such as a price discount.

number of customers is a common finding in many studies. It highlights the importance of Spring

Distribution maintaining good relations with this pivotal set of customers.

Exhibit 12.11, Panel B, ranks customers on revenue (before price discounts). Three of the four

smallest customers (based on revenue) are unprofitable. Moreover, customer E, with revenues of

€193 000, is only marginally profitable. Further analysis revealed that a former sales representative

gave customer E an excessively high price discount in an attempt to meet a monthly sales- volume

target.

Managers often find the bar chart presentation in Exhibit 12.12 to be the most intuitive way to

analyse customer profitability. The highly profitable customers clearly stand out. Moreover, the

number of loss-customers and the magnitude of their losses are apparent.

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Assessing customer value

The information in Exhibits 12.9 and 12.12 relates to customer profitability in a monthly account-

ing period. This is one of several factors that managers should consider in deciding how to allo-

cate resources across customers. Other factors include:

1 *Short-run and long-run customer profitability.* This factor will be influenced by factors 2 and

3 below, as well as by the level of resources likely to be required to retain the accounts.

2 *Likelihood of customer retention.* The more likely a customer is to continue doing business

with a company, the more valuable the customer. Customers can differ in their loyalty and their

willingness to ‘take their business elsewhere’ on a frequent basis.

3 *Potential for customer growth.* This factor will be influenced by the likely growth of the cus-

tomer’s industry and the likely growth of the customer (due to, say, its ability to develop new

products). This factor will also be influenced by cross-selling opportunities, that is, when a

customer of one of the company’s products becomes a customer of one or more of the com-

pany’s other products.

4 *Increases in overall demand from having well-known customers.* Some customers with estab-

lished reputations are often worth mentioning during customer visits to drive sales. Other

customers are valuable because of their willingness to provide product endorsements.

5 *Ability to learn from customers.* Customers can be an important source of ideas about new

products or ways to improve existing products. Customers willing to provide such input can

be especially valuable.

Managers should be particularly cautious when deciding to drop customers. Long-run prof-

itability reports may provide misleading signals about their short-run profitability. Not all costs

assigned to a customer are variable in the short run. Dropping a currently unprofitable customer

will not necessarily eliminate in the short run all the costs assigned to that customer.

Exhibit 12.12

Bar chart presentation of customer profitability for Spring

Distribution

60 000

B

50 000

40

€)

000

A

30 000

C

20

D

000

Operating profit (

10

F

000

J

E

0

G

Customers

H

I

–10 000

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Summary

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Concepts in action

Zara uses target pricing to become the world's largest fashion retailer

In recent years, fast fashion has taken the apparel world by storm. Quickly designed and manufactured to respond to the latest fashion trends, fast fashion retailers work to ensure their store shelves are always stocked with the trendiest clothes at affordable prices. At Zara, many of the items you see in stores today will have been designed as little as two weeks before. This has allowed Zara's parent company, Inditex SA, to become the world's largest fashion retailer by sales. In 2017, Zara sold nearly $20 billion worth of the 18 000 fast-fashion designs on its racks in 2251 stores in 50 countries. How did this happen?

Aggressive target pricing, coupled with a unique business model focused on speed to market and reducing unnecessary costs.

Every day, more than 200 designers located at Zara headquarters in Spain collect information about the decisions made by customers in each of the chain's stores. When Zara decides to produce an item, an inhouse team of designers,

production managers, and logisticians establish its price and how many will be made. Unlike most fashion retailers

who focus only on their spring and fall collections, Zara changes its inventory every 15 days or so. They produce items

in small batches, which allows more than 60% of its garments to be manufactured in Spain and nearby countries in

a matter of days. This is critical for Zara, because all garments are shipped directly to stores from its headquarters,

meaning it does not use warehouses to store excess inventory. This means that Zara has much lower inventories than

its rivals, and therefore lower inventory costs and less need to discount unsold goods. On average, only 15–20% of

Zara items are marked down, compared to 45% for competitor H&M. When a Zara store needs more inventory of a

particular item, it notifies managers at headquarters and the process begins anew.

This model inspires customers to spend their money differently. In Zara, every purchase is an impulse buy; that

trendy leather jacket in the window is likely to be gone in a matter of days. As a result, Zara customers typically visit

stores four or five times more often than customers of more traditional fashion retailers.

Sources: Intedex SA, *2017 Annual Report* (Arteixo, Spain: Intedex SA, 2018); Girotra, K. and Netessine, S. (2012) 'Business model innovation is the gift that keeps on giving', *Harvard Business Review,* 5 December (https://hbr.org/2012/12/the-gift-that-keeps-giving-bus); Buck, T. (2014) 'Fashion: A better business model', *Financial Times,* 18 June (https://www.ft.com/content/a7008958-f2f3-11e3-a3f8-00144feabdc0);

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Summary

The following points are linked to the chapter's learning objectives.

1 Three major influences on pricing decisions are customers, competitors and costs.

2 Short-run pricing decisions focus on a period of a year or less and have no long-run implications. Long-run pricing

decisions focus on a product in a major market with a time horizon of longer than one year. The time horizon

appropriate to a decision on pricing dictates which costs are relevant.

3 One approach to pricing is to use a target price. Target price is the estimated price that potential customers are

willing to pay for a product (or service). A target operating profit per unit is subtracted from the target price to

determine the target cost per unit. The target cost per unit is the estimated long-run cost of a product (or service)

that when sold enables the firm to achieve the targeted profit. The challenge for the organisation is to make the

cost improvements necessary through value-engineering methods to achieve the target cost.

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4 Cost incurrence arises when resources are actually sacrificed or used up. Locked-in costs refer to costs that have

not yet been incurred but which, based on decisions that have already been made, will be incurred in the future.

5 The cost-plus approach to pricing chooses prospective prices by using a general formula that adds a mark-up to

a cost base. Many different costs (such as full product costs or manufacturing costs) can serve as the cost base in

applying the cost-plus formula. Prices are then modified on the basis of customers' reactions and competitors'

responses.

6 Life-cycle budgeting and life-cycle costing estimate, track and accumulate the costs (and revenues) attributable to

each product from its initial R&D to its final customer service and support in the marketplace. Life-cycle costing

offers three important benefits: (a) the full set of costs associated with each product become visible; (b) differences

among products in the percentage of their total costs incurred at early stages in the life cycle are highlighted; and

(c) interrelationships among value-chain business function costs are emphasised. Companies choose prices to

maximise the profits earned over a product's life cycle.

7 The revenues of customers purchasing the same product can differ due to differences in the quantity of units

purchased and discounts from list price.

8 Customer cost hierarchies highlight how some costs can be reliably assigned to individual customers while other

costs can be reliably assigned only to distribution channels or to corporate-wide efforts.

9 Customer profitability reports, shown in a cumulative form, often reveal that a small percentage of customers

contribute a large percentage of profits. It is important that companies devote sufficient resources to maintaining

and expanding relationships with these key contributors to profitability.

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CHAPTER 12

Assessment material

Review questions

12.1 What are the three major influences on pricing decisions?

12.2 Give two examples of pricing decisions with a short-run focus.

12.3 How is activity-based costing useful for pricing decisions?

12.4 What is a target cost per unit?

12.5 Give two examples each of a value-added cost and a non-value-added cost.

12.6 ‘It is not important for a firm to distinguish between cost incurrence and locked-in costs.’ Do you

agree? Explain.

12.7 Describe three alternative cost-plus methods.

12.8 Give two examples where the difference in the costs of two products or services is much smaller

than the difference in their prices.

12.9 Why is customer profitability analysis a vitally important topic to managers?

12.10 ‘A customer profitability profile highlights those customers that should be dropped to improve

profitability.’ Do you agree?

Exercises

Intermediate level

12.11 Relevant-cost approach to short-run pricing decisions (20–30 minutes)

Alexon SL is an electronics business with eight product lines. Profit data for one of the products

(XT-107) for the month just ended (June 2022) are as follows:

Sales, 200 000 units at average price of €100

€20 000 000

Variable costs

Direct materials at €35 per unit

€7 000 000

Direct manufacturing labour at €10 per unit

2 000 000

Variable manufacturing overhead at €5 per unit

1 000 000

Sales commissions at 15% of sales

3 000 000

Other variable costs at €5 per unit

1 000 000

Total variable costs

14 000 000

Contribution margin

6 000 000

Fixed costs

5 000 000

Operating profit

€1 000 000

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Xuclà Mecàniques Fluvià SA, an instruments company, has a problem with its preferred supplier

of XT-107 component products. This supplier has had a three-week strike and will not be able

to supply Xuclà 3000 units next month. Xuclà approaches the sales representative of Alexon SL,

Angela Zamora, about providing 3000 units of XT-107 at a price of €80 per unit. Zamora informs

the XT-107 product manager, Francisco García-Salve, that she would accept a flat commission

of €6000 rather than the usual 15% if this special order were accepted. Alexon has the capacity

to produce 300 000 units of XT-107 each month, but demand has not exceeded 200 000 units in

any month in the last year.

Required

1 If the 3000-unit order from Xuclà is accepted, what will be the effect on monthly operating

profit? (Assume the same cost structure as occurred in June 2022.)

2 Francisco ponders whether to accept the 3000-unit special order. He is afraid of the precedent

that might be set by cutting the price. He says, ‘The price is below our full cost of €95 per unit.

I think we should quote a full price, or Xuclà will expect favoured treatment again and again

if we continue to do business with them.’ Do you agree with Francisco? Explain.

12.12 Target prices, target costs, activity-based costing (25–30 minutes)

Pagnol-Carrelages SNC is a small distributor of marble tiles. Pagnol-Carrelages identifies its three

major activities and cost pools as ordering, receiving and storage, and shipping, and reports the

following details for 2022:

Quantity of

Cost per unit

Activity

cost driver

of cost driver

Cost driver

1

Placing and paying for

Number of orders

500

€50 per order

orders of marble tiles

2 Receiving and storage

Number of loads moved

4000

€30 per load

3

Shipping of marble tiles to Number of shipments

1500

€40 per shipment

retailers

Pagnol-Carrelages buys 250 000 marble tiles at an average cost of €3 per tile and sells them to

retailers at an average price of €4 per tile. Fixed costs are €40 000.

Required

1 Calculate Pagnol-Carrelages' operating profit for 2022.

2 For 2023, retailers are demanding a 5% discount off the 2022 price. Pagnol-Carrelages' suppli-

ers are only willing to give a 4% discount. Pagnol-Carrelages expects to sell the same quantity

of marble tiles in 2023 as it did in 2022. If all other costs and cost driver information remain

the same, what will Pagnol-Carrelages' operating profit be in 2023?

3 Suppose further that Pagnol-Carrelages decides to make changes in its ordering, and receiving

and storing practices. By placing long-term orders with its key suppliers, it expects to reduce

the number of orders to 200 and the cost per order to €25. By redesigning the layout of the

warehouse and reconfiguring the crates in which the marble tiles are moved, Pagnol-Carrelages

expects to reduce the number of loads moved to 3125 and the cost per load moved to €28.

Will Pagnol-Carrelages achieve its target operating profit of €0.30 per tile in 2023? Show your

calculations.

***12.13 Cost-plus and market-based pricing** (25 minutes)

Hospedeiras de Portugal Lda, a large labour contractor, supplies contract labour to building

construction companies. For 2022, Hospedeiras has budgeted to supply 80 000 hours of contract

labour. Its variable cost is €12 per hour and its fixed costs are €240 000. Manuel Girardi, the

general manager, has proposed a cost-plus approach for pricing labour at full cost plus 20%.

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Required

1 Calculate the price per hour that Hospedeiras should charge based on Manuel's proposal.

2 Mirella Restrepo, the marketing manager, has supplied the following information on demand

levels at different prices:

Price per hour

Demand (hours)

€16

120 000

17

100 000

18

80 000

19

70 000

20

60 000

Hospedeiras can meet any of these demand levels. Fixed costs will remain unchanged for all

the preceding demand levels. On the basis of this additional information, what price per hour

should Hospedeiras charge?

3 Comment on your answers to requirements 1 and 2. Why are they the same or not the same?

***12.14 Relevant-cost approach to pricing decisions** (30 minutes)

Østerbro AS cans peaches for sale to food distributors. All costs are classified as either man-

ufacturing or marketing. Østerbro prepares monthly budgets. The March 2022 budgeted

absorption-costing income statement is as follows:

Sales (1000 crates × DKK 100 a creat)

DKK 100 000

100%

Cost of goods sold

60 000

60

Gross profit

40 000

40

Marketing costs

30 000

30

Operating profit

DKK 10 000

10%

Normal mark-up percentage:

DKK 40 000 ÷ DKK 60 000 = 66.7% of absorption cost

Monthly costs are classified as fixed or variable (with respect to the cans produced for manufac-

turing costs and with respect to the cans sold for marketing costs):

Fixed

Variable

Manufacturing

DKK 20 000

DKK 40 000

Marketing

16 000

14 000

Østerbro has the capacity to can 1500 crates per month. The relevant range in which monthly

fixed manufacturing costs will be ‘fixed’ is from 500 to 1500 crates per month.

Required

1 Calculate the normal mark-up percentage based on total variable costs.

2 Assume that a new customer approaches Østerbro to buy 200 crates at DKK 55 per crate. The

customer does not require additional marketing effort except that additional manufacturing

costs of DKK 2000 (for special packaging) will be required. Østerbro believes that this is a

one-time-only special order because the customer is discontinuing business in six weeks' time.

Østerbro is reluctant to accept this 200-crate special order because the DKK 55 per crate price

is below the DKK 60 per crate absorption cost. Do you agree with this reasoning? Explain.

3 Assume that the new customer decides to remain in business. How would this longevity affect

your willingness to accept the DKK 55 per crate offer? Explain.

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12.15 Product costs, activity-based costing systems (20–25 minutes)

Combrai Informatique (CI) manufactures and sells computers and computer peripherals to sev-

eral nationwide retail chains. Marcel Proust is the manager of the printer division. Its two largest

selling printers are P-41 and P-63.

The manufacturing cost of each printer is calculated using CI's activity-based costing system.

CI has one direct-manufacturing cost category (direct materials) and the following five indirect-

manufacturing-cost pools:

Indirect manufacturing

cost pool

Allocation base

Allocation rate

1 Materials handling

Number of parts

€1.20 per part

2 Assembly management

Hours of assembly time

€40 per hour of assembly time

3 Machine insertion of parts Number of machine-inserted €0.70 per machine-inserted

parts

part

4 Manual insertion of parts

Number of manually inserted €2.10 per manually inserted

parts

part

5 Quality testing

Hours of quality testing time €25 per testing-hour

Product characteristics of P-41 and P-63 are as follows:

P-41

P-63

Direct material costs

€407.50

€292.10

Number of parts

85 parts

46 parts

Hours of assembly time

3.2 hours

1.9 hours

Number of machine-inserted parts

49 parts

31 parts

Number of manually inserted parts

36 parts

15 parts

Hours of quality testing

1.4 hours

1.1 hours

Required

What is the manufacturing cost of P-41? Of P-63?

12.16 Profit calculation (From ACCA Financial Information for Management, Part 1, June 2005)

(40 minutes)

Ella Ltd recently started to manufacture and sell product DG. The variable cost of product DG

is £4 per unit and the total weekly fixed costs are £18 000. The company has set the initial selling

price of product DG by adding a mark-up of 40% to its total unit cost. It has assumed that pro-

duction and sales will be 3000 units per week. The company holds no stocks of product DG.

Required

1 Calculate for product DG:

a the initial selling price per unit; and

b the resultant weekly profit.

The management accountant has established that a linear relationship between the unit selling

price (P in £) and the weekly demand (Q in units) for product DG is given by:

$P = 20 - 0.002Q$

The marginal revenue (MR in £ per unit) is related to weekly demand (Q in units) by the

equation:

$MR = 20 - 0.004Q$

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2 Calculate the selling price per unit for product DG that should be set in order to maximise

weekly profit.

3 Distinguish briefly between penetration and skimming pricing policies when launching a new

product.

Advanced level

***12.17 Life-cycle product costing, product emphasis** (30–40 minutes)

Decision Support Systems (DSS) is examining the profitability and pricing policies of its software

division. The DSS software division develops software packages for engineers. DSS has collected

data on three of its more recent packages:

● EE-46: package for electrical engineers

● ME-83: package for mechanical engineers

● IE-17: package for industrial engineers.

Summary details on each package over their two-year ‘cradle-to-grave’ product lives are as follows:

Number of units sold

Package

Selling price

Year 1

Year 2

EE-46

€250

2000

8000

ME-83

300

2000

3000

IE-17

200

5000

3000

Assume that no stock remains on hand at the end of year 2.

DSS is deciding which product lines to emphasise in its software division. In the past two years, the

profitability of this division has been mediocre. DSS is particularly concerned with the increase

in R&D costs in several of its divisions. An analyst at the software division pointed out that for

one of its most recent packages (IE-17), major efforts had been made to cut back R&D costs.

Last week Kari Pystynen, the software division manager, attended a seminar on product life-cycle

management. The topic of life-cycle reporting was discussed. Kari decides to use this approach in

her own division. She collects the following life-cycle revenue and cost information for the EE-46,

ME-83 and IE-17 packages:

EE-46

ME-83

IE-17

Year 1

Year 2

Year 1

Year 2

Year 1

Year 2

Revenues

€500 000 €2 000 000 €600 000

€900 000 €1 000 000

€600 000

Costs

R&D

700 000

0

450 000

0

240 000

0

Design of product

185 000

15 000

110 000

10 000

80 000

16 000

Manufacturing

75 000

225 000

105 000

105 000

143 000

65 000

Marketing

140 000

360 000

120 000

150 000

240 000

208 000

Distribution

15 000

60 000

24 000

36 000

60 000

36 000

Customer service

50 000

325 000

45 000

105 000

220 000

388 000

Required

1 How does a product life-cycle income statement differ from an income statement that is

calendar-based? What are the benefits of using a product life-cycle reporting format?

2 Present a product life-cycle income statement for each software package. Which package is the

most profitable, and which is the least profitable?

3 How do the three software packages differ in their cost structure (the percentage of total costs

in each cost category)?

12.18 Target cost, activity-based costing systems (continuation of Exercise 12.15) (50–60 minutes)

Assume all the information in Exercise 12.15. Marcel has just received some bad news. A foreign

competitor has introduced products very similar to P-41 and P-63. Given their announced selling

prices, he estimates the P-41 clone to have a manufacturing cost of approximately €680 and the

P-63 clone to have a manufacturing cost of approximately €390. He calls a meeting of product

designers and manufacturing personnel at the printer division. They all agree to have the €680

and €390 figures become target costs for redesigned versions of CI's P-41 and P-63, respectively.

Product designers examine alternative ways of designing printers with comparable performance

but lower cost. They come up with the following revised designs for P-41 and P-63 (termed P-41

REV and P-63 REV, respectively):

P-41 REV

P-63 REV

Direct material costs

€381.20

€263.10

Number of parts

71 parts

39 parts

Hours of assembly time

2.1 hours

1.6 hours

Number of machine-inserted parts

59 parts

29 parts

Number of manually inserted parts

12 parts

10 parts

Hours of quality testing

1.2 hours

0.9 hours

Required

1 What is a target cost per unit?

2 Using the activity-based costing system outlined in Exercise 12.15, calculate the manufacturing

costs of P-41 REV and P-63 REV. How do they compare with the €680 and €390 target costs

per unit?

3 Explain the differences between P-41 and P-41 REV and between P-63 and P-63 REV.

4 Assume now that Marcel has achieved major cost reductions in one of the activity areas. As

a consequence, the allocation rate in the assembly-management activity area will be reduced

from €40 to €28 per assembly-hour. How will this activity-area cost reduction affect the man-

ufacturing costs of P-41 REV and P-63 REV? Comment on the results.

12.19 Life-cycle product costing, activity-based costing (35–40 minutes)

Les Saturniens SA makes digital watches. Les Saturniens is preparing a product life-cycle budget

for a new watch, MX3. Development on the new watch with features such as a calculator and a

daily diary is to start shortly. Les Saturniens expects the watch to have a product life cycle of three

years. Estimates about MX3 are as follows:

Year 1

Year 2

Year 3

Units manufactured and sold

50 000

200 000

150 000

Price per watch

€45

€40

€35

R&D and design costs

€900 000

€100 000

–

Manufacturing

Variable cost per watch

€16

€15

€15

Variable cost per batch

€700

€600

€600

Watches per batch

400

500

500

Fixed costs

€600 000

€600 000

€600 000

Year 1

Year 2

Year 3

Marketing

Variable cost per watch

€3.60

€3.20

€2.80

Fixed costs

€400 000

€300 000

€300 000

Distribution

Variable cost per watch

€1

€1

€1

Variable cost per batch

€120

€120

€100

Watches per batch

200

160

120

Fixed costs

€240 000

€240 000

€240 000

Customer service costs per watch

€2

€1.50

€1.50

Ignore the time value of money in your answers.

Required

1 Calculate the budgeted life-cycle operating profit for the new watch.

2 What percentage of the budgeted product life-cycle costs will be incurred at the end of the

R&D and design stages?

3 An analysis reveals that 80% of the total product life-cycle costs of the new watch will be

locked in at the end of the R&D and design stages. What implications would this finding have

on managing MX3's costs?

4 Les Saturniens' Market Research Department estimates that reducing MX3's price by €3 each

year will increase sales by 10% each year. If sales increase by 10%, Les Saturniens plans to

increase manufacturing and distribution batch sizes by 10% as well. Assume that all variable

costs per watch, variable costs per batch and fixed costs will remain the same. Should Les

Saturniens reduce MX3's price by €3?

12.20 Customer profitability, service company (20–30 minutes)

Overloon BV is a repair-service company specialising in the rapid repair of photocopying

machines. Each of its 10 clients pays a fixed monthly service fee (based on the type of photocop-

ying machines owned by that client and the number of employees at that site). Overloon keeps

records of the time technicians spend at each client as well as the cost of the equipment used to

repair each photocopying machine. Overloon recently decided to calculate the profitability of

each customer. The following data (in thousands) pertain to May 2022:

Customer revenues

Customer costs

Hytop BV

€260

€182

Koninklijk Nederlands Meteorologisch Instituut

180

184

Hoogovens Scrap Processing

163

178

Borgh Pensioen Consultancy

322

225

Edah Supermarkten

235

308

Hogeschool Eindhoven

80

74

Koninklijk Instituut voor de Marine

174

100

Eindhovens Dagblad

76

108

Randmeer College

137

110

NRC Handelsblad

373

231

Required

1 Calculate the operating profit of each customer. Prepare exhibits for Overloon that are similar

to Exhibits 12.11 and 12.12. Comment on the results.

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Chapter 12 Pricing issues and customer profitability analysis

2 What options regarding individual customers should Overloon consider in light of your cus-

tomer profitability analysis in requirement 1?

3 What problems might Overloon encounter in accurately estimating the operating cost of each

customer?

12.21 Customer profitability, distribution (40 minutes)

Spring Distribution has decided to analyse the profitability of another five customers (see pages

373 of the text). It buys bottled water at €0.50 per bottle and sells to wholesale customers at a list

price of €0.60 per bottle. Data pertaining to five customers are:

Customer

P

Q

R

S

T

Bottles sold

50 000

210 000

1 460 000

764 000

94 000

List selling price

€0.60

€0.60

€0.60

€0.60

€0.60

Actual selling price

€0.60

€0.59

€0.55

€0.58

€0.54

Number of purchase orders

15

25

30

25

30

Number of sales visits

2

4

6

2

3

Number of deliveries

10

30

60

40

20

Kilometres travelled per delivery

14

4

3

8

40

Number of expedited deliveries

0

0

0

0

1

Its five activity areas and their cost drivers are:

Activity area

Cost driver and rate

Order taking

€100 per purchase order

Sales visits

€80 per sales visit

Delivery vehicles

€2 per delivery kilometre

travelled

Product handling

€0.02 per bottle sold

Expedited deliveries

€300 per expedited delivery

Required

1 Calculate the operating profit of each of the five customers now being examined (P, Q, R, S

and T). Comment on the results.

2 What insights are gained by reporting both the list selling price and the actual selling price for

each customer?

3 What factors should Spring Distribution consider in deciding whether to drop one or more of

customers P, Q, R, S or T?

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CHAPTER 13

Capital investment decisions

Organisations often make decisions whose consequences are felt over

many future years. Such decisions frequently involve large investments of

Learning objectives

money and have uncertain actual outcomes that have long-lasting effects

on the organisation. For example, Airbus, one of the largest global aircraft

After studying this chapter, you

manufacturers is making investments to produce the world's first zero

should be able to:

emission commercial aircraft. The company will do so by exploring different

●

Identify the five stages of capital

configurations and hydrogen technologies. The concept is referred to as

budgeting for a project

ZEROe for aircraft powered by hydrogen combustion through modified

gas turbine engines. Companies react to economic and technological

●

Understand the time value of

possibilities and gauging customer appetite for new product concepts.

money concept and opportunity

The President of Airbus Africa and the Middle East, Mikail Houari notes

costs

that the ‘market is expecting this from us. As a leader in the industry, we

●

Apply the net present value (NPV)

are responsible for driving the whole ecosystem into a sustainable value

method and the internal rate of

chain’ (Arab News, 2022). Sometimes companies with a project investment

return (IRR) method

causing losses may decide to invest more to attain profitability. For instance,

●

Understand the value of sensitivity

in February 2022, Airbus and the Canadian province of Quebec, Canada's

analysis in capital budgeting

aerospace hub, agreed a $1.2 bil ion investment deal to remain in the loss-

●

Identify relevant cash flows used

making A220 jet programme, expecting it to ultimately become profitable.

in discounting

Quebec would invest $325 bil ion with the balance coming from Airbus.

The latter would buy back Quebec's investment in 2030. The province had

●

Apply the payback method and

in 2015 already invested $1.2 bil ion into the venture intending a buyout

the accounting rate of return

in 2026. The Quebec Economy Minister Pierre Fitzgibbon defended the

(ARR) method

investment noting that the A220 programme showed sufficient promise

●

Assess capital budgeting project

to be profitable with a further four years added to the buyout as well as

management issues

generate key jobs for the province: ‘I'm very hopeful we're going to make

●

Identify the impact of tax and

money and recuperate the original investment’ (Lampert, 2022).

inflation on investment cash flows

Investment decisions can span many years. The investments and

●

Distinguish between the real rate

the outcomes from those investments are collectively referred to as

investment projects

of return and the nominal rate

or investment programmes. Poor long-term

of return and recognise risk in

investment decisions can affect the future stability of an organisation

investment decisions

because it is often difficult for firms to recover money tied up in bad investments. Sometimes, such investments can alter an enterprise’s strategy, brand and even culture. Thus, there may be qualitative effects from long-term investment decisions which may indirectly influence

financial performance and economic viability. Some managers desire a long-range planning tool or process to analyse and control investments with long-term consequences. This is the emphasis of this chapter.

Capital budgeting is the decision process relating to long-term capital investment programmes. Income determination and the planning and control of routine operations focus primarily on the current time period. Capital budgeting is a decision-making and control approach that focuses primarily on projects or programmes whose effects span multiple years.

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Stages of capital budgeting

Capital budgeting is the process of making long-run planning decisions for investments in projects.

In much of accounting, income is calculated on a period-by-period basis. In choosing investments, however, managers make a selection from among multiple projects, each of which may span several periods. Exhibit 13.1 illustrates these two different yet intersecting dimensions of

cost analysis: (1) horizontally across, as the *project dimension,* and (2) vertically upward, as the

accounting-period dimension. Each project is represented as a horizontal rectangle, starting and

ending at different times and stretching over time spans longer than one year. The vertical rectan-

gle for the 2022 accounting period, for example, represents the dimensions of income determi-

nation and routine annual planning and control that cut across all projects that are ongoing that

year. Accounting profit is of particular interest to the manager because bonuses are frequently

based on reported profit. Profit reported in an accounting period is also important to a company

because of its impact on the company's stock price. Excessive focus on short-run accounting

profit, however, can cause a company to forgo long-term profitability. Many managers balance

short-term accounting-period considerations with longer-term project considerations in their

decision process. Capital-budgeting decisions ought to take into account an organisation's objec-

tives as well as its strategies. By strategy, we refer to the manner in which an organisation attempts

to match its own capabilities with the opportunities in the marketplace to accomplish its overall

objectives (see Chapter 20).

To make capital budgeting decisions, managers have to decide on what to include in their

analysis. Managers will usually opt to analyse each project by considering all the life-span cash

flows from its initial investment through its termination. This process is analogous to life-cycle

budgeting and costing (see Chapter 12). For example, when Honda considers producing a new

model of automobile, it begins by estimating all potential revenues from the project as well as

any costs that will be incurred during its life cycle, which may be as long as 10 years. Only after

examining the potential costs and benefits across all of the business functions in the value chain,

from research and development (R&D) to customer service, across the entire life span of the new-

car project does Honda decide whether the new model is a wise investment.

Any system that focuses on the life span of a project ordinarily covers several years and thus

might consider the time value of money. The *time value of money* takes into account the fact that

a euro (or any other monetary unit) received today is worth more than a euro received tomorrow.

Exhibit 13.1

The project and time dimensions of capital budgeting

Project P

Project O

Project N

Project M

Project N

2016

2017

2018

2019

2020

2021

Accounting period

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The reason is that €1 received today can be invested to start earning a return of 5% per year (say)

so that it grows to €1.05 at the end of the year. The time value of money is the opportunity cost

(the return of €0.05 forgone) from not having the money today. Capital budgeting focuses on

projects that can be accounted for using life-cycle costing and that must be evaluated taking into

consideration the time value of money.

Managers use capital budgeting as a decision-making and a control tool. Like the decision

process that we have emphasised throughout this book, there are stages to the capital-budgeting

process. We break down the process into five steps:

Stage 1: Identification stage To distinguish which types of capital expenditure projects are neces-

sary to accomplish organisational objectives. Capital expenditure initiatives are closely tied to the

strategies of an organisation or an organisational subunit. So an organisation's strategy could be

to increase revenues by targeting new products, customers or markets. For example, Nike, makes

significant investments in product innovation, engineering and design, hoping to develop the next

generation of high-quality sportswear. Alternatively, a company might set out to reduce costs by

improving productivity and efficiency and so, for example, Dell might choose to outsource certain

components to lower-cost contract manufacturing facilities located overseas. Identifying which

types of capital investment projects to invest in will be affected by corporate strategy and usually

this is the responsibility of line management.

Stage 2: Information-acquisition stage To consider the predicted costs and predicted consequences

of alternative capital investments. These consequences can be quantitative and qualitative.

Information should be collected from all parts of the value chain to evaluate alternative projects.

Returning to the new-car example at Honda, in this stage, the firm's top managers ask the company's

marketing managers for potential revenue numbers, plant managers for assembly times, and suppliers

for prices and the availability of key components. Lower-level managers are asked to validate the

data provided and to explain the assumptions underlying them. The goal is to encourage open and

honest communication that results in accurate estimates so that the best investment decisions are

made. Some projects will be rejected at this stage. For example, suppose Honda learns that the car

cannot be built using existing plants. It may then opt to cancel the project altogether.

Stage 3: Make predictions Forecast all potential cash flows attributable to the alternative projects

at this stage. A new project generally requires a firm to make a substantial initial outlay of capital,

which is recouped over time through annual cash inflows and the disposal value of the project's

assets after it is terminated. Consequently, investing in a new project requires the firm to forecast

its cash flows several years into the future. BMW, for example, estimates yearly cash flows and sets

its investment budgets accordingly using a 12-year planning horizon. Because of the significant

uncertainty associated with these predictions, firms typically analyse a wide range of alternate cir-

cumstances. In the case of BMW, the marketing group is asked to estimate a band of possible sales

figures. Firms also attempt to ensure that estimates, especially for the later years of a project, are

grounded in realistic scenarios. It may be tempting to some managers to introduce biases into these

projections in order to drive the outcome of the capital-budgeting process to their preferred choice.

Stage 4: Choose among alternatives Here the managers determine which investment yields the

greatest benefit and the least cost to the organisation. Using the quantitative information obtained

in Stage 3, the firm uses any one of several capital-budgeting methodologies to determine which

project best meets organisational goals. While capital-budgeting calculations are typically lim-

ited to financial information, managers use their judgement and intuition to factor in qualitative

information and strategic considerations as well. For example, even if a proposed new line of

cars meets its financial targets on a standalone basis, Honda might decide not to pursue the line

if it is not aligned with the strategic imperatives of the company on matters such as brand posi-

tioning, industry leadership in safety and technology, and fuel consumption. Considerations of

environmental sustainability might also favour certain projects that currently appear unprofitable.

Managers may spend much time assessing the risks of a project, in terms of both the uncertainty

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of the estimated cash flows as well as the potential downside risks of the project (including to the

firm as a whole) if the worst-case scenario were to occur.

Stage 5: Implementation and control stage To put the project in motion and monitor perfor-

mance. As the project is implemented, the company must evaluate whether capital investments are

being made as scheduled and within the budget. As the project generates cash inflows, monitoring

and control may include a post-investment audit, in which the predictions made at the time the

project was selected are compared with the actual results. There are two elements. First there is

a need to obtain funding and make the investments selected in Stage 4. The sources of funding

include internally generated cash as well as equity and debt securities sold in capital markets.

Making capital investments is often an arduous task. If Honda opts to build a new car, it must

order steel, aluminium, paint, and so on. If some of the materials are unavailable, managers must

determine the economic feasibility of using alternative inputs. Then there is a need to track real-

ised cash flows, compare against estimated numbers, and revise plans if necessary. As the cash

outflows and inflows begin to accumulate, managers can verify whether the predictions made in

Stage 3 agree with the actual flows of cash from the project. It is equally important for a company

to abandon projects that are performing poorly relative to expectations. A natural bias for man-

agers is to escalate their commitment to a project they chose to implement for fear of revealing

they made an incorrect capital-budgeting decision. It is in the firm's and the managers' long-term

interest, however, to acknowledge a mistake when it is clear that the project is not financially

sustainable. In practice, the capital-budgeting process in most organisations entails these formal

stages but is also influenced by behavioural, organisational and political factors. Beyond the num-

bers, the ability of individual managers to 'sell' their own project to senior management is often

pivotal in the acceptance or rejection of projects. Senior managers themselves highlight emerging

concerns which affect investment strategies. Today, environmental and sustainability concerns

are in particular, being prioritised by corporate leaders. Sustainability concerns play a key role

in investment assessments by leading companies and institutions. For instance, the World Bank

uses a well-developed environmental and social policy framework to guide projects it supports

through its 'Investment Project Financing' platform. The policy reflects the World Bank's support

of borrowers in the development and implementation of projects that are environmentally and

socially sustainable, and to enhancing the capacity of borrowers' environmental and social frame-

works to assess and manage the environmental and social risks and impacts of projects (World

Bank, 2022). Enterprises that invest sustainably also attract investors who consider it important

to incorporate their values and concerns (such as environmental concerns) into their selection of

investments instead of simply considering the potential profitability, risks and outlay conditions

that investment opportunities may present. Socially responsible investors are concerned with Envi-

ronmental, Social, and (Corporate) Governance principles (often referred to as ESGs), encompass-

ing the three broad areas of concern. Consumer ideals impact the payoffs from investments and

with millennials and Generation Zers engaging with markets, ESG issues are rising in significance

for all stakeholders. A Morgan Stanley survey indicated that almost 90% of millennial investors

are interested in pursuing investments that more closely reflect the values they hold (CFI, 2022).

We use information from Hôpital-Nord to illustrate capital budgeting. Hôpital-Nord is a not-

for-profit organisation that is not subject to taxes. Tax considerations in capital budgeting are

introduced later in the chapter.

One of Hôpital-Nord's goals is to improve the productivity of its X-Ray Department. To

achieve this goal, the manager of Hôpital-Nord *identifies* a need to purchase a new state-of-

the-art X-ray machine to replace an existing machine. The *search* stage yields several alternative

models, but the hospital's technical staff focuses on one machine, XCAM8, as being particularly

suitable. They next begin to *acquire information* for a more detailed evaluation. Quantitative

financial information for the formal analysis is as follows:

1 Regardless of whether the new X-ray machine is acquired or not, revenue will not change.

Hôpital-Nord charges a fixed rate for a particular diagnosis, regardless of the number of

X-rays taken. The only relevant financial benefit in evaluating Hôpital-Nord's decision to

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purchase the X-ray machine is the cash savings in operating costs. The existing X-ray machine

can operate for another five years and will have a disposal value of zero at the end of five years.

The required net initial investment for the new machine is €379 100. The initial investment con-

sists of the cost of the new machine – €372 890 – plus an additional cash investment in working

capital (supplies and spare parts for the new machine) of €10 000 minus cash of €3790 obtained

from the disposal of the existing machine (€372 890 + €10 000 − €3790 = €379 100).

2 The manager expects the new machine to have a five-year useful life and a disposal value of

zero at the end of five years. The new machine is faster and easier to operate and has the ability

to X-ray a larger area. This will decrease labour costs and will reduce the average number of

X-rays taken per patient. The manager expects the investment to result in annual cash savings

of €100 000. These cash flows will generally occur throughout the year; however, to simplify

calculations, we assume that the cash flows occur at the end of each year. The cash inflows are

expected to come from cash savings in operating costs of €100 000 for each of the first four

years and €90 000 in year 5 plus recovery of working capital investment of €10 000 in year 5.

Managers at Hôpital-Nord also identify the following non-financial quantitative and qualitative

benefits of investing in the new X-ray equipment:

1 *The quality of X-rays.* Higher-quality X-rays will lead to improved diagnoses and better patient

treatment.

2 *The safety of technicians and patients.* The greater efficiency of the new machine would mean

that X-ray technicians and patients are less exposed to the possibly harmful effects of X-rays.

These benefits are not considered in the formal financial analysis.

In the *selection* stage, managers must decide whether Hôpital-Nord should purchase the new

X-ray machine. They start with financial information. This chapter discusses the following meth-

ods that they can use:

- discounted cash flow methods:
- net present value (NPV) method
- internal rate of return (IRR) method
- payback method
- accounting rate of return method.

Concepts in action

Capital budgeting for sustainability at Johnson & Johnson

Johnson and Johnson as the world's largest pharmaceuticals company, believes that 'When you're a global healthcare

company, you have to think big when it comes to your sustainability efforts.' In mid-2021, it executed three separate

virtual power purchase agreements in Europe to provide the equivalent of 100% renewable electricity for all J&J

properties across its three business sectors — pharmaceuticals, medical devices and consumer health — in France,

Germany, Spain, UK, Sweden, Switzerland, Greece and Italy.

Many large companies have established sustainability goals and targets, and it is becoming increasingly common

for these goals to address significant environmental challenges such as climate change. Improved sustainability per-

formance, however, is not always valued in internal capital-budgeting decisions. That's because it can be difficult to

accurately value the 'extra-financial' benefits of reduced exposure to energy price volatility and water risk, for example.

Healthcare company Johnson & Johnson found a unique way to create business value through its capital projects

while reducing its environmental impact. Johnson & Johnson established a special fund that increases its capital

budget to allow for greenhouse-gas-reduction projects like chiller optimisation and solar photovoltaic installations

that also reduce operating costs. The operating budget is then reduced to reflect expected savings. This helps the

company to invest in projects that have higher initial costs but lower operating costs, resulting in a net benefit.

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Each year, Johnson & Johnson's capital relief fund allocates at least $40 million to make capital investments in

greenhouse-gas-reduction projects that otherwise would not be able to compete for limited capital budget dollars on

traditional measures. These projects undergo an internal vetting process to ensure energy reductions, environmental

benefits, and cost savings for the company. A committee of energy, engineering and finance managers reviews the

technical, environmental and financial aspects of the proposed projects to ensure they are aligned with best practices

and standards, as well as meet the required after-tax internal rate of return of 15%.

The company has set a long-term target of 2045 with investment analyses tying into this time frame with the

following interim targets:

● By 2025, source 100% of electricity needs from renewable sources.

● By 2030, achieve carbon neutrality for operations, going beyond its Science-Based Target to reduce absolute Scope

1 and 2 emissions 60% from 2016 levels.

By 2030, reduce absolute upstream value chain (Scope 3) emissions 20% from 2016 levels.

Sources: Perera, A., Putt Del Pino, S. and Oliveria, B. (2013) 'Aligning profit and environmental sustainability: stories from industry', World Resources Institute working paper, February 2013 (https://www.wri.org/research/aligning-profit-and-environmental-sustainability); Sustain Case, 'How Johnson & Johnson promotes environmental and social responsibility throughout its supply chain' (https://sustaincase.com/case-study-how-johnson-johnson-

promotes-environmental-and-social-responsibility-throughout-its-supply-chain/); Mazur, N. F. (2022) '6 super sustainable Johnson & Johnson sites around the world' (www.jnj.com/innovation/6-super-sustainable-johnson-johnson-sites-around-the-world) (accessed 4 May 2022). Asad, A.

(2021) 'Johnson & Johnson Achieves 100% Renewable Electricity Across European Operations' (https://www.environmentalleader.com/2021/07/

johnson-johnson-achieves-100-renewable-electricity-across-european-operations/)

Discounted cash flow methods

Discounted cash flow (DCF) measures the expected future cash inflows and outflows of a project as

if they occurred now so that they can be compared in an appropriate way. The discounted cash

flow methods recognise that the use of money has an opportunity cost – return forgone. The

key feature of DCF methods is the time value of money, which means that a euro (or any other

monetary unit) received today is worth more than a euro received at any future time. Because

the DCF methods explicitly and routinely weight cash flows by the time value of money, they are

often considered as better methods to use for long-run decisions.

DCF focuses on *cash* inflows and outflows rather than on *operating profit* as used in conven-

tional accounting. Cash is invested now with the expectation of receiving a greater amount of

cash in the future. Injecting accrual concepts of accounting into DCF analysis should be avoided,

as it can create confusion. For example, depreciation is deducted as an accrual expense when cal-

culating operating profit under accounting. Depreciation is not deducted in DCF analysis because

depreciation expense entails no cash outflow.

There are two main DCF methods:

- net present value (NPV)
- internal rate of return (IRR).

NPV is calculated using the required rate of return (RRR), which is the minimum acceptable

rate of return on an investment. It is the return that the organisation could expect to receive else-

where for an investment of comparable risk. This rate is also called the discount rate, hurdle rate

or opportunity cost of capital because it typically must exceed the cost of funds as determined by

the return expected by those who provide the funds. When working with IRR, the RRR is used

as a point of comparison.

Assume that the required rate of return, or discount rate, for the Hôpital-Nord X-ray machine

project is 8%.

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Net present value method

The net present value (NPV) method calculates the expected net monetary gain or loss from a

project by discounting all expected future cash inflows and outflows to the present point in time,

using the required rate of return. Only projects with a positive net present value are acceptable.

Why? Because the return from these projects exceeds the cost of capital (the return available by

investing the capital elsewhere). Managers prefer projects with higher NPVs to projects with lower

NPVs, if all other things are equal. Using the NPV method entails the following steps:

Step 1: Sketch the relevant cash inflows and outflows The right-hand side of Exhibit 13.2 shows

how these cash flows are portrayed. Outflows appear in parentheses. The sketch helps the decision

maker to organise the data in a systematic way. Note that Exhibit 13.2 includes the outflow for the

new machine at year 0, the time of the acquisition. The NPV method focuses only on cash flows.

NPV analysis is indifferent to where the cash flows come from (operations, purchase or sale of

equipment, or investment or recovery of working capital) and to the financial accounting treat-

ments of individual cash-flow items (for example, depreciation costs on equipment purchases).

Exhibit 13.2

Net present value method: Hôpital-Nord

Net initial investment

€379 100

Useful life

5 years

Recurring cash flows

€100 000

Required rate of return

8%

Present

Total

value of €1

Sketch of relevant cash flows at end of year

present

discounted

value

at 8%

0

1

2

3

4

5

Approach 1:

Discounting each year's cash flow separately†

Net initial investment

€(379 100)

1.000

€(379 100)†

⌈ 92 600

0.926

€100 000

⌋ 85 700

0.857

€100 000

⌋

Recurring cash flows

⌇ 79 400

0.974

€100 000

⌋ 73 500

0.735

€100 000

⌋ ⌊ 68 100

0.681

€100 000

Net present value

€20 200

Approach 2: Using annuity table‡

Net initial investment

€(379 100)

1.000

€(379 100)

€

€

€

€

€

100 000 100 000 100 000 100 000 100 000

Recurring cash flows

399 300

3.993

Net present value

€20 200

† Parentheses denote relevant cash outflows throughout all exhibits in Chapter 13.

‡ The annuity-table value of 3.993 is the sum of the individual discount rates 0.926 + 0.857 + 0.794 + 0.735 + 0.681, subject to rounding error.

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Step 2: Choose the correct compound interest table In our example, we can discount each year's

cash flow separately using the present value table, or we can calculate the present value of an

annuity using the annuity table. If we use the present value table, we find the discount factors

for periods 1 to 5 under the 8% column. Approach 1 in Exhibit 13.2 presents the five discount

factors. Because the investment produces an annuity, a series of equal cash flows at equal intervals,

we may use the annuity table. We find the discount factor for five periods under the 8% column.

Approach 2 in Exhibit 13.2 shows that this discount factor is 3.993 (3.993 is the sum of the five

discount factors used in approach 1). To obtain the present-value figures, multiply the discount

factors by the appropriate cash amounts in the sketch in Exhibit 13.2.

Step 3: Sum the present-value figures to determine the net present value If the sum is zero or

positive, the NPV model indicates that the project should be accepted. That is, its expected rate

of return equals or exceeds the required rate of return. If the total is negative, the project is unde-

sirable. Its expected rate of return is below the required rate of return.

Exhibit 13.2 indicates an NPV of €20 200 at the required rate of return of 8%; the expected return

from the project exceeds the 8% required rate of return. Therefore, the project is desirable. The cash

flows from the project are adequate to (1) recover the net initial investment in the project, and (2)

earn a return greater than 8% on the investment tied up in the project from period to period. Had

the NPV been negative, the project would be undesirable on the basis of financial considerations.

Of course, the manager of the hospital must also weigh non-financial factors. Consider the

reduction in the average number of individual X-rays taken per patient with the new machine.

This reduction is a qualitative benefit of the new machine given the health risks to patients and

technicians. Other qualitative benefits of the new machine are the better diagnoses and treatments

that patients receive. Had the NPV been negative, the manager would need to judge whether the

non-financial benefits outweigh the negative NPV.

It is important that you do not proceed until you thoroughly understand Exhibit 13.2. Com-

pare approach 1 with approach 2 in Exhibit 13.2 to see how the annuity table merely aggregates

the present-value factors of the present value table. That is, the fundamental table is the present

value table; the annuity table reduces calculations when there is an annuity – a series of equal

cash flows at equal intervals.

Internal rate of return method

The internal rate of return (IRR) is the discount rate at which the present value of expected cash

inflows from a project equals the present value of expected cash outflows of the project. That is,

the IRR is the discount rate that makes NPV = €0. IRR is sometimes called the time-adjusted

rate of return. As in the NPV method, the sources of cash flows and the accounting treatment of

individual cash flows are irrelevant to the IRR calculations. We illustrate the computation of the

IRR using the X-ray machine project of Hôpital-Nord. Exhibit 13.3 presents the cash flows and

shows the calculation of the NPV using a 10% discount rate. At a 10% discount rate, the NPV

of the project is zero. Therefore, the IRR for the project is 10%.

How do we determine the 10% discount rate that yields NPV = €0? In most cases, analysts

solving capital-budgeting problems have a calculator or computer programmed to provide the

internal rate of return. Without a calculator or computer program, a trial-and-error approach

can provide the answer.

Step 1 Try a discount rate and calculate the NPV of the project using that discount rate.

Step 2 If the NPV is less than zero, try a lower discount rate. (A lower discount rate will increase

the NPV; remember, we are trying to find a discount rate for which NPV = €0. (If the NPV is

greater than zero, try a higher discount rate to lower the NPV. Keep adjusting the discount rate

until NPV = €0. In the Hôpital-Nord example, a discount rate of 8% yields NPV of + €20 200

(see Exhibit 13.2). A discount rate of 12% yields NPV of −€18 600 (3.605, the present-value

annuity factor from the annuity table × €100 000 − €379 100). Therefore, the discount rate that

makes NPV = €0 must lie between 8% and 12%. We happen to try 10% and get NPV = €0.

Hence, the IRR is 10%.

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Exhibit 13.3

Internal rate of return method: Hôpital-Nord

Net initial investment

€379 100

Useful life

5 years

Recurring cash flows

€100 000

Required rate of return

10%*

Present

Total

value of €1

Sketch of relevant cash flows at end of year

present discounted

value

at 10%

0

1

2

3

4

5

Approach 1: Discounting each year's cash flow separately†

Net initial investment

€(379 100)

1.000 €(379 100)

90 900

0.909

€100 000

82 600

0.826

€100 000

Recurring cash flows

75 100

0.751

€100 000

68 300

0.683

€100 000

62 100

0.621

€100 000

Net present value||

€0§

Approach 2: Using annuity table||

Net initial investment

€(379 100)

1.000 €(379 100)

€

€

€

€

100 000 100 000 100 000 100 000 100 000

Recurring cash flows

379 100

3.791

Net present value

€0

* The internal rate of return is computed by methods explained in the text.

† Present values from present value table.

‡ The zero difference (subject to rounding error) proves that the internal rate of return is 10%.

§ Sum is €(100) due to rounding errors. We round to €0.

| Annuity present values from annuity table. The annuity-table value of 3.791 is the sum of the individual discount rates of 0.909 + 0.826 + 0.751 + 0.683 + 0.621, subject to rounding error.

The step-by-step computations of an internal rate of return are easier when the cash inflows

are equal, as in our example. Information from Exhibit 13.3 can be expressed in the following

equation:

€379 100 = Present value of annuity of €100 000 at %

x

for 5 years

Or, using the annuity table, what factor *F* will satisfy the following equation?

€379 100 = €100 000 *F*

F = 3.791

On the five-period line of the annuity table, find the percentage column that is closest to

3.791. It is exactly 10%. If the factor *F* falls between the factors in two columns, straight-line

interpolation is used to approximate the IRR. The formula for straight-line interpolation is:

LR

LN

+

(HR − LR)

LN − HN

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where LR is the required rate of return of the low estimate, HR is the rate of return of the high

estimate, LN is the NPV of cash inflow of the low estimate and HN is the NPV of cash inflow of

the high estimate (see Exercises 13.18 and 13.22 for examples). The use of computer spreadsheets

can facilitate this exercise.

A project is accepted only if the internal rate of return exceeds the required rate of return (the

opportunity cost of capital). In the Hôpital-Nord example, the X-ray machine has an IRR of

10%, which is greater than the required rate of return of 8%. On the basis of financial factors,

Hôpital-Nord should invest in the new machine. If the IRR exceeds the RRR, then the project has

a positive NPV when project cash flows are discounted at the RRR. If the IRR equals the RRR,

NPV = €0. If the IRR is less than the RRR, NPV is negative. Obviously, managers prefer pro-

jects with higher IRRs to projects with lower IRRs, if all other things are equal. The IRR of 10%

means that the cash inflows from the project are adequate to (1) recover the net initial investment

in the project, and (2) earn a return of exactly 10% on investment tied up in the project over its

useful life.

Comparison of NPV and IRR methods

This text emphasises the NPV method, which has the important advantage that the end result of

the computations is euros, not a percentage. We can therefore add the NPVs of individual inde-

pendent projects to estimate the effect of accepting a combination of projects. In contrast, the

IRRs of individual projects cannot be added or averaged to derive the IRR of the combination

of projects.

A second advantage of the NPV method is that we can use it in situations where the required

rate of return varies over the life of the project. For example, suppose in the X-ray machine

example, Hôpital-Nord has a required rate of return of 8% in years 1, 2 and 3 and 12% in years 4

and 5. The total present value of the cash inflows is as follows:

Required rate of

Present value of €1

Total present value

Year

Cash inflows

return

discounted at required rate

of cash inflows

1

€100 000

8%

0.926

€92 600

2

100 000

8

0.857

85 700

3

100 000

8

0.794

79 400

4

100 000

12

0.636

63 600

5

100 000

12

0.567

56 700

€378 000

Given the net initial investment of €379 100, NPV calculations indicate that the project is unat-

tractive: it has a negative NPV of − €1100 (€378 000 − €379 100). However, it is not possible

to use the IRR method to infer that the project should be rejected. The existence of different

required rates of return in different years (8% for years 1, 2 and 3 versus 12% for years 4 and 5)

means there is not a single RRR that the IRR (a single figure) must exceed for the project to be

acceptable.

Finally, in some situations, the IRR method is prone to indicating erroneous decisions. This

can occur when mutually exclusive projects with unequal lives or unequal levels of initial invest-

ment are being compared to one another. The reason is that the IRR method implicitly assumes

that project cash flows can be reinvested at the *project's* rate of return. The NPV method, in

contrast, accurately assumes that project cash flows can only be reinvested at the *company's*

required rate of return. Despite its limitations, the IRR method is widely used. Why? Probably

because managers find the percentage return computed under the IRR method easy to under-

stand and compare.

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Sensitivity analysis

To highlight the basic differences between the NPV and IRR methods, we have assumed that the

anticipated values of cash flows will occur for certain. Obviously, managers know that their pre-

dictions are imperfect and thus uncertain. To examine how a result will change if the predicted

financial outcomes are not achieved or if an underlying assumption changes, managers can use

sensitivity analysis.

Sensitivity analysis can take various forms. For example, suppose Hôpital-Nord management

believes forecast savings are uncertain and difficult to predict. Management could then ask:

What is the minimum annual cash savings that will cause us to invest in the new X-ray machine

(that is, for NPV = €0)? For the data in Exhibit 13.2, let ACI = annual cash inflows and let

NPV = €0. The net initial investment is €379 100, and the present-value factor at the 8% required

rate of return for a five-year annuity of €1 is 3.993. Then,

NPV = €0

3.993 × ACI − €379 100 = €0

3.993 × ACI = €379 100

ACI = €94 941

Thus, at the discount rate of 8%, annual cash inflows can decrease to €94 941 (a decline of

€100 000 − €94 941 = €5059) before NPV falls below zero. If management believes it can attain

annual cash savings of at least €94 941, it could justify investing in the new X-ray machine on

financial grounds alone.

Exhibit 13.4 shows how the net present value of the X-ray machine project is affected by vari-

ations in (1) the annual cash inflows, and (2) the required rate of return. NPVs can also vary with

the useful life of a project. Sensitivity analysis helps a manager focus on those decisions that are

most sensitive, and it eases the manager's mind about those decisions that are not so sensitive. For

the X-ray machine project, Exhibit 13.4 shows that variations in either the annual cash inflows or

the required rate of return have sizeable effects on NPV.

The use of probabilities for different possible cash-flow outcomes can readily be integrated

within sensitivity analyses (see Chapter 8 appendix for a discussion of decision analysis under

conditions of uncertainty and the calculation of expected values). A real options approach to

investment analysis may also be adopted whereby cash flows are discounted after considering

such options as waiting before investing, or abandoning the investment temporarily, depending

on certain outcomes, or even integrating investment possibilities in the future that are con-

tingent on different present-day investment options (Bhimani et al., 2007; see also Dixit and

Pindyck, 1994).

Exhibit 13.4

Net present value calculations for Hôpital-Nord under different assumptions of annual cash inflows and required rates of return

Annual cash inflows*

Required rate

of return

€80 000

€90 000

€100 000

€110 000

€120 000

6%

€(42 140)

€(22)

€42 100

€84 220

€126 340

8%

(59 660)

(19 730)

20 200

60 130

100 060

10%

(75 820)

(37 910)

0

37 910

75 820

* All entries in cells assume a useful project life of five years.

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Relevant cash flows in discounted cash flow analysis

The key point of discounted cash flow (DCF) methods is to focus exclusively on differences in

expected future cash flows that result from implementing a project. All cash flows are treated the

same, whether they arise from operations, purchase or sale of equipment, or investment in or

recovery of working capital. The opportunity cost and the time value of money are tied to the

cash flowing in or out of the organisation, not to the source of the cash.

One of the biggest challenges in DCF analysis is determining those cash flows that are relevant

to making the decision. Relevant cash flows are expected future cash flows that differ among the

alternatives. At Hôpital-Nord, the alternatives are either to continue to use the old X-ray machine

or to replace it with the new machine. The relevant cash flows are the *differences* in cash flows

between continuing to use the old machine and purchasing the new one. When reading this sec-

tion, focus on identifying future expected cash flows of each alternative and differences in cash

flows between alternatives.

Capital investment projects (for example, purchasing a new machine) typically have five major

categories of cash flows: (1) initial investment in machine and working capital, (2) cash flow from

current disposal of the old machine, (3) cash flows from operations, (4) cash flow from terminal

disposal of machine and recovery of working capital, and (5) income tax impacts on cash flows.

We discuss the first four categories here, using Hôpital-Nord's purchase decision of the X-ray

machine as an illustration. Income tax impacts are described later in the chapter.

1 **Initial investment.** Two components of investment cash flows are (a) the cash outflow to pur-

chase the machine, and (b) the working-capital cash outflows.

a *Initial machine investment.* These outflows, made for purchasing plant, equipment and

machines, occur in the early periods of the project's life and include cash outflows for trans-

porting and installing the item. In the Hôpital-Nord example, the €372 890 cost (including

transportation and installation costs) of the X-ray machine is an outflow in year 0. These

cash flows are relevant to the capital-budgeting decision because they will be incurred only

if Hôpital-Nord decides to purchase the new machine.

b *Initial working-capital investment.* Investments in plant, equipment and machines and in the

sales promotions for product lines are invariably accompanied by incremental investments in

working capital. These investments take the form of current assets, such as receivables and

stocks (supplies and spare parts for the new machine in the Hôpital-Nord example), minus

current liabilities, such as creditors. Working-capital investments are similar to machine

investments. In each case, available cash is tied up.

The Hôpital-Nord example assumes a €10 000 incremental investment in working capital

(supplies and spare parts stock) if the new machine is acquired. The incremental working-

capital investment is the difference between the working capital required to operate the new

machine (say, €15 000) and the working capital required to operate the old machine (say,

€5000). The €10 000 additional investment in working capital is a cash outflow in year 0.

2 **Current disposal price of old machine.** Any cash received from disposal of the old machine is

a relevant cash inflow (in year 0) because it is an expected future cash flow that differs between

the alternatives of investing and not investing in the new project. In some situations the termi-

nal disposal value can be critical to projects. If Hôpital-Nord invests in the new X-ray machine,

it will be able to dispose of its old machine for €3790. These proceeds are included as cash

inflow in year 0.

Recall from Chapter 10 that the book value (original cost minus total depreciation) of the

old equipment is irrelevant. It is a past cost. Nothing can change what has already been spent

or what has already happened.

The net initial investment for the new X-ray machine, €379 100, is the initial machine

investment plus the initial working-capital investment minus current disposal value of the old

machine: €372 890 + €10 000 − €3790 = €379 100.

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3 **Annual cash flow from operations.** This category includes the difference between each year's

cash flow from operations under the alternatives. Organisations make capital investments to

generate cash inflows in the future. These inflows may result from producing and selling addi-

tional goods or services, or, as in the Hôpital-Nord example, from savings in operating cash

costs. Annual cash flow from operations can be net outflows in some periods. For example, oil

production may require large expenditures every five years (say) to improve oil extraction rates.

Focus on operating cash flows, not on accrued revenues and costs.

To underscore this point, consider the following additional facts about the Hôpital-Nord

X-ray machine example:

● Total X-Ray Department overhead costs will not change whether the new machine is pur-

chased or the old machine is kept. The X-Ray Department overhead costs are allocated to

individual X-ray machines – Hôpital-Nord has several – on the basis of the labour costs

for operating each machine. Because the new X-ray machine will have lower labour costs,

overhead allocated to it will be €30 000 less than the amount allocated to the machine it is

replacing.

● Depreciation on the new X-ray machine using the straight-line method is €74 578 [(original

cost, €372 890 – expected terminal disposal value, €0) ÷ useful life, 5 years].

The savings in operating cash flows (labour and materials) of €100 000 in each of the first

four years and €90 000 in the fifth year are clearly relevant because they are expected future

cash flows that will differ between the alternatives of investing and not investing in the new

machine. But what about the decrease in allocated overhead costs of €30 000? What about

depreciation of €74 578?

a *Overhead costs.* The key question is: Do total overhead cash flows decrease as a result of

acquiring the new machine? In our example, they do not. Total X-Ray Department overhead

costs remain the same whether or not the new machine is acquired. Only the overhead allo-

cated to individual machines changes. The overhead costs allocated to the new machine are

€30 000 less. This €30 000 will be allocated to *other* machines in the department. No cash

flow savings in total overhead occur. Therefore, the €30 000 should not be included as part

of annual cash savings from operations.

b *Depreciation.* Ignoring possible income tax considerations (which differ from country to

country), depreciation is irrelevant. It is a non-cash allocation of costs whereas DCF is

based on inflows and outflows of cash. In DCF methods, the initial cost of equipment is

regarded as a *lump-sum* outflow of cash at year 0. Deducting depreciation from operating

cash inflows would be counting the *lump-sum* amount twice.

4 **Terminal disposal of investment.** The disposal of the investment at the date of termination of

a project generally increases cash inflow in the year of disposal. Errors in forecasting the ter-

minal disposal value are seldom critical on long-duration projects because the present value of

amounts to be received in the distant future is usually small. Two components of the terminal

disposal value of an investment are (a) the terminal disposal value of the machine, and (b) the

recovery of working capital.

a *Terminal disposal value of machine.* At the end of the useful life of the project, the initial

machine investment may not be recovered at all, or it may be only partially recovered in the

amount of the terminal disposal value.

The relevant cash inflow is the difference in expected terminal disposal values at the end

of five years under the two alternatives – the terminal disposal value of the new machine

(zero in the case of Hôpital-Nord) minus the terminal disposal value of the old machine

(also zero in the Hôpital-Nord example).

b *Recovery of working capital.* The initial investment in working capital is usually fully

recouped when the project is terminated. At that time, stocks and receivables necessary to

support the project are no longer needed. The relevant cash inflow is the difference in the

expected working capital recovered under the two alternatives. If the new X-ray machine is

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purchased, Hôpital-Nord will recover €15 000 of working capital in year 5. If the new

machine is not acquired, Hôpital-Nord will recover €5000 of working capital in year 5, at

the end of the useful life of the old machine. The relevant cash inflow in year 5 if Hôpital-

Nord invests in the new machine is €10 000 (€15 000 − €5000).

Some capital investments *reduce* working capital. Assume that an Internet of Things (IoT)

project with a seven-year life will reduce stocks and hence working capital by €20 million from,

say, €50 million to €30 million. This reduction will be represented as a €20 million cash inflow

for the project at year 0. At the end of seven years, the recovery of working capital will show a

relevant cash *outflow* of €20 million. Why? Because the company recovers only €30 million of

working capital with the IoT project rather than the €50 million of working capital it would have

recovered had it not opted for IoT.

Exhibit 13.5 presents the relevant cash inflows and outflows for Hôpital-Nord's decision to

purchase the new machine as described in items 1 to 4 in the above list. The total relevant cash

flows for each year are the same as the relevant cash flows used in Exhibits 13.2 and 13.3 to illus-

trate the NPV and IRR methods.

Payback method

Uniform cash flows

We now consider a third method for analysing the financial aspects of projects. The payback

method measures the time it will take to recoup, in the form of net cash inflows, the net initial

investment in a project. Like NPV and IRR, the payback method does not distinguish the sources

of cash inflows (operations, disposal of equipment or recovery of working capital). In the

Hôpital-Nord example, the X-ray machine costs €379 100, has a five-year expected useful life,

and generates a €100 000 uniform cash inflow each year. The payback calculations are as follows:

Payback =

Net initial investment

Uniform increase in annual cash flows

= €379 100 = 3.791 years

€100 000

Exhibit 13.5

Relevant cash inflows and outflows for Hôpital-Nord

Sketch of relevant cash flows at end of year

0

1

2

3

4

5

1 a Initial machine investment

€(372 890)

b Initial working-capital investment

(10 000)

2 Current disposal price of old machine

3790

Net initial investment

(379 100)

3 Recurring operating cash flows

€100 000

€100 000

€100 000

€100 000

€100 000

4 a Terminal disposal value of machine

0

b Recovery of working capital

10 000

Total relevant cash inflows and outflows

as shown in Exhibits 13.2 and 13.3

€(379 100)

€100 000

€100 000

€100 000

€100 000

€100 000

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Payback method

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Cash savings from the new X-ray machine occur *throughout* the year, but for simplicity in

calculating NPV and IRR, we assume they occur at the *end* of each year. A literal interpretation

of this assumption would imply a payback of four years because Hôpital-Nord will recover its

investment only when cash inflows occur at the end of the fourth year. The calculations shown in

this chapter, however, better approximate Hôpital-Nord's payback on the basis of uniform cash

flows throughout the year.

Under the payback method, organisations often choose a cutoff period for a project. The

greater the risks of a project, the smaller the cutoff period. Why? Because, faced with higher

risks, managers would like to recover the investments they have made more quickly. For example,

Hualtenbanken Hydro uses a payback period of 3–4 years for investment decisions at its Ormen

Lange oil refinery. Projects with a payback period less than the cutoff period are acceptable.

Those with a payback period greater than the cutoff period are rejected. If Hôpital-Nord's cutoff

period under the payback method is three years, Hôpital-Nord will reject the new machine. If

Hôpital-Nord uses a cutoff period of four years, Hôpital-Nord will consider the new machine

to be acceptable.

The major strength of the payback method is that it is easy to understand. Like the DCF

methods described previously, the payback method is not affected by accounting conventions

such as depreciation. Advocates of the payback method argue that it is a handy measure when (1)

estimates of profitability are not crucial and preliminary screening of many proposals is necessary,

and (2) the predicted cash flows in later years of the project are highly uncertain.

Two major weaknesses of the payback method are (1) it neglects the time value of money, and

(2) it neglects to consider project cash flows after the net initial investment is recovered. Consider

an alternative to the €379 100 X-ray machine mentioned earlier. Assume that another X-ray

machine, with a three-year useful life and zero terminal disposal value, requires only a €300 000

net initial investment and will also result in cash inflows of €100 000 per year. First, compare the

two payback periods:

Payback period for machine 1

€379 100

=

= 3.8 years

€100 000

Payback period for machine 2

€300 000

=

= 3.0 years

€100 000

The payback criterion would favour buying the €300 000 machine, because it has a shorter pay-

back. In fact, if the cutoff period is three years, then Hôpital-Nord would not acquire machine

1 because it fails to meet the payback criterion. Consider next the NPV of the two investment

options using Hôpital-Nord's 8% required rate of return for the X-ray machine investment. At a

discount rate of 8%, the NPV of machine 2 is −€42 300 (2.577, the present value annuity factor

for 3 years at 8% from the annuity table €100 000 = €257 700 − the net initial investment

of €300 000). Machine 1, as we know, has a positive NPV of €20 200 (from Exhibit 13.2). The

NPV criterion suggests that Hôpital-Nord should acquire machine 1. Machine 2, with a negative

NPV, would fail to meet the NPV criterion. The payback method gives a different answer from

the NPV method because the payback method (1) does not consider cash flows after the payback

period, and (2) does not discount cash flows.

There are situations where payback calculations suggest indifference between two projects.

For instance, if Project A yields €10 000 in year 1 and €90 000 in year 6, and Project B yields

€90 000 in year 1 and €10 000 in year 6, the two projects would have identical payback periods.

The NPV rule would naturally point to Project B as the preferred option. An added problem

with the payback method is that choosing too short a cutoff period for project acceptance may

promote the selection of only short-lived projects. The organisation will tend to reject long-term,

positive-NPV projects.

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Non-uniform cash flows

The payback formula presented above is designed for uniform annual cash inflows. When annual

cash inflows are not uniform, the payback computation takes a cumulative form. The years' net

cash inflows are totalled until the amount of the net initial investment has been recovered. Assume

that the solicitors' firm Slaughter and Ogilvy is considering the purchase of a €150 000 cloud

video-conferencing facility that will enable its solicitors and clients to interact in a conference

format without physically travelling. This facility is expected to produce a total cash saving of

€380 000 over the next five years (primarily due to a reduction in travel costs and more effective

use of senior staff time). The cash savings occur evenly throughout each year but non-uniformly

across five years. Payback occurs during the third year:

	Cumulative
Net initial investment yet to	

Year

Cash savings

cash savings

be recovered at end of year

0

–

–

€150 000

1

€50 000

€50 000

100 000

2

60 000

110 000

40 000

3

80 000

190 000

–

4

90 000

280 000

–

5

100 000

380 000

–

Straight-line interpolation within the third year reveals that the final €40 000 needed to recover

the €150 000 investment (that is, €150 000 − €110 000 recovered by the end of year 2) will be

achieved halfway through year 3 (in which €80 000 of cash savings occur):

Payback 2 years

€40 000

+

× 1 years = 2.5 years

(

)

€80 000

The cloud video-conferencing example has a single cash outflow of €150 000 at year 0. Where a

project has multiple cash outflows occurring at different points in time, these outflows are added

to derive a total cash outflow figure for the project. No adjustment is made for the time value of

money when adding these cash outflows in computing the payback period.

Accounting rate of return method

We now consider a fourth method for analysing the financial aspects of capital-budgeting projects.

The accounting rate of return (ARR) is an accounting measure of income (based on accrual income)

divided by an accounting measure of investment. It is also called the *return on investment (ROI)*.

We illustrate ARR for the Hôpital-Nord example using the project's net initial investment as the

denominator.

Increase in expected average annual operating profit

ARR =

Net initial investment

If Hôpital-Nord purchases the new X-ray machine, the increase in expected average annual

savings in operating costs will be €98 000: this amount is the total operating savings of €490 000

(€100 000 for 4 years and €90 000 in year 5) ÷ 5. The new machine has a zero terminal disposal

value. Straight-line depreciation on the new machine is €372 890 ÷ 5 = €74 578. The net initial

investment is €379 100. The accounting rate of return is equal to:

ARR

€98 000

€74 578

€23 422

=

–

=

= 6.18%

€379 100

€379 100

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The ARR of 6.18% indicates the rate at which a euro of investment generates operating profit.

Projects whose ARR exceeds an accounting return required for the project are considered desirable.

Managers using this method prefer projects with higher, rather than lower, ARR, if all other

things are equal.

The ARR method is similar in spirit to the IRR method – both methods calculate a rate-

of-return percentage. Whereas the ARR computation calculates return using operating profit

numbers after considering accruals, the IRR method calculates return on the basis of cash flows

and the time value of money. For capital-budgeting decisions, the IRR method is conceptually

superior to the ARR method in terms of financial theory and financial decision making.

The ARR computations are simple and easy to understand and use routinely maintained

accounting numbers. Unlike the payback method, the ARR method considers profitability. Unlike

the NPV and IRR methods, however, the ARR focuses on operating profit effects and hence con-

siders accruals. It does not track cash flows and ignores the time value of money. Critics cite these

arguments as major drawbacks of the ARR computations.

Managing the project

This section discusses stage 6 of capital budgeting, which deals with implementation and control.

Two different aspects of management control are discussed: management control of the invest-

ment activity itself and management control of the project as a whole.

Management control of the investment activity

Some initial investments such as purchasing an X-ray or a video-conferencing facility are relatively

easy to implement. Other initial investments such as building retail centres or new manufacturing

plants are more complex and take more time. In the latter case, monitoring and controlling the

investment schedules and budgets is critical to the success of the overall project.

Management control of the project: post-investment audit

A post-investment audit compares the predictions of investment costs and outcomes made at the

time a project was selected to the actual results. It provides management with feedback about their

performance. Suppose, for example, that actual outcomes (operating cash savings from the new

X-ray machine in the Hôpital-Nord example) are much lower than predicted outcomes. Manage-

ment must then investigate whether this occurred because the original estimates were too optimistic

or because there were problems in implementing the project. Both types of problem are a concern.

Optimistic estimates are a concern because they may result in the acceptance of a project

that would otherwise have been rejected. To discourage optimistic estimates, some companies

in the West maintain records comparing actual performance to the estimates made by individual

managers when seeking approval for capital investments. These companies believe that post-

investment audits discourage managers from making unrealistic forecasts. Problems in

implementing a project can be a concern because the returns from the project will not meet

expectations. Post-investment audits can point to areas requiring corrective action.

Care should be exercised when performing a post-investment audit. It should be done only after

project outcomes have stabilised. Doing the audit early may give a misleading picture. Obtain-

ing actual data to compare against estimates is often not easy. For example, actual labour cost

savings from the new X-ray machine may not be comparable to the estimated savings because

the actual number and types of X-ray taken may be different from the quantities assumed during

the capital-budgeting process. Other benefits, such as the impact on patient treatment, may be

difficult to quantify.

We next examine how managers analyse income taxes and changing prices in capital budgeting.

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Income tax factors

The importance of income taxes

Income taxes often have a large influence on investment decisions. For example, income taxes can

sizably reduce the net cash inflows from individual projects and so change their relative desirabil-

ity. Decisions to locate plants in certain countries such as Ireland or Jersey are often motivated by

tax incentive reasons. The benefits of lower taxes sometimes outweigh lower project operating

costs.

Treatment of depreciation for tax purposes

Tax rules regarding income measurement are sometimes the same as the generally accepted

accounting principles used for preparing financial statements. But, in most countries, there are

tax rules, such as those pertaining to depreciation, which differ from those suitable for preparing

financial accounts. Income tax laws frequently allow taxpayers to use shorter useful lives for

depreciation.

We emphasise income tax provisions affecting depreciation. Tax laws for depreciation deduc-

tions in many countries typically cover the amount allowable for depreciation, the time period

over which the asset is to be depreciated, and the pattern of allowable depreciation.

Under such circumstances, tax can be an important consideration in assessing the financial

value of capital investment projects. In computing tax it is necessary first to calculate taxable

profit as distinct from the reported profit in external financial accounts. The amount of tax pay-

able is based on this figure at the prevailing statutory level.

Under most tax regimes, the depreciation used by financial accountants in calculating the profit

figure is not regarded as an allowable expense. Instead, an alternative schedule of tax allowances

is used which provides a depreciation framework valid for tax calculation only. In the UK these

tax allowances are referred to as capital allowances. For instance, most plant and equipment in

the UK qualifies for ‘writing-down allowances’. This means that each year, for example, 25% of

the written-down value of an asset can be claimed as tax depreciation. Thus, for an asset costing

€5000, we should have the following:

Written-down value

Written-down value

Year

(opening)

25% allowance

(closing)

0

5000.00

1250.00

3750.00

1

3750.00

937.50

2812.50

2

2812.50

703.13

2109.38

3

2109.38

527.34

1582.03

4

1582.03

395.51

1186.52

The allowance continues indefinitely. Sometimes, when an asset is disposed of, the remaining

written-down value may be claimed as an allowance. Other less generous allowances apply to

certain assets.

We now consider the tax paid by a company which uses the asset to generate net revenues

(before depreciation) of €1500 per year. For simplicity, we assume a corporate tax rate of 40%.

In year 0, instead of assessing tax on €1500, the taxable profit is €250(= €1500 − €1250), i.e.

the tax is €100 instead of €600. (Note that if the accountant applies 10% straight-line depreciation

(SL), in which an equal amount of depreciation is taken each year, then reported profits will be

€1000.) Similar calculations apply in subsequent years. The timing of tax payments can also be

a relevant factor. In most countries, tax payments generally take place one year after the end of

a company's accounting year.

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Capital budgeting and inflation

Capital budgeting and inflation

Inflation can be defined as the decline in the general purchasing power of the monetary unit (for

example, the pound in the UK or the Swiss franc). An inflation rate of 10% in 1 year means that

what could be bought with €100 (say) at the start of the year will cost €110 [€100 + (10% × €100)]

at the end of the year. Some countries – for example, Argentina, Brazil, Israel, Mexico and Russia –

have in the past experienced annual inflation rates of 15% to over 400%. Even an annual inflation

rate of 5% over, say, a 5-year period can result in sizeable declines in the general purchasing power

of the monetary unit over that time.

Why is it important to account for inflation in capital budgeting? Because declines in the

general purchasing power of the monetary unit (pounds, say) will inflate future cash flows above

what they would have been had there been no inflation. We now examine how inflation can be

explicitly recognised in capital-budgeting analysis.

Real and nominal rates of return

When analysing inflation, distinguish between the real rate of return and the nominal (money)

rate of return:

● Real rate of return is the rate of return required to cover return and investment risk.

● Nominal rate of return is the rate of return required to cover return, investment risk and the

anticipated decline, due to inflation, in the general purchasing power of the cash that the invest-

ment generates. The rates of return (or interest) earned on the financial markets are nominal

rates, because they compensate investors for both risk and inflation.

We next describe the relationship between real and nominal rates of return. Assume that

the real rate of return for investments in high-risk cellular data-transmission equipment at

Surrey Communications is 20% and that the expected inflation rate is 10%. The nominal rate

of return is:

Nominal rate = (1 + Real rate)(1 + Inflation rate) − 1

= (1 + 0.20)(1 + 0.10) − 1

= [(1.20)(1.10)] − 1 = 1.32 − 1 = 0.32

The nominal rate of return is also related to the real rate of return and the inflation rate as follows:

Real rate of return

0.20

Inflation rate

0.10

Combination (0.20 × 0.10)

0.02

Nominal rate of return

0.32

The real rate of return can be expressed in terms of the nominal rate of return as follows:

Real = (1 + Nominal rate) − 1

(1 + Inflation rate)

= (1 + 0.32) − 1

(1 + 0.10)

= 0.20

Note that the nominal rate is slightly higher than the real rate (0.20) plus the inflation rate (0.10).

Why? Because the nominal rate recognises that inflation also decreases the purchasing power of

the real rate of return earned during the year.

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Net present value method and inflation

The watchwords when incorporating inflation into the net present value (NPV) method are inter-

nal consistency. There are two internally consistent approaches:

● *Nominal approach.* Predict cash inflows and outflows in nominal monetary units and use a

nominal rate as the required rate of return.

● *Real approach.* Predict cash inflows and outflows in real monetary units and use a real rate as

the required rate of return.

Consider an investment that is expected to generate sales of 100 units and a net cash inflow

of €1000 (€10 per unit) each year for two years *without inflation.* If inflation of 10% is expected

each year, net cash inflows from the sale of each unit would be €11(€10 × 1.10) in year 1 and

€12.10 [€11

1.10 or €10

1.102

×

×

] in year 2, resulting in net cash inflows of €1100 in year 1

and €1210 in year 2. The net cash inflows of €1100 and €1210 are nominal cash inflows because

they include the impact of inflation. *These are the cash flows recorded by the accounting*

system. The cash inflows of €1000 each year are real cash flows because they exclude inflation-

ary effects. Note that the real cash flows equal the nominal cash flows discounted for inflation,

€1000

€1100

1.10

€1210

(1.10)2

=

÷

=

÷

. Many managers find the nominal approach easier

to understand and use because they observe nominal cash flows in their accounting systems and

the nominal rates of return on financial markets.

Summary

The following points are linked to the chapter’s learning objectives.

1 Capital budgeting can be viewed as a five-stage process: (a) identification stage, (b) information-acquisition stage,

(c) prediction stage, (e) alternatives assessment stage, and (f) implementation and control stage.

2 The time value of money takes into account this fact: a euro received today can be invested to start earning a

return (for example, interest), so it is worth more than a euro received tomorrow. The time value of money is the

opportunity cost (return forgone) from not having the money today.

3 Discounted cash flow (DCF) methods explicitly include all project cash flows and the time value of money in

capital-budgeting decisions. Two DCF methods are the net present value (NPV) method and the internal rate

of return (IRR) method. The NPV method calculates the expected net monetary gain or loss from a project by

discounting all expected future cash inflows and outflows to the present point in time, using the required rate

of return. A project is acceptable if it has a positive NPV. The IRR method calculates the rate of return (discount

rate) at which the present value of expected cash inflows from a project equals the present value of expected cash

outflows from a project. A project is acceptable if its IRR exceeds the required rate of return.

4 Non-financial and qualitative factors, such as the effects of investment decisions on employee learning and on

the company's ability to respond faster to market changes, are often not explicitly considered in capital-budgeting

decisions. However, non-financial and qualitative factors can be extremely important. In making decisions, man-

agers must consider different possible scenarios by engaging in sensitivity analysis.

5 Relevant cash inflows and outflows are the expected future cash flows that differ among the alternatives. Only cash

inflows and outflows matter. Accounting concepts such as accrued revenues and accrued expenses are irrelevant

for the discounted cash flow methods.

6 The payback method measures the time it will take to recoup, in the form of cash inflows, the total amount invested

in a project. The payback method neglects profitability and the time value of money. The accounting rate of return

(ARR) is operating profit divided by a measure of investment. The ARR considers profitability but ignores the time

value of money.

7 A variety of project management issues are important to consider including how estimates can become too opti-

mistic and unrealistic and the value of carrying out post-investment audits.

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8 Three factors influence the amount of depreciation claimed as a tax deduction: (a) the amount allowable for depre-

ciation (called ‘capital allowances’ in the UK), (b) the time period over which the asset is to be depreciated, and (c)

the pattern of allowable depreciation. The real rate of return is the rate of return required to cover investment risk

and return.

9 The nominal rate of return is the rate of return required to cover return, investment risk and the anticipated decline,

due to inflation, in the general purchasing power of the cash that the investment generates. Two internally con-

sistent ways to account for inflation in capital budgeting are (a) to predict cash inflows and outflows in nominal

terms and to use a nominal discount rate, and (b) to predict cash inflows and outflows in real terms and to use a

real discount rate. The nominal and real approaches are equivalent: both yield the same net present value, but

many managers find the nominal approach easier to work with.

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CHAPTER 13

Assessment material

Review questions

13.1 What is the essence of the discounted cash flow method?

13.2 ‘Only quantitative outcomes are relevant in capital-budgeting analyses.’ Do you agree? Explain.

13.3 What is the payback method? What are its main strengths and weaknesses?

13.4 Describe the accounting rate of return method. What are its main strengths and weaknesses?

13.5 How is the accounting rate of return method different from the payback method?

13.6 'Let's be more practical. DCF is not the gospel. Managers should not become so enchanted with

DCF that strategic considerations are overlooked.' Do you agree? Explain.

13.7 What is a post-investment audit? Why is it important?

13.8 'Corporation tax only plays a role in capital budgeting because of capital allowances.' Do you

agree? Explain.

13.9 Distinguish between the nominal rate of return and the real rate of return.

13.10 What approaches might be used to recognise risk in capital budgeting?

13.11 'Discounted cash flow techniques are relevant only to for-profit organisations.' Do you agree?

Explain.

Exercises

Basic level

13.12 Comparison of approaches to capital budgeting (22–25 minutes)

Bayern-Bauwerk is thinking of buying, at a cost of €220 000, some new packaging equipment that

is expected to save €50 000 in cash-operating costs per year. Its estimated useful life is 10 years,

and it will have zero terminal disposal value. The required rate of return is 16%.

Required

1 Calculate the payback period.

2 Calculate the net present value.

3 Calculate the internal rate of return.

4 Calculate the accounting rate of return based on net initial investment. Assume straight-line

depreciation.

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13.13 Special order, relevant costs, capital budgeting (A. Spero, adapted) (30 minutes)

Euro-Jouets SNC sells neon-coated ‘Feu-Follet’ cars to several local toy stores. It has the capacity

to make 250 000 of these units per year, but during the year ending 31 December 2022, it made and

sold 130 000 cars to its existing customers. It makes these cars by dipping its highly unsuccessful

‘Garou-Garou’ model plastic toy cars into a vat of neon paint. It originally purchased 780 000 of

the Garou-Garous but has been unable to sell them as Garou-Garous. These plastic cars originally

cost €20 per unit, and 650 000 of them remain in stock.

Euro-Jouets’ accountant has prepared the following cost sheet per Feu-Follet car:

Selling price per car

€59

Manufacturing costs per car

Direct materials

Plastic cars

€20

Neon paint

6

Boxes

3

29

Direct manufacturing labour

8

Depreciation of vat

10

Allocated plant manager’s salary

5

Manufacturing costs per car

52

Gross margin per car

7

Marketing costs per car (€2 of which is variable)

6

Operating margin per car

€1

On 31 December 2022, the Mille-Fontaines chain asked Euro-Jouets to provide 100 000 Feu-Follet

cars at a special price of €50 per car. Euro-Jouets will not need to incur any marketing cost for

the Mille-Fontaines sale.

Euro-Jouets expected to sell the Feu-Follet cars to its existing customers for the next four years

at the current level of demand of 130 000 units per year and none thereafter. At the end of four

years, Euro-Jouets will dispose of the VAT and whatever cars remain at zero net disposal value.

If Euro-Jouets accepts the Mille-Fontaines order, it is certain that its other customers will refuse

to pay the current price of €59 and will demand a discount. Euro-Jouets estimates a required rate

of return of 16%.

Required

1 Should Euro-Jouets accept the special order if it must also offer the same price of €50 to its

existing customers for the next four years?

2 Suppose Euro-Jouets is uncertain about the discount the existing customers would demand.

Determine the price that Euro-Jouets would have to offer its existing customers for the next

four years to be indifferent between accepting and rejecting Mille-Fontaines' special order.

***13.14 Question from the Association of Chartered Certified Accountants, Pilot Paper 2.4,**

Financial Management and Control (45 minutes)

Bread Products Ltd is considering the replacement policy for its industrial size ovens which are

used as part of a production line that bakes bread. Given its heavy usage, each oven has to be

replaced frequently. The choice is between replacing every two years or every three years. Only

one type of oven is used, each of which costs £24 500.

Maintenance costs and resale values are as follows:

Year

Maintenance per annum

Resale value

1

£500

2

£800

£15 600

3

£1 500

£11 200

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Original cost, maintenance costs and resale values are expressed in current prices. That is, for

example, maintenance for a two-year-old oven would cost £800 for maintenance undertaken now.

It is expected that maintenance costs will increase at 10% per annum and oven replacement cost

and resale values at 5% per annum. The money discount rate is 15%.

Required

1 Calculate the preferred replacement policy for the ovens in a choice between a two-year or

three-year replacement cycle.

2 Identify the limitations of net present value techniques when applied generally to investment

appraisal.

Intermediate level

13.15 Net present value, internal rate of return, sensitivity analysis (20–30 minutes)

Carmelo, SA, is planning to buy equipment costing €120 000 to improve its materials handling

system. The equipment is expected to save €40 000 in cash-operating costs per year. Its estimated

useful life is six years, and it will have zero terminal disposal value. The required rate of return

is 14%.

Required

1 Calculate the net present value. Calculate the internal rate of return.

2 What is the minimum annual cash savings that will make the equipment desirable on a net

present value basis?

3 When might a manager calculate the minimum annual cash savings described in requirement 2

rather than use the €40 000 savings in cash-operating costs per year to calculate the net present

value or internal rate of return?

13.16 DCF, accounting rate of return, working capital, evaluation of performance (20–30 minutes)

Meer has been offered a special-purpose metal-cutting machine for €110 000. The machine is

expected to have a useful life of eight years with a terminal disposal value of €30 000. Savings in

cash-operating costs are expected to be €25 000 per year. However, additional working capital is

needed to keep the machine running efficiently and without stoppages. Working capital includes

such items as filters, lubricants, bearings, abrasives, flexible exhaust pipes and belts. These items

must continually be replaced so that an investment of €8000 must be maintained in them at all

times, but this investment is fully recoverable (will be ‘cashed in’) at the end of the useful life.

Meer’s required rate of return is 14%.

Required

1 a Calculate the net present value.

b Calculate the internal rate of return.

2 Calculate the accounting rate of return based on the net initial investment. Assume straight-line

depreciation.

3 You have the authority to make the purchase decision. Why might you be reluctant to base your

decision on the DCF model?

13.17 Sporting contract, net present value, payback (30 minutes)

Aalesund Fotballklubb is a Norwegian football team with a long tradition of winning. However,

the last three years have been traumatic. The team has not won a major championship, and

attendance at games has dropped considerably. Norsk Fiskevær AS is Aalesund Fotballklubb's

major corporate sponsor. Sverre Aspelund, the president of Norsk Fiskevær, is also the president

of Aalesund Fotballklubb. Sverre proposes that the team purchase the services of Brazilian star,

Monteiro. Monteiro would create great excitement for Aalesund Fotballklubb's fans and spon-

sors. Monteiro's agent notifies Aspelund that terms for the superstar's signing with Aalesund

Fotballklubb are a bonus of NOK 3 million payable now (start of 2022) plus the following four-

year contract (assume all amounts are in millions and are paid at the end of each year):

2023

2024

2025

2026

Salary

NOK 4.5

NOK 5.0

NOK 6.0

NOK 6.5

Living and other costs

1.0

1.2

1.3

1.4

Aspelund's initial reaction is one of horror. As president of Norsk Fiskevær, he has never earned

more than NOK 800 000 a year. However, he swallows his pride and decides to examine the

expected additions to Aalesund Fotballklubb's cash inflows if Monteiro is signed for the four-year

contract (assume all cash inflows are in millions and are received at the end of each year):

2023

2024

2025

2026

Net gate receipts

NOK 2.0

NOK 3.0

NOK 3.0

NOK 3.0

Corporate sponsorship

3.0

3.5

4.0

4.0

Television royalties

0.0

1.2

1.4

2.0

Merchandise income (net of costs)

0.6

0.6

0.7

0.7

Aspelund believes that a 12% required rate of return is appropriate for investments by Aalesund

Fotballklubb.

Required

1 For Monteiro's proposed four-year contract, calculate (a) the net present value, and (b) the

payback period.

2 What other factors should Aspelund consider when deciding whether to sign Monteiro the

four-year contract?

13.18 Comparison of projects with unequal lives (20–30 minutes)

The manager of the Robin Hood Company is considering two investment projects that are mutu-

ally exclusive. The after-tax required rate of return of this company is 10%, and the anticipated

cash flows are as follows:

Cash inflows

Project no.

Investment required now

Year 1

Year 2

Year 3 Year 4

1

€10 000

€12 000

€0

€0

€0

2

10 000

0

0

0

17 500

Required

1 Calculate the internal rate of return of both projects. Which project is preferable?

2 Calculate the net present value of both projects. Which project is preferable?

3 Comment briefly on the results in requirements 1 and 2. Be specific in your comparisons.

Advanced level

13.19 Ranking projects (adapted from NAA Research Report No. 35, pp. 83–5) (40 minutes)

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Assume that six projects, A–F in the table that follows, have been submitted for inclusion in the

coming year’s budget for capital expenditures:

Project cash flows

Year

A

B

C

D

E

F

Investment

0

€(100 000) €(100 000) €(200 000) €(200 000) €(200 000) €(50 000)

1

0

20 000

70 000

0

5 000 23 000

2

10 000

20 000

70 000

0

15 000 20 000

3

20 000

20 000

70 000

0

30 000 10 000

4

20 000

20 000

70 000

0

50 000 10 000

5

20 000

20 000

70 000

0

50 000

Per year

6–9

20 000

20 000

200 000

50 000

10

20 000

20 000

50 000

Per year

11–15

20 000

Internal rate of return

14%

?

?

?

12.6%

12.0%

Required

1 Calculate the internal rates of return (to the nearest half per cent) for projects B, C and D. Rank

all projects in descending order in terms of the internal rate of return. Show your calculations.

2 Based on your answer in requirement 1, state which projects you would select, assuming a 10%

required rate of return (a) if €500 000 is the limit to be spent, (b) if €550 000 is the limit, and

(c) if €650 000 is the limit.

3 Assuming a 16% required rate of return and using the net present value method, calculate the

net present values and rank all the projects. Which project is more desirable, C or D? Compare

your answer with your ranking in requirement 1.

4 What factors other than those considered in requirements 1 to 3 would influence your project

rankings? Be specific.

13.20 Equipment replacement, relevant costs, sensitivity analysis (30–40 minutes)

A toy manufacturer that specialises in making fad items has just developed a £50 000 moulding

machine for producing a special toy. The machine has been used to produce only one unit so far.

The company will depreciate the £50 000 initial machine investment evenly over four years, after

which production of the toy will be stopped. The company's expected annual costs will be direct

materials, £10 000; direct manufacturing labour, £20 000; and variable manufacturing overhead,

£15 000. Variable manufacturing overhead varies with direct manufacturing labour costs. Fixed

manufacturing overhead, exclusive of depreciation, is £7500 annually, and fixed marketing and

administrative costs are £12 000 annually.

Suddenly a machine salesperson appears. He has a new machine that is ideally suited for produc-

ing this toy. His automatic machine is distinctly superior. It reduces the cost of direct materials by

10% and produces twice as many units per hour. It will cost £44 000 and will have a zero terminal

disposal value at the end of four years.

Production and sales of 25 000 units per year (sales of £100 000) will be the same whether the

company uses the old machine or the new machine. The current disposal value of the toy com-

pany's moulding machine is £5000. Its terminal disposal value in four years will be £2600.

Required

1 Assume that the required rate of return is 18%. Using the net present value method, show

whether the new machine should be purchased. What is the role of the book value of the old

machine in the analysis?

2 What is the payback period for the new machine?

3 As the manager who developed the £50 000 old moulding machine, you are trying to justify not

buying the new £44 000 machine. You question the accuracy of the expected cash operating

savings. By how much must these cash savings fall before the point of indifference – the point

where the net present value of investing in the new machine – reaches zero?

13.21 Capital budgeting, computer-integrated manufacturing, sensitivity (25 minutes)

Dinamica Lda is planning to replace one of its production lines, which has a remaining useful life

of 10 years, book value of €9 million, a current disposal value of €5 million, and a neglible ter-

minal disposal value 10 years from now. The average investment in working capital is €6 million.

Dinamica plans to replace the production line with a computer-integrated manufacturing (CIM)

system at a cost of €45 million. Manuel Ericeira, the production manager, estimates the following

annual cash-flow effects of implementing CIM:

a Cost of maintaining software programs and CIM equipment, €1.5 million.

b Reduction in lease payments due to reduced floor-space requirements, €1 million.

c Fewer product defects and reduced rework, €4.5 million.

In addition, Manuel estimates the average investment in working capital will decrease to

€2 million. The estimated disposal value of the CIM equipment is €14 million at the end of

10 years. Dinamica uses a required rate of return of 14%.

Required

1 Calculate the net present value of the CIM proposal. On the basis of this criterion, should

Dinamica adopt CIM?

2 Manuel argues that the higher quality and faster production resulting from CIM will also

increase Dinamica's revenues. He estimates additional cash revenues net of cash-operating

costs from CIM of €3 million per year. Calculate the net present value of the CIM proposal

under this assumption.

3 Management is uncertain if the cash flows from additional revenues will occur. Calculate the

minimum annual cash flow from additional revenues that will cause Dinamica to invest in CIM

on the basis of the net present value criterion.

4 Discuss the effects of reducing the investment horizon for CIM to five years, Dinamica's usual

time period for making investment decisions. Assume disposal values at the end of five years

of CIM line, €20 million; and of old production line, €4 million. Also assume additional cash

revenues net of cash-operating costs from CIM of €3 million per year.

***13.22 Question from CIMA 2010 Chartered Institute of Management Accountants, Specimen**

Examination Paper 1 (30 minutes)

The board of directors of a company is considering two mutually exclusive projects. Both projects

necessitate buying new machinery, and both projects are expected to have a life of five years.

Project One

This project has already been evaluated. Details of the project are:

Initial investment needed £500 000

Net present value £41 000

Accounting rate of return 31%.

Project Two

Details of project two are:

Year

1

2

3

4

5

Revenue (£000)

370

500

510

515

475

Operating costs (£000)

300

350

380

390

400

Depreciation (£000)

90

90

90

90

90

The figures for revenue and operating costs in the table above are cash-flow estimates, have been

stated at current values and are assumed to occur at the year end. However, differential inflation

is expected: 8% per annum for revenue and 6% per annum for operating costs. The machinery

will cost £500 000 and will be sold for £50 000 cash at the end of year 5.

Additional information

● The company pays tax at 30%. Tax is paid and/or received one year in arrears.

● The machines qualify for tax depreciation at the rate of 25% per annum on a reducing balance

basis.

● The company's cost of capital is 12% per annum. The current rate of return on investments

in the money market is 7%.

● The project chosen will be funded by internal funds.

● The target accounting rate of return is 30%. The company defines ‘Accounting rate of return’

as the average profit before tax divided by the average investment.

Required

1 a Calculate the net present value and the accounting rate of return of Project Two.

b Prepare a report for the Board of Directors which:

(i) recommends which of the projects, if any, they should invest in

(ii) identifies two non-financial factors that are relevant to the decision

(iii) explains the strengths and weaknesses of net present value and accounting rate of return.

2 A government organisation has a fixed interest ten-year loan. The rate on the loan is 8% per

annum. The loan is being repaid in equal annual instalments at the end of each year. The

amount borrowed was £250 000. The loan has just over four years to run.

Ignore taxation.

Required

Calculate the present value of the amount outstanding on the loan.

13.23 Question from Association of Chartered Certified Accountants Financial Management,

section B, June 2015 (45 minutes)

Hraxin Co is appraising an investment project which has an expected life of four years and which

will not be repeated. The initial investment, payable at the start of the first year of operation, is

£5 million. Scrap value of £500 000 is expected to arise at the end of four years. There is some

uncertainty about what price can be charged for the units produced by the investment project, as

this is expected to depend on the future state of the economy. The following forecast of selling

prices and their probabilities has been prepared:

Future economic state

Weak

Medium

Strong

Probability of future economic state

35%

50%

15%

Selling price in current price terms

£25 per unit

£30 per unit

£35 per unit

These selling prices are expected to be subject to annual inflation of 4% per year, regardless of

which economic state prevails in the future. Forecast sales and production volumes, and total

nominal variable costs, have already been forecast, as follows:

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Year	**1**	**2**	**3**	**4**
Sales and production (units)	150 000	250 000	400 000	300 000
Nominal variable cost (£000)				

2 385

4 200

7 080

5 730

Incremental overheads of £400 000 per year in current price terms will arise as a result of under-

taking the investment project. A large proportion of these overheads relate to energy costs which

are expected to increase sharply in the future because of energy supply shortages, so overhead

inflation of 10% per year is expected.

The initial investment will attract tax-allowable depreciation on a straight-line basis over the

four-year project life. The rate of corporation tax *t* is 30% and tax liabilities are paid in the year

in which they arise. Hraxin Co has traditionally used a nominal after-tax discount rate of 11%

per year for investment appraisal.

Required

1 Calculate the expected net present value of the investment project and comment on its financial

acceptability.

2 Critically discuss if sensitivity analysis will assist Hraxin Co in assessing the risk of the invest-

ment project.

13.24 Question from CIMA Performance Operations, section C, November 2014 (40 minutes)

ST operates in a highly competitive market and is considering introducing a new product to

expand its current range. The new product will require the purchase of a specialised machine

costing £825 000. The machine has a useful life of four years and is expected to have a scrap value

at the end of Year 4 of £45 000. The company uses the straight line method of depreciation. The

machine would be used exclusively for the new product.

Due to a shortage of space in the factory, investment in the new machine would necessitate the

disposal, for £23 000, of an existing machine which has a net book value of £34 000. This machine,

if retained for a further year, would have earned a contribution of £90 000 before being scrapped

for nil value. The machine had a zero tax written-down value and therefore there will be no effect

on tax depreciation arising from the disposal of the machine.

The company employed the services of a consultant, at a cost of £29 000, to determine the demand

for the new product. The consultant's estimated demand is given below:

Year 1

18 000 units

Year 2

24 000 units

Year 3

26 000 units

Year 4

22 000 units

The new product is expected to earn a contribution of £30 per unit.

Fixed costs of £380 000 per annum, including depreciation of the new machine, will arise as a

direct result of the manufacture of the new product.

Taxation

ST's Financial Director has provided the following taxation information:

● Tax depreciation: 25% per annum of the reducing balance, with a balancing adjustment in the

year of disposal.

● Taxation rate: 30% of taxable profits. Half of the tax is payable in the year in which it arises;

the balance is paid in the following year.

● ST has sufficient taxable profits from other parts of its business to enable the offset of any

pre-tax losses on this project.

Other information

A cost of capital of 12% per annum is used to evaluate projects of this type. Ignore inflation.

Required

Evaluate whether ST should introduce the new product. You should use net present value (NPV)

as the basis of your evaluation.

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PART II

Case study problems

Case 201

Permaclean Products plc

David Otley, University of Lancaster

The central issue in this case concerns product pricing. The analysis requires the estimation of

appropriate costs and assessing price-demand information using past sales data.

Permaclean Products is an old-established firm, located in Dunstable, manufacturing a compre-

hensive range of domestic cleaning materials. It has a sound reputation and a well-known brand

name, which has made it a market leader in a wide range of products designed for home use.

Although Permaclean has several competitors, the total sales of each are small in comparison

with those of Permaclean, mainly because none offers such a complete product range.

In 2020 the price of one of Permaclean's major products, Permashine – a mini-bottled bath

cleaner, was raised from 75p per bottle to 99p when the product was repackaged in a newly

designed bottle, one dose; however, the contents were identical to the previous pack, both in

formulation and quantity. During the following two years sales fell by 27%. At 75p per bottle

Permashine had been competitively priced but when its price was increased manufacturers of sim-

ilar products had not followed. In the period from 2018 to 2021 the price of competing products

had been raised by only 5p.

Prices were fixed once a year, to come into force on 1 February, before the annual peak demand

which occurred in the spring. In January 2022, John Williams, the marketing manager, met with

Andrea Garcia, the chief accountant, to review the company's pricing policy for the coming year.

Permashine

Permashine is a proprietary cleaning product for bathrooms and in 2018 had accounted for

over 10% of the company's sales. Although there are a variety of competing products that are

mini-bottled on the market, Permashine has special properties which make it especially suitable

for cleaning baths made of acrylic materials. Such baths are becoming increasingly common, but

great care has to be taken to avoid scratching them when they are being cleaned. Permashine con-

tains no abrasive materials yet is able to clean acrylic surfaces with great efficiency, giving a surface

shine that is very durable. No competing product appears to have this combination of advantages.

Source: Adapted from Otley, D. (1988) 'Permaclean Products plc', in D. Otley, D. Brown and C. Wilkinson (eds) *Case Studies in Management Accounting* (Hemel Hempstead, UK: Philip Allan Publishers). Reproduced with permission.

PART II Case study problems

The process used in the manufacture of Permashine involves a hazardous chemical reaction

that has to be precisely controlled. Production therefore takes place in a separate building on the

same site as the main factory where the other products are made but some distance from it. This

production unit, which was constructed in 2014 for safety reasons, is not capable of being adapted

for the manufacture of other Permaclean products without substantial expenditure. Although the

manufacture of Permashine is potentially hazard ous, no serious accidents have occurred during

the 15 years in which it has been produced and the final product is itself completely harmless.

In early 2019, Andrea Garcia had installed an improved cost accounting system which

allowed product costs to be determined and product profitability to be reviewed. With regard

to Permashine, this took into account the new packaging costs, as well as the overhead costs

that were separately attributable to the production unit. Her analysis, shown in Exhibit 201.1,

indicated that the total cost of Permashine was greater than the current selling price of 75p. As a

result, at the annual pricing review in 2020 the selling price was increased to 99p.

Although total industry sales continued to rise during 2020 and 2021, Permashine suffered a

reduction in both its market share and its total sales, as shown in Exhibit 201.2.

The 2022 pricing review

Both Mr Williams and Ms Garcia were concerned to improve the profitability of Permashine, as

it was one of the company's major products. Mr Williams had joined the company in 2014 and

had introduced a number of changes in the firm's marketing methods. One of his major successes

had been his decision to replace wholesalers with a team of salaried sales representatives who

Exhibit 201.1

Estimated costs of Permashine at various production volumes

Annual production ('000 bottles)

Cost (p/bottle)

250

300

400

500

600

700

800

Direct labour

17.5

17.5

17.0

17.0

17.0

17.5

18.0

Materials

8.0

8.0

8.0

8.0

8.0

8.0

8.0

Dept. overhead

Variable

9.0

9.0

9.0

9.0

9.0

9.0

9.0

Fixed

14.4

12.0

9.0

7.2

6.0

5.1

4.5

Factory overhead (20% of direct labour)

3.5

3.5

3.4

3.4

3.4

3.5

3.6

Factory cost

52.4

50.0

46.4

44.6

43.4

43.1

43.1

Selling and administration cost

at 80% of factory cost

41.9

40.0

37.1

35.7

34.7

34.5

34.5

Total cost

94.3

90.0

82.7

80.3

78.1

77.6

77.6

Exhibit 201.2

Permashine: sales and price

2015

2016

2017

2018

2019

2020

2021

Permashine sales (’000 bottles)

400

429

486

525

536

462

391

Total industry sales (’000 bottles)

2000

2050

2250

2200

2300

2650

2900

Permashine % of market

20

21

22

24

23

17.5

13.5

Permashine price (p)

60

70

70

75

75

99

99

Competitors’ price range (p)

56–62

65–70 65–70 69–75 69–75 70–80

75–80

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sold the company’s full product range direct to retailers. Ms Garcia had been appointed in 2018,

following the retirement of the previous chief accountant, and had been responsible for installing

a modern computer-based accounting system.

Mr Williams pressed for a return to the previous price of 75p for Permashine; at this price

he was confident that the market share of the product could be increased to 20% in 2022. He

thought that total industry sales would continue to increase to at least 3 million bottles in 2022,

and that Permashine was capable of regaining its previous position, provided that it was compet-

itively priced. Because Permaclean had a modern production facility and a manufacturing output

greater than any competitor, he was confident that factory production costs were the lowest in

the industry. He therefore supported a policy of reducing the price so that other firms would find

it uneconomic to continue to compete.

Mr Williams was convinced that sales would continue to fall if the price were to be maintained

at 99p, although he believed that there would always be a premium market for Permashine because

of its unique qualities. He thought that annual sales were unlikely to fall below 250 000 bottles

even at the current price.

Ms Garcia replied that she was well aware of the problems being experienced in selling the

higher-priced product. Nevertheless, her analysis showed that the 99p price covered the costs of

the product, even at the lowest volume envisaged. If the price were reduced to 75p costs would

fail to be covered, even if sales volume rose to the 800 000 bottles which represented the maximum

practical capacity of the plant. She referred to her detailed costings (Exhibit 201.1) to support her

argument. These figures, she stated, were based on actual data from past years; where data were

s

not available, she had made what she regarded as realistic assumptions.

roblem

Question

tudy p

What price would you recommend for Permashine? Support your recommendation with detailed

calculations, making the underlying assumptions on which your analysis is based as clear as possible.

Case s

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PART III

Planning and budgetary control systems

This part of the book focuses on what managers need to know about expected outcomes once decisions have been made and to build on such information in making further decisions. We look at ways in which management accounting approaches may assist in planning for the future and in learning from past activities.

Chapter 14 looks at organisational and behavioural issues which affect the design of internal accounting systems and considers also the consequences of using the information output of such systems. Chapters 15, 16 and 17 stress calculative considerations in the formal planning and control process.

Chapter 14

Motivation, budgets and responsibility accounting

Chapter 15

Flexible budgets, variances and management control: I

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Chapter 16

Flexible budgets, variances and management control: II

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Chapter 17

Measuring yield, mix and quantity effects

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Part III

Case study problems

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CHAPTER 14

Motivation, budgets and responsibility

accounting

Budgets are one of the most widely used tools for planning and controlling enterprises. Surveys show an almost universal use of budgets

Learning objectives

by medium and large companies in many parts of the globe. Budgeting systems turn managers' perspectives forward. A forward-looking

After studying this chapter, you

perspective enables managers to be in a better position to exploit

should be able to:

opportunities. It also enables them to anticipate problems and take steps

- Understand what a master budget

to eliminate or reduce their severity. One belief is that: 'Few businesses

is and explain its major benefits

plan to fail, but many of those that flop failed to plan.'

This chapter examines budgeting as a planning and coordinating tool.

- Describe major components of

Topics covered in prior chapters feature in this discussion. Budgets give

the master budget

financial expression to many of themes we have covered in this book

- Prepare the budgeted profit

so far. For example, budgets can quantify the planned financial effects

statement and its supporting

of activities aimed at continuous improvement and cost reduction. By schedules

understanding cost behaviour (covered in Chapters 2 and 9), managers

- Describe the uses of computer-

can better predict how total budgeted costs are affected by different based financial planning models

projected output levels. Familiarity with cost tracing and cost allocation

- Explain kaizen budgeting and its

(covered in Chapters 3, 4 and 5), allows managers to consider how importance for cost management

different projected revenue and cost amounts will impact on the budgeted profit and loss statement and balance sheet.

- Illustrate an activity-based

The material covered in this chapter is also integral to subsequent budgeting approach

chapters. For example, Chapters 15 and 16 examine how the numbers

- Describe responsibility centres used in budgets assist in evaluating the performance of managers or the and responsibility accounting business areas for which they have responsibility.
- Explain how controllability relates to responsibility accounting

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Major features of budgets

Definition and role of budgets

A *budget* is a quantitative expression of a proposed plan of action by management for a future time period and is an aid to the coordination and implementation of the plan. It can cover both financial and non-financial aspects of these plans and acts as a blue-print for the company to follow in the forthcoming period.

James McKinsey is regarded as the father of business budgets. Just over a 100 years ago on

20 June 1922 he wrote his 26-chapter book titled *Budgetary Control* (McKinsey, 1923). He noted

that ‘mere study of past records is inadequate . . . The past is gone and cannot be changed. It is

only future operations over which control can be exercised.’ Budgets for most firms today heed

this in covering financial aspects quantified on the basis of management’s expectations regard-

ing future income, cash flows and financial position. Just as individual financial statements are

prepared covering past periods, so they can be prepared covering future periods – for example, a

budgeted income statement, a budgeted cash-flow statement and a budgeted balance sheet. Under-

lying these financial budgets can be non-financial budgets for, say, units manufactured, number

of new products introduced to the market, or head count. It is noteworthy that McKinsey later

founded the consulting firm which bears his name. McKinsey & Co today employs over 30 000

workers, has revenues exceeding $10 billion making it the largest (and oldest) of the ‘Big Three’

management consultancies in the world.

Many organisations adopt the following budgeting cycle:

1 Before the start of the fiscal year, managers at all levels take into account the company's past

performance, market feedback, and anticipated future changes to initiate plans for the next

period. For example, an anticipated economic recovery from a recession may cause managers

to plan for sales increases, higher production, and greater promotion expenses. Managers and

management accountants work together to develop plans for the company as a whole and the

performance of its subunits, such as departments or divisions.

2 At the beginning of the fiscal year, senior managers give subordinate managers a frame of ref-

erence, a set of specific financial or non-financial expectations against which they will compare

actual results.

3 During the course of the year, management accountants help managers investigate any devi-

ations from the plans, such as an unexpected decline in sales. If necessary, corrective action

follows – changes in a product's features, a reduction in prices to boost sales, or cutting of

costs to maintain profitability.

The master budget coordinates all the financial projections in the organisation's individual budg-

ets in a single organisation-wide set of budgets for a given time period. It embraces the impact of

both *operating* decisions and *financing* decisions. Operating decisions are about the acquisition

and use of scarce resources. Financing decisions deal with how to obtain the funds to acquire

resources. This chapter emphasises operating budgets. The terminology used to describe budg-

ets varies among companies. For example, budgeted financial statements are sometimes called

pro forma statements. Some companies, such as Hewlett-Packard, refer to budgeting as *targeting*

whereas others, such as Nissan Motor Company refer to the budget as a *profit plan.* Microsoft

refers to goals as *commitments* and distributes firm-level goals across the company, connecting

them to organisational, team, and – ultimately – individual commitments.

The term *master* in 'master budget' refers to it being a comprehensive, organisation-wide

set of budgets. Consider the Credit Suisse Group which owns the Credit Suisse Bank. It is one

of the world's most profitable and important banks upon which international financial stabil-

ity depends. It has four divisions, Investment Banking, Wealth Management, Swiss Bank and

Asset Management. A Shared Services Group provides legal, IT, risk management, marketing

and support to all areas. The four divisions each have a separate budgeted income statement, a

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separate budgeted cash-flow statement, and so on. The master budgeted income statement for

the Credit Suisse Group is a single income statement that combines information from all these

individual budgeted income statements. Similarly, the master budgeted cash-flow statement is a

single cash-flow statement that combines information from all these individual budgeted cash-

flow statements.

Roles of budgets

Budgets are a major feature of management control systems for many companies. Current think-

ing concerning budgetary control systems suggests two opposite views. On the one hand, there is

the view that espouses incremental improvement to budgetary processes in terms of linking such

processes more closely to operational requirements and planning systems and increasing the fre-

quency of budget revisions and the deployment of rolling budgets. Conversely, an alternative view

advocates the abandonment of budgetary control and its replacement with alternative techniques

to enable firms to become more adaptive and agile. Some companies have extensively altered the

manner in which budgetary control is exercised or even abandoned the practice. For instance,

when Jan Wallander became the chief executive officer of Svenska Handelsbanken – one of the

most profitable international banks in Europe – he abolished the budget process, viewing it as an

'unnecessary evil'. Control is now undertaken using alternative management approaches. Other

companies, such as Ikea, Volvo, Ericsson, Boots and Diageo, have moved away from traditional

department-focused budgetary control. Still most firms favour budgets and see the following

useful functions.

Strategy and plans

Budgeting for most companies is especially useful when it is integrated with a company's longer-

term strategy. We may think of strategy as what an organisation does to align its capabilities with

the opportunities it identifies in the market environment it operates in (this is further discussed

in Part 4 of the book). In considering strategic choices, organisational participants may ques-

tion: What are our objectives? What set of integrated choices can we make along the value chain

(for example, in product and service design, operations and marketing) to create value for our

customers? How do we distinguish ourselves from our competitors? What organisational and

financial structures serve us best? What are the risks and opportunities of alternative strategies,

and what are our contingency plans if our preferred plan fails? A company, such as Carrefour, can

have a strategy of providing quality products or services at a low price. Another company, such as

Porsche or Kempinski Hotels, can have a strategy of providing a unique product or service that

is priced higher than the products or services of competitors.

Consider the diagram in Exhibit 14.1. Strategic analysis underlies both long-run and short-run

planning. In turn, these plans lead to the formulation of budgets. The arrows in the diagram are

pointing in two directions. Why? Because strategy, plans and budgets are interrelated and affect

one another. Budgets provide feedback to managers about the likely effects of their strategic plans.

Managers then use this feedback to revise their strategic plans. In an increasingly competitive

business climate, consumers shop around and demand greater returns for the prices they pay.

The communications industry is no exception. BT Retail, for instance, places great reliance on

‘top-down’ and ‘bottom-up’ forecasts to ensure all customer requirements are taken into account.

For its core telephony revenue, BT takes into account myriad factors, including the incorporation

of new products, customer segmentation, external economic and social factors, in its budget

forecasts. Start-ups in the digital space need to swiftly reformulate their business strategy on an

ongoing basis. At times the hypothesis on which they are founded needs to be pivoted extensively

in the light of new information. In such technology-based businesses assessing information via a

‘tech start-up financial control loop’ becomes useful (Bhimani, 2022).

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Exhibit 14.1

Strategic analysis in the formulation of long-run and short-run budgets

Long-run planning

Long-run budgets

Strategy

analysis

Short-run planning

Short-run budgets

A framework for judging performance

Budgeted performance measures can overcome two key limitations of using past performance as

a basis for judging actual results. One limitation is that past results incorporate past miscues and

substandard performance. Consider a mobile phone company (Mobile Communications) exam-

ining the 2023 performance of its salesforce. Suppose the past performance in 2022 incorporates

the efforts of many departed salespeople who left because they did not have an understanding of

the marketplace. Using the sales record of those departed employees would set the performance

bar for new sales-people too low.

A second limitation of past performance is that the future may be expected to be very different

from the past. Consider again our mobile phone company. Suppose that Mobile Communications

had a 20% revenue increase in 2023 compared with a 10% increase in 2022. Does this indicate

excellent sales performance? Before saying yes, consider two additional facts. Fact one is that

in November 2022, an industry trade association forecast that the 2023 growth rate in industry

revenues would be 40%. Fact two is that in 2023, the actual growth rate in industry revenues was

50%. The 20% actual revenue gain in 2023 takes on a negative connotation given these facts, even

though it exceeds the 2022 actual growth rate of 10%. Use of the 40% figure as the budgeted rate

provides a better way to evaluate the 2023 sales performance than does use of the 2022 actual

rate of 10%. A cycling analogy is appropriate here. A budgeted industry growth rate of 40% is

equivalent to the cyclist going downhill on a steep slope. Top management of Mobile Commu-

nications might expect that good performance will achieve above-average speed compared with

other cyclists in similar conditions.

Some companies have evolved their budget practices as Marciano (2022) explains in his article

‘The amazing history, present, and future of business budgets’, in which he quotes Ivo de Brouwer,

the Finance Director at the French food group, Danone stating: ‘The old ways were still working

in 1999. When I started in my career it really was possible for a company to predict the world and

what would go on. Even in some circumstances, we could influence the future. In that world it

really makes sense that you make a yearly budget and a few times a year you look and see where

we are deviating from this budget and ask how do we cope with that?’ But less than two decades

later, Danone subscribed more closely to a world of high volatility, uncertainty, complexity and

ambiguity (often referred to as VUCA). De Brouwer said: ‘We introduced rolling forecasts which

meant we are continuously looking one and half years in front of us at what we could expect

could happen.’

Coordination and communication

Coordination is the meshing and balancing of all factors of production or service and of all the

departments and business functions so that the company can meet its objectives. *Communication*

is getting those objectives understood and accepted by all departments and functions.

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Coordination forces executives to think of relationships among individual operations, depart-

ments, the company as a whole and across companies. Coordination implies, for example, that

purchasing officers make material purchase plans based on production requirements. Also, pro-

duction managers plan personnel and machinery needs to produce the number of products nec-

essary to meet revenue forecasts. How does a budget lead to coordination? Consider budgeting

at Pace, a United Kingdom-based manufacturer of electronic products. A key product is Pace's

digital set-top box for decoding satellite broadcasts. The production manager can achieve more

timely production by coordinating and communicating with the company's marketing team to

understand when set-top boxes need to be shipped to customers. In turn, the marketing team can

make better predictions of future demand for set-top boxes by coordinating and communicating

with Pace's customers.

Suppose BSkyB, one of Pace's largest customers, is planning to launch a new high-definition

personal video recorder service. If Pace's marketing group is able to obtain information about the

launch date for the service, it can share this information with Pace's manufacturing group. The

manufacturing group must then coordinate and communicate with Pace's materials-procurement

group, and so on. The point to understand is that Pace is more likely to have personal video record-

ers in the quantities customers demand if Pace coordinates and communicates both within its busi-

ness functions and with its customers and suppliers during the budgeting and production processes.

Motivation and related organisational pursuits

Budgets help managers, but budgets need help. Top management has the ultimate responsibility

for the budgets of the organisation they manage. Management at all levels, however, should

understand and support the budget and all aspects of the management control system. Zero-based

budgeting (ZBB) is an approach to budgeting which forces managers to justify every item within

their business units every year as part of the control process. ZBB was developed 60 years ago

but recently the ‘number of companies publicly referring to zero-base budgeting has exploded’

(Fitzpatrick and Hawke, 2015). The approach is widely used as a motivational device by many

large companies including WPP, Alcoa and Quicksilver. Unilever also is one company that is using

ZBB to enable their managers to ‘approach spending and manufacturing with fresh eyes’. Altering

management behaviour can be achieved through budgetary control measures. At Unilever, this

was seen as essential following a takeover attempt by Kraft Heinz’s $115 billion bid for the com-

pany which failed. But the company was ‘sufficiently rattled to raise margin targets and talk-up

its enthusiasm for ZBB’ (Guthrie, 2018).

The manner in which a budget is administered can adversely impact on the managers’ behav-

iour. Budgets should not be administered rigidly. Managers sometimes use budgeted targets to

effect changes in a forceful way. Budgetary control entails more than the simple application of

rules and calculative procedures and the quantitative evaluation of performance. Budgeting activ-

ities achieve specific significance depending on the organisational processes through which budg-

etary pressures and demands arise. Having a formal document such as the budget is an effective

way to communicate a consistent set of plans to the organisation as a whole. There are instances

where budgets serve to send strategic messages. In practice, it is rarely possible to disentangle the

organisational from the technical aspects of budgeting emphasised in this chapter. An enterprise

can set a ‘difficult to attain’ budget in an attempt to motivate good performance. This is because,

in practice, budgets that are set up to a certain degree of tightness often become stronger moti-

vators, although motivation tends to decline after a certain point (see the aspirations budget in

Exhibit 14.2). The expectation may be that the budget target set to motivate high performance

from employees will not be attained. An alternative budget for financial planning purposes may

therefore have to be established based on what is expected to be achieved. Such alternative uses of

budgets sometimes require a ‘write-down’ to be determined. If such ‘write-downs’ become known

in the organisation, relationships between managers and subordinates and across departments

will possibly be adversely affected. Consequently, the motivational role of the aspirations budget

is certain to suffer.

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Exhibit 14.2

The conflicting purposes of budgeting

Budgeted

Expectations

performance

budget

Aspirations

budget

Performance

Actual

performance

An easy

A budget of

A very

budget

intermediate

difficult

difficulty

budget

Degree of budget difficulty

Source: Hopwood, A. (1974) *Accounting and Human Behaviour* (London: Haymarket).

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Situations where decision makers agree about the aims of particular organisational actions

or over the activities of particular organisational units sometimes coincide with certainty about

what will ensue if certain actions are taken. In such instances, we can think of budgets as facili-

tating the coordination and integration of organisational activities through direct computation.

For instance, expected budgeted cash-flow changes can readily be assessed and future overdraft

requirements can be anticipated in advance. If, however, there exists uncertainty over what might

happen as a consequence of taking some action, we can think of the budget as offering the

possibility of helping managers to learn rather than to provide computational answers. In other

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words, managers can simulate different budgeting and planning situations and can ponder over

'what-if' scenarios. It is clear, however, that often managers will not see eye to eye on the objec-

tives that ought to be pursued. Even if the consequences of action are undisputed, a high level of

bargaining and debate may underlie decisions as to the best course of action to be pursued. Often,

top managers face situations with high ambiguity, high stakes and extreme uncertainty. Discord,

contention, debate, disagreement and conflict are natural in such situations. Reasonable people

are likely to perceive an ambiguous and uncertain world in different ways and to make differing

assessments about what might happen in the future. They will show different preferences for alter-

natives. Moreover, senior executives in charge of large and important sectors of the organisation

will receive information and pressure from their own unique constituencies within the firm and

will form objectives that reflect different responsibilities. Executives will act as forceful advocates

for ‘truth’ as they see it. Conflict is apt to ensue.

In such circumstances, budgetary controls may be deployed to further the ends of only some

groups of managers by, for instance, highlighting, measuring and reporting only certain activities

but omitting others. As such, budgets can become synonymous with ‘ammunition’ in that they

determine what is regarded as relevant and worthwhile or problematic. There are even times

when both what is to be aimed for and what consequences may follow from particular actions

are uncertain. Budgets can in such circumstances help rationalise and justify courses of action

over which there is already commitment. In other words, budgetary activities do not enhance

the quality of decisions but simply provide legitimation for what has been decided beforehand.

Although managers often prefer to acknowledge ways in which budgets are useful in providing

answers or in helping them to probe and learn, it is clear that budgets also exist in organisations

as ammunition and rationalisation means.

Types of budget

Time coverage

The purpose(s) for budgeting should guide the time period chosen for the budget. Consider

budgeting for a new Harley-Davidson 500cc motorcycle. If the purpose is to budget for the total

profitability of this new model, a five-year period (or more) may be appropriate (covering design,

manufacture, sales and after-sales support). In contrast, consider budgeting for a Christmas play.

If the purpose is to estimate all cash outlays, a 14-month period from the planning to staging of

the play may be adequate.

The most frequently used budget period is one year. The annual budget is often subdivided by

months for the first quarter and by quarters for the remainder of the year. The budgeted data for

a year are frequently revised as the year unfolds. For example, at the end of the first quarter, the

budget for the next three quarters is changed in light of new information.

Some businesses use *rolling budgets.* A rolling budget is a budget or plan that is always available

for a specified future period by adding a month, quarter or year in the future as the month, quarter

or year just ended is dropped. Thus, a 12-month rolling budget for the March 2022 to February

2023 period becomes a 12-month rolling budget for the April 2022 to March 2023 period the next

month, and so on. There is always a 12-month budget in place. Rolling budgets constantly force

management to think concretely about the forthcoming 12 months, regardless of the month at

hand. Consider Electrolux, the global appliance company, which has a three- to five-year strategic

plan and a one-year rolling budget. A one-year rolling budget for the April 2022 to March 2023

period is superseded by a one-year rolling budget for July 2022 to June 2023 and so on. Rolling

budgets force Electrolux's management to constantly think about the forthcoming 12 months.

Some companies, such as Borealis, Europe's leading polyolefin plastics manufacturer, and Nordea,

the largest financial services group in the Nordic and Baltic Sea region, prepare rolling financial

forecasts that look ahead five quarters.

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An illustration of a master budget

A good way to explain the budgeting process is to walk through the development of an actual

budget. We shall use a master budget because it provides a comprehensive picture of the entire

budgeting process at Wessex Engineering, a manufacturer of aircraft replacement parts. Its job

costing system for manufacturing costs has two direct-cost categories (direct materials and direct

manufacturing labour) and one indirect-cost pool (manufacturing overhead). Manufacturing over-

head (both variable and fixed) is allocated to products using direct manufacturing labour-hours

as the allocation base.

Exhibit 14.3 shows a simplified diagram of the various parts of the master budget for Wessex

Engineering. The master budget summarises the financial projections of all the organisation's

individual budgets. The master budget results in a set of related financial statements for a set time

period, usually a year. The bulk of Exhibit 14.3 presents a set of budgets that together is often

called the operating budget, which is the budgeted profit statement and its supporting budget

schedules. The supporting budget schedules cut across different categories of the value chain from

R&D to customer service. The financial budget is that part of the master budget that comprises

the capital budget, cash budget, budgeted balance sheet, and budgeted statement of cash flows.

It focuses on the impact of operations and planned capital outlays on cash.

The final master budget is often the result of several iterations. Each of its drafts involves

interaction across the various business functions of the value chain.

Basic data and requirements

Wessex Engineering is a machine shop that uses skilled labour and metal alloys to manufacture

two types of aircraft replacement parts: Regular and Heavy-Duty. Wessex managers are ready

to prepare a master budget for the year 2022. To keep our illustration manageable for clarifying

basic relationships, we make the following assumptions:

1 The only source of revenues is sales of the two parts. Non-sales-related revenue, such as interest

income, is assumed to be zero.

2 Work-in-progress stock is negligible and is ignored.

3 Direct materials stock and finished goods stock are costed using the first-in, first-out (FIFO)

method.

4 Unit costs of direct materials purchased and finished goods sold remain unchanged throughout

the budget year (2022).

5 Variable production costs are variable with respect to direct manufacturing labour-hours. Var-

iable non-production costs are variable with respect to revenues. Both assumptions are simpli-

fying ones made to keep our example relatively straightforward.

6 For computing inventoriable costs, all manufacturing costs (fixed and variable) are allocated

using a single allocation base – direct manufacturing labour-hours.

After carefully examining all relevant factors, the executives of Wessex Engineering forecast

the following figures for 2022:

Direct materials

Material 111 alloy

€7 per kilogram

Material 112 alloy

€10 per kilogram

Direct manufacturing labour

€20 per hour

Product

Regular

Heavy-Duty

Content of each product unit

aircraft part

aircraft part

Direct materials 111 alloy

12 kilograms

12 kilograms

Direct materials 112 alloy

6 kilograms

8 kilograms

Direct manufacturing labour

4 hours

6 hours

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Exhibit 14.3

Overview of the master budget for Wessex Engineering

Revenue

budget

Closing

Production

stock

budget

budget

Direct

Direct

manufacturing

Manufacturing

materials

labour costs budget

overhead

costs budget

costs budget

Cost of

goods sold

budget

R&D/Design

costs budget

Operating

budget

Marketing

costs budget

Distribution

costs budget

Customer-

service

costs budget

Administrative

costs budget

Budgeted

profit

statement

Financial

Capital

Cash

Budgeted

Budgeted statement

budget

budget

budget

balance

of cash flow

sheet

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Types of budget

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All direct manufacturing costs are variable with respect to the units of output produced. Additional

information regarding the year 2022 is as follows:

Product

Regular

Heavy-Duty

Expected sales in units

5 000

1 000

Selling price per unit

€600

€800

Target closing stock in units*

1 100

50

Opening stock in units

100

50

Opening stock in euros

€38 400

€26 200

Direct materials

111 Alloy

112 Alloy

Opening stock in kilograms

7000

6000

Target closing stock in kilograms*

8000

2000

*Target stocks depend on expected sales, expected variation in demand for products, and

management philosophies such as just-in-time stock management.

At the anticipated output levels for the Regular and Heavy-Duty aircraft parts, management

believes the following manufacturing overhead costs will be incurred:

Variable: €26 per direct manufacturing labour-hour

Fixed: €420 000 manufacturing overhead cost for production within relevant range

Other (non-production) costs expected to be incurred:

Variable:

R&D/product design

€76 000

Marketing

133 000

Distribution

66 500

Customer service

47 500

Administrative

152 000

€475 000

Fixed:

R&D/product design

60 000

Marketing

67 000

Distribution

33 500

Customer service

12 500

Administrative

222 000

395 000

Total

€870 000

Our task at hand is to prepare a budgeted operating profit statement for the year 2022. As shown

in Exhibit 14.3, this is one component of Wessex's master budget. Other components of the

master budget – the budgeted balance sheet and the cash budget – are discussed in the appendix

to this chapter.

The following supporting budget schedules will be prepared when developing Wessex's

budgeted profit statement:

1 Revenue budget

2 Production budget (in units)

3 Direct materials usage budget and direct materials purchases budget

4 Direct manufacturing labour budget

5 Manufacturing overhead budget

6 Closing stock budget

7 Cost of goods sold budget

8 Other (non-production) costs budget.

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Most organisations have a budget manual, which contains instructions and relevant informa-

tion for preparing budgets. Although the details differ among organisations, the following basic

steps are common for developing a budgeted profit statement. Beginning with the revenue budget,

each budget follows step by step in logical fashion. In most cases, computer software speeds the

budget computations.

Steps in preparing an operating budget

Step 1: Revenue budget The revenue budget (schedule 1) is the usual starting point for budgeting.

Why? Because production (and hence costs) and stock levels generally depend on the forecast

level of revenue.

Schedule 1: Revenue budget for the year ending 31 December 2022

Units

Selling price

Total revenues

Regular

5 000

€600

€3 000 000

Heavy-Duty

1 000

800

800 000

Total

€3 800 000

The €3.8 million is the amount of revenues in the budgeted income statement. The revenue budget

is often the outcome of elaborate information gathering and discussions among sales managers

and field sales representatives.

Pressures can exist for budgeted revenues to be either over- or underestimates of the expected

amounts. Pressure for employees to underestimate budgeted revenues can occur when a company

uses the difference between actual and budget amounts to evaluate marketing managers. These

managers may respond by giving highly conservative forecasts. Padding the budget or introducing

budgetary slack refers to the practice of underestimating budgeted revenues (or overestimating

budgeted costs) in order to make budgeted targets more easily achievable. Introducing budgetary

slack makes it more likely that actual revenues will exceed budgeted amounts. From the marketing

manager's standpoint, budgetary slack hedges against unexpected adverse circumstances.

Occasionally, revenues are limited by available production capacity. For example, unusually

heavy market demand, shortages of personnel or materials, or strikes may cause a company to

exhaust its finished goods stock completely. Additional sales cannot be made because no stock of

the product is available. In such cases, the production capacity – the factor that limits revenue – is

the starting point for preparing the revenue budget.

Step 2: Production budget (in units) After revenues are budgeted, the production budget (sched-

ule 2) can be prepared. The total finished goods units to be produced depends on planned sales

and expected changes in stock levels:

Budgeted

Budgeted

Target closing

Opening

production =

sales

+ finished goods − finished goods

(units)

(units)

stock (units)

stock (units)

Schedule 2: Production budget (in units) for the year ending 31 December 2022

Product

Regular

Heavy-Duty

Budgeted sales (schedule 1)

5000

1000

Add target closing finished goods stock

1100

50

Total requirements

6100

1050

Deduct opening finished goods stock

100

50

Units to be produced

6000

1000

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Types of budget

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When unit sales are not stable throughout the year, managers must decide whether (1) to adjust

production levels periodically to minimise stock held, or (2) to maintain constant production

levels and let stock rise and fall. Increasingly, managers are choosing to adjust production. Chap-

ter 21 discusses just-in-time production systems whose objective is to keep extremely low levels

of stock throughout the year.

Step 3: Direct materials usage budget and direct materials purchases budget The decision

on the number of units to be produced (schedule 2) is the key to computing the usage of direct

materials in quantities and in euros.

Schedule 3A: Direct materials usage budget in kilograms and euros for the year ending

31 December 2022

Material

111 Alloy 112 Alloy

Total

Direct materials to be used in production of

72 000

36 000

Regular parts (6000 units × 12 and

6 kg – see schedule 2)

Direct materials to be used in production of

12 000

8 000

Heavy-Duty parts (1000 units × 12 and

8 kg – see schedule 2)

Total direct materials to be used (kg)

84 000

44 000

Direct materials to be used from opening stock

7 000

6 000

(under a FIFO cost-flow assumption)

Multiply by cost per kilogram of opening stock

€7

€10

Cost of direct materials to be used from

€49 000

€60 000

€109 000

opening stock: (a)

Direct materials to be used from purchases

77 000

38 000

(84 000 – 7000; 44 000 – 6000)

Multiply by cost per kilogram of purchased materials

€7

€10

Cost of direct materials to be used from purchases: (b)

€539 000

€380 000 €919 000

Total costs of direct materials to be used: (a) + (b)

€588 000

€440 000 €1 028 000

Schedule 3B calculates the budget for direct materials purchases, which depends on the budg-

eted direct materials to be used, the opening stock of direct materials, and the target closing stock

of direct materials:

Purchases

Usage

Target closing

Opening stock

of direct = of direct + stock of direct −

materials

materials

stock of direct

of direct materials

Schedule 3B: Direct materials purchases budget for the year ending 31 December 2022

Material

111 Alloy 112 Alloy

Total

Direct materials to be used in production

84 000

44 000

from schedule 3A (kg)

Add target closing direct materials stock (kg)

8 000

2 000

Total requirements (kg)

92 000

46 000

Deduct opening direct materials stock (kg)

7 000

6 000

Direct materials to be purchased (kg)

85 000

40 000

Multiply by cost per kilogram of purchased materials

€7

€10

Total direct materials purchase costs

€595 000

€400 000

€995 000

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Step 4: Direct manufacturing labour budget These costs depend on wage rates, production

methods and hiring plans. The computations of budgeted direct manufacturing labour costs

appear in schedule 4.

Schedule 4: Direct manufacturing labour budget for the year ending 31 December 2022

Direct

Output units

manufacturing

Hourly

produced

labour-hours

Total

wage

(schedule 2)

per unit

hours

rate

Total

Regular

6 000

4

24 000

€20

€480 000

Heavy-Duty

1 000

6

6 000

20

120 000

Total

30 000

€600 000

Step 5: Manufacturing overhead budget The total of these costs depends on how individual

overhead costs vary with the assumed cost driver, direct manufacturing labour-hours. The spe-

cific variable- and fixed-cost categories may be obtained, following discussions with company

personnel in different areas. The calculations of budgeted manufacturing overhead costs appear

in schedule 5.

Schedule 5: Manufacturing overhead budget for the year ending 31 December 2022

At budgeted level of 30 000 direct

manufacturing labour-hours

Variable manufacturing overhead costs

Supplies

€90 000

Indirect manufacturing labour

210 000

Direct and indirect manufacturing

labour fringe costs

300 000

Power

120 000

Maintenance

60 000

€780 000

Fixed manufacturing overhead costs

Depreciation

220 000

Property taxes

50 000

Property insurance

10 000

Supervision

100 000

Power

22 000

Maintenance

18 000

420 000

Total manufacturing overhead costs

€1 200 000

Wessex treats both variable and fixed manufacturing overhead as inventoriable costs. This

stock costing method is termed absorption costing; see Chapter 6 for further discussion. It stocks

manufacturing overhead at the budgeted rate of €40 per direct manufacturing labour-hour (total

manufacturing overhead, €1 200 000 ÷ 30 000 budgeted direct manufacturing labour-hours). It

does not use separate variable and fixed manufacturing overhead rates.

Step 6: Closing stock budget Schedule 6A shows the computation of unit costs for the two prod-

ucts. These unit costs are used to calculate the costs of target closing stocks of direct materials

and finished goods in schedule 6B.

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Types of budget

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Schedule 6A: Computation of unit costs of manufacturing finished goods in 2022

Product

Cost per

Regular

Heavy-Duty

unit of

input*

Inputs*

Amount

Inputs*

Amount

Material 111 alloy

€7

12

€84

12

€84

Material 112 alloy

10

6

60

8

80

Direct manufacturing labour

20

4

80

6

120

Manufacturing overhead

40†

4

160

6

240

Total

€384

€524

*In kilograms or hours.

† Direct manufacturing labour-hours are the sole allocation base for manufacturing overhead (both variable and fixed).

The budgeted manufacturing overhead rate per direct manufacturing labour-hour of €40 was calculated in step 5.

Schedule 6B: Closing stock budget as at 31 December 2022

Kilograms

Cost per kilogram

Total

Direct materials

111 alloy

8 000

€7

€56 000

112 alloy

2 000

10

20 000

€76 000

Units

Cost per unit

Finished goods

Regular

1 100

€384*

€422 400

Heavy-Duty

50

524*

26 200

448 600

Total closing stock

€524 600

* From schedule 6A, this is based on 2022 costs of manufacturing finished goods because under the FIFO costing

method, the units in finished goods closing stock consist of units that are produced during 2022.

Step 7: Cost of goods sold budget The information from schedules 3 to 6 leads to schedule 7:

Schedule 7: Cost of goods sold budget for the year ending 31 December 2022

From schedule

Total

Opening finished goods stock,

1 January 2022

Given*

€64 600

Direct materials used

3A

€1 028 000

Direct manufacturing labour

4

600 000

Manufacturing overhead

5

1 200 000

Cost of goods manufactured

2 828 000

Cost of goods available for sale

2 892 600

Deduct closing finished goods stock,

31 December 2022

6B

448 600

Cost of goods sold

€2 444 000

*Given in the description of basic data and requirements (Regular €38 400, Heavy-Duty €26 200).

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Note that the following holds:

Cost of

Opening finished

Cost of goods

Closing finished

=

+

–

goods sold

goods stock

manufactured

goods stock

Step 8: Other (non-production) costs budget Schedules 2 to 7 cover budgeting for Wessex's

production area of the value chain. For brevity, other areas of the value chain are combined into

a single schedule.

Schedule 8: Other (non-production) costs budget for the year ending 31 December 2022

Variable costs

R&D/product design

€76 000

Marketing

133 000

Distribution

66 500

Customer service

47 500

Administrative

152 000

475 000*

Fixed costs

R&D/product design

60 000

Marketing

67 000

Distribution

33 500

Customer service

12 500

Administrative

222 000

395 000

Total costs

€870 000

*Total variable cost for schedule 8 is €0.125 per revenue euro (€475 000 ÷ €3 800 000).

Step 9: Budgeted operating profit statement Schedules 1, 7 and 8 provide the necessary infor-

mation to complete the budgeted operating profit statement, shown in Exhibit 14.4. Of course,

more details could be included in the profit statement, and then fewer supporting schedules would

be prepared.

Top management's strategies for achieving revenue and operating profit goals influence the costs

planned for the different business functions of the value chain. As strategies change, the budget

allocations for different elements of the value chain will also change. For example, a shift in

strategy towards emphasising product development and customer service will result in increased

resources being allocated to these parts of the master budget. The actual data resulting from

this strategy will be compared with budgeted results. Management can then evaluate whether

the focus on product development and customer service has been successful. This feedback is an

important input in subsequent plans.

Exhibit 14.4

Budgeted operating profit for Wessex Engineering for the year

ending 31 December 2022

Revenues

Schedule 1

€3 800 000

Costs

Cost of goods sold

Schedule 7

2 444 000

Gross margin

1 356 000

Operating costs

R&D/product design costs

Schedule 8

€136 000

Marketing costs

Schedule 8

200 000

Distribution costs

Schedule 8

100 000

Customer-service costs

Schedule 8

60 000

Administration costs

Schedule 8

374 000

870 000

Operating profit

€486 000

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Financial planning models

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Financial planning models

Exhibit 14.1 shows how strategic analysis, planning and budgeting are interrelated. The value of

budgets to managers in their strategic analysis and planning is enhanced by conducting sensitivity

analysis. Sensitivity analysis is a ‘what-if’ technique that examines how a result will change if the

original predicted data are not achieved or if an underlying assumption changes. In its simplest

form, it can be performed in the straightforward way shown in Chapter 8. Here a hand-held

calculator would suffice to do the calculations. Commercial software packages are now available

for more complex tasks, such as sensitivity analysis for the financial statements found in a master

budget. These packages do the calculations for financial planning models, which are mathematical

representations of the relationships across operating activities, financial activities and financial

statements. Consider Wessex Engineering. Its financial planning model assumes the following:

● Direct materials and direct manufacturing labour costs vary proportionately with the quanti-

ties of Regular and Heavy-Duty parts produced.

● Variable manufacturing overhead costs vary with direct manufacturing labour-hours.

● Variable non-manufacturing costs vary with revenues.

Exhibit 14.5 presents the budgeted operating profit for three what-if scenarios for Wessex

Engineering:

● *Scenario 1.* A 3% decrease in the selling price of the Regular part and a 3% decrease in the

selling price of the Heavy-Duty part.

● *Scenario 2.* A 4% decrease in units sold of the Regular part and a 4% decrease in units sold of

the Heavy-Duty part.

● *Scenario 3.* A 5% increase in the price per kilogram of 111 alloy and a 5% increase in the price

per kilogram of 112 alloy.

Exhibit 14.5 indicates that, relative to the master budget, budgeted operating profit decreases by

21% under scenario 1, by 10% under scenario 2, and by 9% under scenario 3. Managers can use

this information to plan actions that they may need to take if faced with these scenarios.

Exhibit 14.5

Effect of changes in budget assumptions on budgeted operating

profit for Wessex Engineering

Key assumptions

Direct

materials

Budgeted

Units sold

Selling price

cost*

operating profit

Change

What-if

Heavy-

Heavy-

111

112

from master

scenario

Regular

Duty

Regular

Duty

Alloy

Alloy

€

budget

Master budget 5000

1000

€600

€800

€7.00

€10.00

€486 000

–

Scenario 1

5000

1000

582

776

7.00

10.00

386 250 21% decrease

Scenario 2

4800

960

600

800

7.00

10.00

438 273 10% decrease

Scenario 3

5000

1000

600

800

7.35

10.50

448 380

9% decrease

* Per kilogram.

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Concepts in action

P.F. Chang’s and internet-based budgeting

P.F. Chang’s China Bistro is an Asian-themed casual dining restaurant chain, with more than 300 locations globally and approximately $900 million in annual revenues. The com-

pany uses Adaptive Insights Business Planning Cloud, an internet-based software platform, to manage its planning and budgeting process. P.F. Chang's develops a budget for revenue, food cost, labour cost, and overhead expenses for each location. The Adaptive software consolidates those budgets to quickly create a companywide budget. The system has reduced budget and forecasting cycle times by 80%. As one P.F. Chang's manager concluded, 'In the time it takes me to make a lettuce wrap, I'm able to put together a budget!'

Managers measure key performance indicators in real-time at each location to better understand costs, improve profit margins and fund growth. Restaurant managers can gauge the success of marketing campaigns and the impact of menu changes. Managers can work with each other and perform 'what if?' budget scenario analysis from anywhere in the world. Recently, chief financial officer Jim Bell examined how kitchen staff cuts at the company's Boston restaurants affected profitability while on a flight from Spokane, Washington, to Phoenix, Arizona.

Sources: 'Cooking up a modern FP&A environment for a global dining empire', Adaptive Insights customer case study, June 2017 (https://www.adaptiveinsights.com/customer-stories/p-f-changs); Shumsky, T. (2017) 'Corporate finance cuts back on Excel', *The Wall Street Journal,* 24 November

(https://www.wsj.com/articles/stop-using-excel-finance-chiefs-tell-staffs-1511346601).

Kaizen budgeting

Chapter 1 noted how continuous improvement is one of the key issues facing management today.

The Japanese use the term kaizen for continuous improvement. Kaizen budgeting is a budgetary

approach that explicitly incorporates continuous improvement during the budget period into the

resultant budget numbers.

Consider our Wessex Engineering example in schedule 4. The 2022 budget assumes that it will

take 4.0 and 6.0 manufacturing labour-hours, respectively, for each Regular and Heavy-Duty aircraft

part. A kaizen budgeting approach would incorporate continuous reduction in these manufacturing

labour-hour requirements during 2022. Assume Wessex budgets the following labour-hour amounts:

Budgeted amounts (labour-hours)

Regular

Heavy-Duty

January–March 2022

4.00

6.00

April–June 2022

3.90

5.85

July–September 2022

3.80

5.70

October–December 2022

3.70

5.55

Unless Wessex meets these continuous improvement goals, unfavourable variances will be reported.

Note that in the Wessex budget, the implications of these direct labour-hour reductions would

extend to reductions in variable manufacturing overhead costs, given that direct manufacturing

labour-hours is the driver of these costs.

Activity-based budgeting

Chapter 11 explained how activity-based costing systems can lead to detailed reporting of past

and current costs. Activity-based costing principles can also be extended in the budgeting of

future costs. Activity-based budgeting focuses on the cost of activities necessary to produce and

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sell products and services. It separates indirect costs into separate homogeneous activity cost

pools. Management uses the cause-and-effect criterion to identify the cost drivers for each of

these indirect-cost pools. Four key steps in activity-based budgeting are:

1 Determine the budgeted costs of performing each unit of activity at each activity area.

2 Determine the demand for each individual activity based on budgeted, production, new product

development, and so on.

3 Calculate the costs of performing each activity.

4 Describe the budget as costs of performing various activities (rather than budgeted costs of

functional or conventional value-chain spending categories).

Many UK managers have reported the following ranking of the benefits from activity-based

budgeting: (1) ability to set more realistic budgets, (2) better identification of resource needs, (3)

linking of costs to outputs, (4) clearer linking of costs with staff responsibilities, and (5) identi-

fication of budgetary slack.

Consider activity-based budgeting for the R&D/product design parts of the value chain at

Ahamed Company. Five activity areas and their cost drivers have been identified. The budgeted

2022 rates for the costs at each activity area are as follows:

Activity

Cost driver/budgeted cost rate

● Computer-aided design (CAD) – using computer

CAD hours, €80 per hour

software to design aircraft parts

● Manual design – manually designing aircraft parts

Manual design hours, €50 per hour

● Prototyping development – building actual

Prototyping hours, €60 per hour

versions of aircraft parts

● Testing – examining how new aircraft parts

Testing hours, €40 per hour

'perform' in different operating conditions

● Procurement – purchasing supplies and

Purchase orders, €25 per purchase order

component parts

Exhibit 14.6 presents the activity-based budget for January to December 2022. Ahamed Com-

pany budgets usage of the cost driver in each activity area based on budgeted production and new

product development. This budgeted usage of the cost driver for each activity is multiplied by the

respective budgeted costs rate per activity to obtain the budgeted activity costs. The budgeted

total costs for R&D/product design is the sum of the budgeted costs of the individual activities

in that part of the value chain.

The activity-based budget in Exhibit 14.6 is for one part of Ahamed's value chain. In many

cases, the same activity will appear in more than one part of the value chain. For example, pro-

curement activities such as purchase ordering and supplier payment are found in most areas of

the value chain. Companies using activity-based budgeting may choose to present their budgets

at either the individual value-chain level or at some more basic activity level such as procurement

by combining budgeted procurement costs from different parts of the value chain.

Exhibit 14.6

Activity-based budget for R&D/product design costs of Ahamed Company: January to December 2022

Budgeted

Budgeted rate

Budgeted

Activity area

usage of driver

per cost driver

costs

Computer-aided design

200 hours

€80

€16 000

Manual design

70 hours

50

3 500

Prototyping development

80 hours

60

4 800

Testing

280 hours

40

11 200

Procurement

120 purchase orders

25

3 000

Total

€38 500

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Budgeting and responsibility accounting

Organisational structure and responsibility

Organisational structure is an arrangement of lines of responsibility within the entity. A company

such as British Petroleum may be organised primarily by business function: exploration, refin-

ing and marketing. Diageo, a major consumer products company, structures itself by regions:

North America, Europe and International. Another company, Norsk Hydro, is organised by

product groups such as Agriculture, Oil and Gas, Light Metals and Petrochemicals. The managers

of the individual groups each have decision-making authority concerning all the business func-

tions (manufacturing, marketing, and so on) within that group. Some companies, such as Swiss

pharmaceutical firm Novartis, combine functional and divisional structures, for example leaving

marketing within divisions but having manufacturing organised as a business function to supply

products to different divisions. There is no perfect organisation structure. Companies choose the

structure that best meets their needs at that time, making the trade-off between efficiency and

end-to-end business authority. Firm structures are sometimes a product of the past reflecting

legacy decisions that may no longer follow a contemporary managerial logic.

To attain the goals described in the master budget, an organisation must coordinate the efforts

of all its employees – from the top executive through all levels of management to every supervised

worker. Coordinating the organisation's efforts means assigning responsibility to managers who

are accountable for their actions in planning and controlling human and physical resources. Man-

agement is in essence a human activity. Budgets exist not for their own sake, but to help managers

achieve their own pursuits and thereby contribute to meeting those of the organisation.

Managers in charge of organisational units are referred to as heading a responsibility centre.

A responsibility centre is a part, segment or subunit of an organisation whose manager is account-

able for a specified set of activities. The higher the manager's level, the broader the responsibility

centre he or she manages and, generally, the larger the number of subordinates who report to him

or her. Responsibility accounting is a system that measures the plans (by budgets) and actions (by

actual results) of each responsibility centre. Four major types of responsibility centre are:

1 Cost centre – manager accountable for costs only.

2 Revenue centre – manager accountable for revenues only.

3 Profit centre – manager accountable for revenues and costs.

4 Investment centre – manager accountable for investments, revenues and costs.

Take for instance the Maintenance Department of Hôtel Ibis which would be a cost centre

because the maintenance manager is responsible only for costs. Hence, the budget would empha-

sise costs. The Sales Department of the hotel would be a revenue centre because the sales manager

is responsible only for revenues. Here the budget would emphasise revenues. The hotel manager

would be in charge of a profit centre because the hotel manager is accountable for both revenues

and costs. Here the budget would emphasise both revenues and costs. The regional manager

responsible for investments in new hotel projects and for revenues and costs would be in charge

of an investment centre. Revenue, costs and the investment base would be emphasised in the

budget for this manager.

Responsibility accounting affects behaviour. Consider the following incident. The Sales Depart-

ment requests a rush production run. The plant scheduler argues that it will disrupt his production

and will cost a substantial, though not clearly determined, amount of money. The answer coming

from sales is, ‘Do you want to take the responsibility of losing the X Company as a customer?’ Of

course, the production scheduler does not want to take such a responsibility, and he gives up, but

not before a heavy exchange of arguments and the accumulation of a substantial backlog of ill

feeling. The accountant proposes an innovative solution. He analyses the payroll in the Assembly

Department to determine the costs involved in getting out rush orders. This information elimi-

nates the cause for argument. Henceforth, any rush order would be accepted by the production

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scheduler, ‘no questions asked’. The extra costs would be duly recorded and charged to the Sales

Department. Within one company which experienced this change, the tension created by rush

orders disappeared, and, somehow, the number of rush orders requested by the Sales Department

was progressively reduced to an insignificant level.

The responsibility accounting approach traces costs to either (1) the individual who has the

best knowledge about why the costs arose, or (2) the activity that caused the costs. In this incident,

the cause was the sales activity, and the resulting costs were charged to the Sales Department. If

rush orders occur regularly, the Sales Department might have a budget for such costs, and the

department's actual performance would then be compared with the budget.

Feedback

Budgets coupled with responsibility accounting provide systematic help for managers, particularly

if managers interpret the feedback carefully. Managers, accountants and students of management

accounting sometimes use variances (the difference between the actual results and the budgeted

results) appearing in the responsibility accounting system to pinpoint fault for operating prob-

lems. In looking at variances, managers should focus on whom they should ask and not on whom

they should blame. Variances only suggest questions or direct attention to persons who should

have the relevant information. Nevertheless, variances, properly used, can be helpful in three ways:

1 *Early warning.* Variances alert managers early to events not easily or immediately evident.

Managers can then take corrective actions or exploit available opportunities.

2 *Performance valuation.* Variances inform managers about how well the company has per-

formed in implementing its strategies.

3 *Evaluating strategy.* Variances sometimes signal to managers that their strategies are ineffective.

Responsibility and controllability

Definition of controllability

Controllability is the degree of influence that a specific manager has over costs, revenues or other

items in question. A controllable cost is any cost that is primarily subject to the influence of a given

manager of a given responsibility centre for a given time span. A responsibility accounting system

could either exclude all uncontrollable costs from a manager's performance report or segregate

such costs from the controllable costs. For example, a machining supervisor's performance report

Summary might be confined to quantities (not costs) of direct materials, direct manufacturing

labour, power and supplies. In practice, controllability is difficult to pinpoint:

1 Few costs are clearly under the sole influence of one manager. For example, costs of direct

materials may be influenced by a purchasing manager, but such costs also depend on market

conditions beyond the manager's control. Quantities used may be influenced by a produc-

tion manager, but quantities used also depend on the quality of materials purchased. Moreo-

ver, managers often work in teams. How can individual responsibility be evaluated in a team

decision?

2 With a long enough time span, all costs will come under somebody's control. However, most

performance reports focus on periods of a year or less. A current manager may have inherited

problems and inefficiencies from his or her predecessor. For example, present managers may

have to work under undesirable contracts with suppliers or trade unions that were negotiated

by their predecessors. How can we separate what the current manager actually controls from

the results of decisions made by others? Exactly what is the current manager accountable for?

Answers to such questions may not be clear cut.

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Senior managers differ in how they embrace the controllability notion when evaluating those

reporting to them. For example, a newly appointed company president took his management

team on a cruise and commented, ‘I expect everybody to meet their budget targets no matter what

happens, and those who don’t should stand a little closer to the railing.’ Other presidents and

managing directors believe that a more risk-sharing approach with managers is preferable where

non-controllable factors are taken into account when making judgements about the performance

of managers who miss their budget.

Emphasis on information and behaviour

Managers should avoid overemphasising controllability. Responsibility accounting is more

far-reaching. It focuses on *information* and *knowledge,* not control. The key question is: Who

is the best informed? Put another way: Who is the person who can tell us the most about

the specific item in question, regardless of that person’s ability to exert personal control? For

instance, purchasing managers may be held accountable for total purchase costs, not because of

their ability to affect market prices, but because of their ability to predict uncontrollable prices

and explain uncontrollable price changes. Similarly, managers at a Pizza Hut unit may be held

responsible for operating income of their units, even though they do not fully control selling

prices or the costs for many food items, and have minimal flexibility as to items to sell or their

ingredients. Why? Because unit managers are in the best position to explain variances between

their actual operating profit and their budgeted operating profit. Some organisations change

performance systems with well thought-out aims. Consider for instance the pay-for-performance

scheme at the Hilti group, a family-owned company based in Lichtenstein but selling con-

struction products and services in 120 countries. In early 2019, 190 Hilti salespeople in eastern

Europe were switched from a salary that was 65 per cent fixed and 35 per cent dependent on

meeting performance targets to an almost entirely fixed salary. As Clark (2022) explains, ‘The

results were impressive: the country group outperformed the market by a factor of 1.4 in 2019,

double the rate of 2018. Staff turnover fell by more than 4 per cent and satisfaction with pay

rose by 19 per cent, double the company-wide increase. Crucially, sales efforts did not drop off.

The new system had obvious advantages over the older one, which was so complex it was hard

to understand exactly how it worked and bred unhelpful habits: staff would rush to close sales

deals to meet monthly targets, rather than nurture more valuable, long-term customer ties.'

Management accountants need to understand that behavioural and financial structures affect

outcomes of control changes.

Performance reports for responsibility centres may include uncontrollable items and this can

change behaviour in the direction top management desires. For example, some companies have

changed the accountability of a cost centre to a profit centre. Why? Because the manager will

probably behave differently. A cost-centre manager may emphasise production efficiency and

de-emphasise the pleas of sales personnel for faster service and rush orders. In a profit centre,

the manager is responsible for both costs and revenues. Thus, even though the manager still has

no control over sales personnel, the manager will now more likely weigh the impact of his or her

decisions on costs and revenues, rather than solely on costs.

Managerial behaviour has to be reflective of what organisational stakeholders value. In

response to pressures from consumers, investors, governments, and nongovernmental organisa-

tions, many companies proactively manage and report on environmental performance. Budgeting

can be a highly effective tool to motivate managers to lessen carbon emissions. Several companies,

such as British Telecom and Unilever, set science-based carbon reduction goals based on climate

models. These science-based targets are stretched to spur innovation, prompt the development of

new technologies and business models, and prepare companies for future regulatory and policy

changes. What is the effect of stretched targets on actual emission reduction? There exists research

which shows that companies that set more difficult targets (to be achieved over several years) com-

plete a higher percentage of such targets. This is particularly true for carbon reduction projects

in high-polluting industries that require more innovation (Ioannou et al., 2016).

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Summary

The following points are linked to the chapter's learning objectives.

1 The master budget summarises the financial projections of all the organisation's budgets and plans. It expresses

management's comprehensive operating and financial plans – the formalised outline of the organisation's financial

objectives and their means of attainment. Budgets are tools that by themselves are neither good nor bad. How

managers administer budgets is the key to their value. When administered wisely, budgets compel management

planning, provide definite expectations that are an appropriate framework for judging subsequent performance,

and promote communication and coordination among the various subunits of the organisation. Budgetary control

inevitably affects managerial behaviour and organisational processes.

2 Two major parts of the master budget are the operating budget, which is the budgeted operating profit statement

and its supporting budget schedules, and the financial budget, which comprises the capital budget, cash budget,

budgeted balance sheet and budgeted statement of cash flows.

3 The foundation for the operating budget is generally the revenue budget. The following supporting budget

schedules are geared to the revenue budget: production budget, direct materials usage budget, direct materials

purchases budget, direct manufacturing labour budget, manufacturing overhead costs budget, closing stock budget,

cost of goods sold budget, R&D/design budget, marketing budget, distribution budget, and customer-service

budget. The operating budget ends with the budgeted profit statement.

4 Financial planning models in the form of mathematical statements of the relationships among operating activities,

financial activities and other factors that affect the budget, are of great significance to managers. These models

allow management to conduct what-if (sensitivity) analyses of the effects on the master budget of changes in the

original predicted data or changes in budget assumptions.

5 Kaizen budgeting captures the continuous improvement notion that is a key management concern. Costs in kaizen

budgeting are based on future improvements that are yet to be implemented rather than on current practices or

methods.

6 Activity-based budgeting focuses on the costs of activities necessary to produce and sell products and services. It is

inherently linked to activity-based costing, but differs in its emphases on future costs and future usage of activity areas.

7 A responsibility centre is a part, segment or subunit of an organisation whose manager is accountable for a

specified set of activities. Four major types of responsibility centres are cost centres, revenue centres, profit centres

and investment centres. Responsibility accounting systems measure the plans (by budgets) and actions (by actual

results) of each responsibility centre.

8 Controllable costs are costs that are primarily subject to the influence of a given manager of a given responsibility

centre for a given time span. Performance reports of responsibility-centre managers, however, often include costs,

revenues and investments that the managers cannot control. Responsibility accounting associates financial items

with managers on the basis of which manager has the most knowledge and information about the specific items,

regardless of the manager's ability to exercise full control. The important question is who should be asked, not

who should be blamed. Naturally, budgets will affect human behaviour. Organisations can thus use budgets as

a mechanism to achieve focused aims like reaching desired quarterly sales targets as well as wider aims such as

reducing environmentally damaging emissions and investing in sustainability-conscious initiatives.

Appendix

The cash budget

The illustration in the chapter features the operating budget. The other major part of the master

budget is the financial budget, which includes the capital budget, cash budget, budgeted balance

sheet and budgeted statement of cash flows. This appendix focuses on the cash budget and the

budgeted balance sheet. Capital budgeting was discussed in Chapter 13; coverage of the budgeted

statement of cash flows is not discussed here and may be found in books on financial accounting

and corporate finance.

Suppose Wessex Engineering in our chapter illustration had the balance sheet for the year

ended 31 December 2021 shown in Exhibit 14.7. The budgeted cash flows for 2022 are as follows:

Quarters			
1	**2**	**3**	**4**
Collections from customers			
€913 700	€984 600	€976 500	€918 400

Disbursements

Direct materials

314 360

283 700

227 880

213 800

Payroll

557 520

432 080

409 680

400 720

Income taxes

50 000

46 986

46 986

46 986

Other costs

184 000

156 000

151 000

149 000

Machinery purchase

–

–

–

35 080

The quarterly data are based on the cash effects of the operations formulated in schedules

1 to 8 in the chapter, but the details of that formulation are not shown here in order to keep the

illustration relatively brief and focused.

The company wants to maintain a €35 000 minimum cash balance at the end of each quarter.

The company can borrow or repay money in multiples of €1000 at an interest rate of 12% per

year. Management does not want to borrow any more cash than is necessary and wants to repay

as promptly as possible. By special arrangement, interest is calculated and paid when the principal

is repaid. Assume that borrowing takes place at the beginning and repayment at the end of the

quarters in question. Interest is calculated to the nearest euro.

Exhibit 14.7

Balance sheet for Wessex Engineering for the year ending

31 December 2021

Assets

Current assets

Cash

€30 000

Debtors

400 000

Direct materials

109 000

Finished goods

64 600

€603 600

Property, plant and equipment

Land

200 000

Building and equipment

2 200 000

Accumulated depreciation

(690 000)

1 710 000

Total

€2 313 600

Liabilities and stockholders' equity

Current liabilities

Creditors

€150 000

Income taxes payable

50 000

€200 000

Stockholders' equity

Common stock, no-par, 25 000 shares outstanding

350 000

Retained earnings

1 763 600

2 113 600

Total

€2 313 600

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Appendix: The cash budget

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Suppose an accountant at Wessex Engineering is given the preceding data and the other data

contained in the budgets in the chapter. He is instructed as follows:

1 Prepare a cash budget. That is, prepare a statement of cash receipts and disbursements by

quarters, including details of borrowing, repayment and interest expense.

2 Prepare a budgeted balance sheet.

3 Prepare a budgeted profit statement, including the effects of interest expense and income taxes.

Assume that income taxes for 2022 (at a tax rate of 40%) are €187 944.

Preparation of budgets

1 The cash budget (Exhibit 14.8) is a schedule of expected cash receipts and disbursements.

It predicts the effects on the cash position at the given level of operations. Exhibit 14.9 presents

the cash budget by quarters to show the impact of cash-flow timing on bank loans and their

repayment. In practice, monthly – and sometimes weekly – cash budgets are very helpful for

cash planning and control. Cash budgets help avoid unnecessary idle cash and unexpected

cash deficiencies. Cash balances are kept in line with needs. Ordinarily, the cash budget has

the following main sections:

a The opening cash balance plus cash receipts equals the total cash available before financ-

ing. Cash receipts depend on collections of debtors, cash sales, and miscellaneous recur-

ring sources such as rental or royalty receipts. Information on the prospective collectibility

of debtors is needed for accurate predictions. Key factors include bad-debt (uncollectable

accounts) experience and average time lag between sales and collections.

b Cash disbursements include the following items:

(i) Direct materials purchases – depends on credit terms extended by suppliers and

invoice-paying patterns of the buyer.

(ii) Direct labour and other wage and salary outlays – depends on payroll dates.

(iii) Other costs – depends on timing and credit terms. *Be sure to note that depreciation does*

not require a cash outlay.

(iv) Other disbursements – outlays for property, plant and equipment, and for long-term

investments.

c Financing requirements depend on how the total cash available for needs, keyed as (a) in

Exhibit 14.9, compares with the total cash needed, keyed as (c). Total cash needed includes

total disbursements, keyed as (b), plus the minimum closing cash balance desired. The

financing plans will depend on the relationship between total cash available for needs and

total cash needed. If there is excess cash, loans may be repaid or temporary investments

made. The outlays for interest expense are usually shown in this section of the cash budget.

d The closing cash balance. The total effect of the financing decisions on the cash budget,

keyed as (d) in Exhibit 14.9, may be positive (borrowing) or negative (repayment), and the

closing cash balance is (a) – (b) + (d).

The cash budget in Exhibit 14.9 shows the pattern of short-term 'self-liquidating cash loans'.

Seasonal peaks of production or sales often result in heavy cash disbursements for purchases,

payroll and other operating outlays as the products are produced and sold. Cash receipts from

customers typically lag behind sales. The loan is self-liquidating in the sense that the borrowed

money is used to acquire resources that are combined for sale, and the proceeds from sales are

used to repay the loan. This self-liquidating cycle – sometimes called the working-capital cycle,

cash cycle or operating cycle – is the movement from cash to stock to debtors and back to cash.

2 The budgeted balance sheet is presented in Exhibit 14.9. Each item is projected in light of the

details of the business plan as expressed in all the previous budget schedules. For example,

the closing balance of debtors of €406 800 is calculated by adding the budgeted revenues of

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€3 800 000 (from schedule 1) to the opening balance of €400 000 (given) and subtracting cash

receipts of €3 793 200 (given in Exhibit 14.10).

3 The budgeted operating profit statement is presented in Exhibit 14.10. It is merely the budgeted

operating profit statement in Exhibit 14.4 expanded to include interest expense and income

taxes.

For simplicity, the cash receipts and disbursements were given explicitly in this illustration.

Frequently, there are lags between the items reported on the accrual basis of accounting in an

income statement and their related cash receipts and disbursements. In the Wessex Engineering

example, collections from customers are derived under two assumptions: (1) in any month, 10%

of sales are cash sales and 90% of sales are on credit, and (2) half the total credit sales are col-

lected in each of the two months subsequent to the sale, as Exhibit 14.11 shows. Of course, such

schedules of cash collections depend on credit terms, collection histories and expected bad debts.

Similar schedules can be prepared for operating costs and their related cash disbursements.

Exhibit 14.8

Cash budget for Wessex Engineering for the year ending 31 December 2022

Quarters

Year as

1

2

3

4

a whole

Cash balance, opening

€30 000

€35 820

€35 934

€35 188

€30 000

Add receipts

Collections from customers

913 700

984 600

976 500

918 400

3 793 200

Total cash available for needs (a)

943 700

1 020 420

1 012 434

953 588

3 823 200

Deduct disbursements

Direct materials

314 360

283 700

227 880

213 800

1 039 740

Payroll

557 520

432 080

409 680

400 720

1 800 000

Income taxes

50 000

46 986

46 986

46 986

190 958

Other costs

184 000

156 000

151 000

149 000

640 000

Machinery purchase

0

0

0

35 080

35 080

Total disbursements (b)

1 105 880

918 766

835 546

845 586

3 705 778

Minimum cash balance desired

35 000

35 000

35 000

35 000

35 000

Total cash needed (c)

1 140 880

953 766

870 546

880 586

3 740 778

Cash excess (deficiency)

€(197 180)

€66 654

€141 888

€73 002

€82 422

(a) - (c)*

Financing

Borrowing (at beginning)

€198 000

€0

€0

€0

€198 000

Repayment (at end)

–

(62 000)

(130 000)

(6 000)

(198 000)

Interest (at 12% per year)†

–

(3 720)

(11 700)

(720)

(16 140)

Total effects of financing (d)

€198 000

€(65 720)

€(141 700)

€(6 720)

€(16 140)

Cash balance, closing

(a) - (c) + (d)

€35 820

€35 934

€35 188

€101 282

€101 282

* Excess of total cash available over total cash needed before current financing.

† Note that the interest payments pertain only to the amount of principal being repaid at the end of a given quarter. The specific computations regarding interest are €62 000 × 0.12

2

× = €3720;

4

€130 000 × 0.12

3

× = €11 700; and €6000 × 0.12

4

× = €720. Also note that *depreciation does not require a cash outlay.*

4

4

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Appendix: The cash budget

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Exhibit 14.9

Wessex Engineering: budgeted balance sheet for the year ending 31 December 2022

Assets

Current assets

Cash (from Exhibit 14.8)

€101 282

Debtors*

406 800

Direct materials†

76 000

Finished goods†

448 600

€1 032 682

Property, plant and equipment

Land‡

200 000

Building and equipment§

€2 235 080

Accumulated depreciation||

(920 000)

1 315 080

1 515 080

Total

€2 547 762

Liabilities and stockholders' equity

Current liabilities

Creditors#

€105 260

Income taxes payable**

46 986

€152 246

Stockholders' equity

Common stock, no-par, 25 000 shares

outstanding††

350 000

Retained earnings‡‡

2 045 516

2 395 516

Total

€2 547 762

Opening balances are used as the starting point for most of the following computations:

* €400 000 + €3 800 000 revenues – €3 793 200 receipts (Exhibit 14.9) = €406 800.

† From schedule 6B.

‡ From opening balance sheet.

§ €2 200 000 + €35 080 purchases = €2 235 080.

|| €690 000 + €230 000 depreciation from schedule 5.

€150 000 + €995 000 (schedule 3B) – €1 039 740 (Exhibit 14.9) €105 260.

There are no wages payable. The detailed payroll consists of €600 000 direct manufacturing labour

(schedule 4) + €620 000 manufacturing overhead salaries (€200 000 indirect manufacturing

labour + €320 000 direct and indirect manufacturing labour fringe cost + €100 000

supervision from schedule 5) + R & D/design salaries €105 000 (schedule 8) + marketing salaries

€130 000 (schedule 8) + distribution salaries and wages €60 000 (schedule 8) + customer-service

salaries €40 000 (schedule 8) + administration salaries and clerical wages

€245 000 (schedule 8) = €1 800 000, all of which was disbursed per Exhibit 14.8.

** €50 000 + €187 944 current year – €190 958 payment = €46 986.

†† From opening balance sheet.

‡‡ €1 763 600 + €281 916 net income per Exhibit 14.11 = €2 045 516.

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Exhibit 14.10

Budgeted profit statement for Wessex Engineering for the year ending 31 December 2022

Revenues

Schedule 1

€3 800 000

Costs

Cost of goods sold

Schedule 7

2 444 000

Gross margin

1 356 000

Operating costs

R&D/product design costs

Schedule 8

€136 000

Marketing costs

Schedule 8

200 000

Distribution costs

Schedule 8

100 000

Customer-service costs

Schedule 8

60 000

Administration costs

Schedule 8

374 000

870 000

Operating profit

486 000

Interest expense

Exhibit 14.9

16 140

Profit before income taxes

469 860

Income taxes

Given

187 944

Net profit

€281 916

Exhibit 14.11

Wessex Engineering’s collections from customers

Cash

collections

in Q3 as

May

June

July

August

September

a whole

Monthly revenue budget for

Wessex (given)

Credit sales, 90%

€307 800

€307 800

€280 800

€280 800

€280 800

Cash sales, 10%

34 200

34 200

31 200

31 200

31 200

Total revenues

€342 000

€342 000

€312 000

€312 000

€312 000

Cash collections from:

Cash sales this month

€31 200

€31 200

€31 200

Credit sales last month

153 900*

140 400‡

140 400§

Credit sales two months ago

153 900†

153 900*

140 400‡

_____

Total Collections

€339 000

€325 500

€312 000

€976 500

* 0.50 × €307 800 (June sales) = €153 900.

† 0.50 × €307 800 (May sales) = €153 900.

‡ 0.50 × €280 800 (July sales) = €140 400.

§ 0.50 × €280 800 (August sales) = €140 400.

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References and further reading

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References and further reading

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CHAPTER 14

Assessment material

Review questions

14.1 Define master budget.

14.2 What are the elements of the budgeting cycle?

14.3 ‘Strategy, plans and budgets are unrelated to one another.’ Do you agree? Explain.

14.4 ‘Budgeted performance is a better criterion than past performance for judging managers.’ Do you

agree? Explain.

14.5 ‘Budgets are wonderful vehicles for communication.’ Comment.

14.6 Define kaizen budgeting.

14.7 Cite three benefits companies report from using an activity-based budgeting approach.

14.8 Define responsibility accounting.

14.9 Explain how the choice of the responsibility centre type (cost, revenue, profit or investment)

affects budgeting.

14.10 Outline three criticisms of traditional budgeting and a related proposal for change.

Exercises

Basic level

14.11 Cost of goods sold budget, fill in the missing numbers (20 minutes)

Embutidos Vallina SA has two direct-cost categories: direct materials and direct manufacturing

labour. Its single indirect-cost category (manufacturing overhead) is allocated on the basis of

machine-hours. Numbers taken from the monthly budgets for June 2022 and November 2022 are

as follows:

June 2022

November 2022

Direct materials used

€?

€847 000

Opening finished goods stock

87 000

?

Closing finished goods stock

?

94 000

Direct manufacturing labour

481 000

389 000

Manufacturing overhead

772 000

?

Cost of goods manufactured

2 215 000

1 878 000

Cost of goods sold

2 189 000

?

Cost of goods available for sale

?

1 949 000

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Required

Fill in the missing numbers.

***14.12 Sales and production budget** (5 minutes)

Lux-Ernster expects 2022 sales of 100 000 units of serving trays. Lux-Ernster's opening stock for

2022 is 7000 trays; target closing stock, 11 000 trays.

Required

Calculate the number of trays budgeted for production in 2022.

14.13 Sales and production budget (5 minutes)

Sarandrea Srl had a target closing stock of 70 000 four-litre bottles of burgundy wine. Sarandrea's

opening stock was 60 000 bottles, and its budgeted production was 900 000 bottles.

Required

Calculate the budgeted sales in number of bottles.

14.14 Direct materials purchases budget (5 minutes)

Europa-Dyonisos SA produces wine. The company expects to produce 1.5 million two-litre bottles

of Chablis in 2022. Europa-Dyonisos purchases empty glass bottles from an outside supplier. Its

target closing stock of such bottles is 50 000; its opening stock is 20 000. For simplicity, ignore

breakage.

Required

Calculate the number of bottles to be purchased in 2022.

14.15 Budgeting material purchases (10 minutes)

Tiilikainen Oy has prepared a sales budget of 42 000 finished units for a three-month period. The

company has a stock of 22 000 units of finished goods on hand at 31 December and has a target

finished goods stock of 24 000 units at the end of the succeeding quarter.

It takes 3 litres of direct materials to make 1 unit of finished product. The company has a stock

of 90 000 litres of direct materials at 31 December and has a target closing stock of 110 000 litres.

Required

How many litres of direct materials should be purchased during the three months ending

31 March?

14.16 Budgetary slack and ethics (CMA, adapted) (15 minutes)

Jacek Zielinski, the budget manager at Jelenia-Silesia, a manufacturer of child furniture and

carriages, is working on the 2022 annual budget. In discussions with Sylwester Czereszewski, the

sales manager, Jacek discovers that Sylwester's sales projections are lower than what Sylwester

believes are actually achievable. When Jacek asked Sylwester about this, Sylwester said, 'Well, we

don't want to fall short of the sales projections, so we generally give ourselves a little breathing

room by lowering the sales projections anywhere from 5 to 10%.' Jacek also finds that Andrzej

Sazanowicz, the production manager, makes similar adjustments. He pads budgeted costs, adding

10% to estimated costs.

Required

As a management accountant, should Jacek take the position that the behaviour described by

Sylwester and Andrzej is unethical?

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Intermediate level

14.17 Revenue, production and purchases budget (15–20 minutes)

The Suzuki Company in Japan has a division that manufactures two-wheel motorcycles. Its budg-

eted sales for Model G in 2016 is 800 000 units. Suzuki's target closing stock is 100 000 units, and

its opening stock is 120 000 units. The company's budgeted selling price to its distributors and

dealers is 400 000 yen per motorcycle.

Suzuki buys all its wheels from an outside supplier. No defective wheels are accepted. (Suzuki's

needs for extra wheels for replacement parts are ordered by a separate division of the company.)

The company's target closing stock is 30 000 wheels, and its opening stock is 20 000 wheels. The

budgeted purchase price is 16 000 yen per wheel.

Required

1 Calculate the budgeted revenue in yen.

2 Calculate the number of motorcycles to be produced.

3 Calculate the budgeted purchases of wheels in units and in yen.

14.18 Budgeted profit and loss account (CMA, adapted) (30 minutes)

Castelo Branco Lda is a manufacturer of video-conferencing products. Regular units are manu-

factured to meet marketing projections, and specialised units are made after an order is received.

Maintaining the video-conferencing equipment is an important area of customer satisfaction.

With the recent downturn in the computer industry, the video-conferencing equipment segment

has suffered, leading to a decline in Castelo Branco's financial performance. The following profit

and loss account shows results for the year 2022:

Profit and loss account for Castelo Branco for the year

ending 31 December 2022 (in thousands)

Sales

Equipment

€6000

Maintenance contracts

1800

Total income

€7800

Cost of goods sold

4600

Gross profit

3200

Operating costs

Marketing

600

Distribution

150

Customer maintenance

1000

Administration

900

Total operating costs

2650

Operating profit

€550

Castelo Branco's management team is in the process of preparing the 2016 budget and is studying

the following information:

a Selling prices of equipment are expected to increase by 10% as the economic recovery begins.

The selling price of each maintenance contract is unchanged from 2022.

b Equipment sales in units are expected to increase by 6%, with a corresponding 6% growth in

units of maintenance contracts.

c The cost of each unit sold is expected to increase by 3% to pay for the necessary technology

and quality improvements.

d Marketing costs are expected to increase by €250 000, but administration costs are expected

to be held at 2022 levels.

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Exercises

e Distribution costs vary in proportion to the number of units of equipment sold.

f Two maintenance technicians are to be added at a total cost of €130 000, which covers wages

and related travel costs. The objective is to improve customer service and shorten response time.

g There is no opening or closing stock of equipment.

Required

Prepare a budgeted profit and loss account for 2023.

14.19 Responsibility of purchasing agent (Adapted from a description by R. Villers) (15 minutes)

Ágúst Karlsson is the purchasing agent for the Akureyri Manufacturing Company. Bjarni Jóhannesson

is head of the Production Planning and Control Department. Every six months, Bjarni gives Ágúst

a general purchasing programme. Ágúst gets specifications from the Engineering Department. He

then selects suppliers and negotiates prices. When he took this job, Ágúst was informed very clearly

that he bore responsibility for meeting the general purchasing programme once he accepted it from

Bjarni. During week 24, Ágúst was advised that Part No. 1234 – a critical part – would be needed

for assembly on Tuesday morning of week 32. He found that the regular supplier could not deliver.

He called everywhere and finally found a supplier in Selfoss, and accepted the commitment. He

followed up by post. Yes, the supplier assured him, the part would be ready. The matter was so

important that on Thursday of week 31, Bjarni checked by phone. Yes, the shipment had left in

time. Bjarni was reassured and did not check further. But on Tuesday of week 32, the part had not

arrived. Enquiry revealed that the shipment had been misdirected and was still in Reykjavik.

Required

What department should bear the costs of time lost in the plant? Why? As purchasing agent, do

you think it fair that such costs be charged to your department?

***14.20 Cash budgeting** (40–50 minutes)

On 1 December 2022, Tire-Lire, SNC, is attempting to project cash receipts and disbursements

to 31 January 2023. On this latter date, a note will be payable in the amount of €100 000. This

amount was borrowed in September to carry the company through the seasonal peak in November

and December.

The trial balance on 1 December shows in part the following information:

Cash

€10 000

Debtors

280 000

Allowance for bad debts

€15 800

Stock

87 500

Creditors

92 000

Sales terms call for a 2% discount if payment is made within the first 10 days of the month after

purchase, with the balance due by the end of the month after purchase. Experience has shown

that 70% of the billings will be collected within the discount period, 20% by the end of the

month after purchase, 8% in the following month, and that 2% will be uncollectable. There are

no cash sales.

The average selling price of the company's products is €100 per unit. Actual and projected sales are

October actual

€180 000

November actual

250 000

December estimated

300 000

January estimated

150 000

February estimated

120 000

Total estimated for year ending 30 June 2023

1 500 000

All purchases are payable within 15 days. Thus approximately 50% of the purchases in a month

are due and payable in the next month. The average unit purchase cost is €70. Target closing stocks

are 500 units plus 25% of the next month’s unit sales.

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Total budgeted marketing, distribution and customer-service costs for the year are €400 000. Of

this amount, €150 000 is considered fixed (and includes depreciation of €30 000). The remainder

varies with sales. Both fixed and variable marketing, distribution and customer-service costs are

paid as incurred.

Required

Prepare a cash budget for December and January. Supply supporting schedules for collections of

receivables for raw materials, and marketing, distribution and customer-service costs.

14.21 Budgetary control issues (From CIMA Management Accounting Pillar Managerial Level Paper,

May 2001) (40 minutes)

M plc designs, manufactures and assembles furniture. The furniture is for home use and therefore

varies considerably in size, complexity and value. One of the departments in the company is the

Assembly Department. This department is labour intensive; the workers travel to various locations

to assemble and fit the furniture using the packs of finished timbers that have been sent to them.

Budgets are set centrally and they are then given to the managers of the various departments

who then have the responsibility of achieving their respective targets. Actual costs are compared

against the budgets and the managers are then asked to comment on the budgetary control state-

ment. The statement for April for the Assembly Department is shown below.

Budget

Actual

Variance

Assembly labour-hours

6 400

7 140

$

$

$

Assembly labour

51 970

58 227

6 257

Adverse

Furniture packs

224 000

205 000

19 000

Favourable

Other materials

23 040

24 100

1 060

Adverse

Overheads

62 060

112 340

50 280

Adverse

Total

361 070

399 667

38 597

Adverse

Note: the costs shown are for assembling and fitting the furniture (they do not include time spent travelling

to jobs and the related costs). The hours worked by the manager are not included in the figure given for the

assembly labour-hours.

The Manager of the Assembly Department is new to the job and has very little previous experience

of working with budgets but he does have many years' experience as a supervisor in assembly

departments. Based on that experience he was sure that the department had performed well. He

has asked for your help in replying to a memo he has just received asking him to 'explain the

serious overspending in his department'. He has sent you some additional information about the

budget:

1 The budgeted and actual assembly labour costs include the fixed salary of $2050 for the

Manager of the Assembly Department. All of the other labour is paid for the hours they work.

2 The cost of furniture packs and other materials is assumed by the central finance office of

M plc to vary in proportion to the number of assembly labour-hours worked.

3 The budgeted overhead costs are made up of three elements: a fixed cost of $9000 for services

from central headquarters, a stepped fixed cost which changes when the assembly hours exceed

7000 hours, and some variable overheads. The variable overheads are assumed to vary in pro-

portion to the number of assembly labour-hours. Working papers for the budget showed the

impact on the overhead costs of differing amounts of assembly labour-hours:

Assembly labour-hours

5 000

7 500

10 000

Overhead costs

$54 500

$76 500

$90 000

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The actual fixed costs for April were as budgeted.

Required

1 Prepare, using the additional information that the Manager of the Assembly Department has

given you, a budgetary control statement that would be more helpful to him.

2 a Discuss the differences between the *format of the statement* that you have produced and

that supplied by M plc;

b Discuss the assumption made by the central office of M plc that costs vary in proportion

to assembly labour-hours.

3 Discuss whether M plc should change to a system of participative budgeting.

Advanced level

***14.22 Activity-based budgeting** (20–30 minutes)

Nyborg Supermarkets AS is preparing its activity-based budget for January 2022 for its operating

costs (that is, its non-cost of goods purchased for resale costs). Its current concern is with its four

activity areas (which are also indirect-cost categories in its product profitability reporting system):

a *Ordering* – covers purchasing activities. The cost driver is the number of purchase orders

b *Delivery* – covers the physical delivery and receipt of merchandise. The cost driver is the

number of deliveries

c *Shelf-stacking* – covers the stacking of merchandise on store shelves and the ongoing restacking

before sale

d *Customer support* – covers assistance provided to customers, including check-out and bagging.

Assume Nyborg Supermarkets has only three product areas: soft drinks, fresh produce and pack-

aged food. The budgeted usage of each cost driver in these three areas of the store and the January

2022 budgeted cost driver rates are as follows:

January 2022 budgeted

Cost driver rates

amount of driver used

2021

January 2022 Soft

Fresh Packaged

Activity area and driver

actual rate budgeted rate drinks produce

food

Ordering (per purchase order)

DKK 1000

DKK 900

24

14

Delivery (per delivery)

DKK 800

DKK 820

12

62

19

Shelf-stacking (per hour)

DKK 200

DKK 210

16

172

94

Customer support (per item sold)

DKK 2.0

DKK 1.8

4 600

34 200

10 750

Required

1 What is the total budgeted cost for each activity area in January 2022?

2 What advantages might Nyborg Supermarkets gain by using an activity-based budgeting

approach over (say) an approach for budgeting operating costs based on a budgeted percent-

age of cost of goods sold times the budgeted cost of goods sold?

14.23 Kaizen approach to activity-based budgeting (continuation of Exercise 14.22)

(20–30 minutes)

Nyborg Supermarkets has a kaizen (continuous improvement) approach to budgeting monthly

activity area costs for each month of 2022. February's budgeted cost driver rate is 0.998 times

the budgeted January 2022 rate. March's budgeted cost driver rate is 0.998 times the budgeted

February 2022 rate, and so on. Assume that March 2022 has the same budgeted amount of cost

drivers used as did January 2022.

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Required

1 What is the total budgeted cost for each activity area in March 2022?

2 What are the benefits of Nyborg Supermarkets adopting a kaizen budgeting approach? What

are the limitations?

14.24 From CIMA Performance Operations, section B, November 2014 (25 minutes)

FG is preparing its cash budgets for January, February and March.

Budgeted data are as follows:

November

December

January

February

March

Sales (units)

750

800

800

850

900

Production (units)

800

800

850

900

950

Direct labour and variable

£48 000

£48, 000

£51 000

£54 000

£56 000

overheads incurred

Fixed overheads incurred

£20 000

£20 000

£20 000

£20 000

£20 000

(excluding depreciation)

The selling price per unit is £200. The purchase price per kg of raw material is £25. Each unit of

finished product requires 2 kg of raw materials which are purchased on credit in the month before

they are used in production. Suppliers of raw materials are paid one month after purchase.

All sales are on credit. 80% of customers, by sales value, pay one month after sale and the

remainder pay two months after sale.

The direct labour cost, variable overheads and fixed overheads are paid in the month in which

they are incurred.

Machinery costing £100 000 will be delivered in February and paid for in March.

Depreciation, including that on the new machinery, is as follows:

Machinery and equipment

£3500 per month

Motor vehicles

£800 per month

The opening cash balance at 1 January is estimated to be £15 000.

Required

Prepare a cash budget for each of the three months, January, February and March.

14.25 From CIMA Performance Management, section A, March 2014 (15 minutes)

PB is a car production company. PB uses a system of standard costing to set its budgets. Budgets

are set annually by the Finance Department and approved by the Board of Directors of PB. The

Finance Department prepares variance reports each month for review at the Board of Directors'

meeting, where actual performance is monitored by comparison to budgeted figures.

A new Finance Director has recently joined PB from a competitor organisation where there was

a Total Quality Management culture. The new Finance Director of PB is keen to discuss the

implementation of kaizen costing at the next meeting of the Board of Directors. The new Finance

Director would like to review the current planning and control system at PB with a view to making

changes so that it could support kaizen costing concepts.

Required

Explain THREE changes required to PB's planning and control system to support the adoption

of kaizen costing concepts.

14.26 Comprehensive review of budgeting (50–60 minutes)

British Beverages bottles two soft drinks under licence to Cadbury Schweppes at its Manchester

plant. Bottling at this plant is a highly repetitive, automated process. Empty bottles are removed

from their carton, placed on a conveyor, and cleaned, rinsed, dried, filled, capped and heated (to

reduce condensation). The only stock held is either direct materials or else finished goods. There

is no work in progress.

The two soft drinks bottled by British Beverages are lemonade and diet lemonade. The syrup for

both soft drinks is purchased from Cadbury Schweppes. Syrup for the regular brand contains a

higher sugar content than the syrup for the diet brand.

British Beverages uses a lot size of 1000 cases as the unit of analysis in its budgeting. (Each case

contains 24 bottles.) Direct materials are expressed in terms of lots, where one lot of direct materi-

als is the input necessary to yield one lot (1000 cases) of beverage. In 2022, the following purchase

prices are forecast for direct materials:

Lemonade

Diet lemonade

Syrup

£1200 per lot

£1100 per lot

Containers (bottles, caps, etc.)

£1000 per lot

£1000 per lot

Packaging

£800 per lot

£800 per lot

The two soft drinks are bottled using the same equipment. The equipment is cleaned daily, but it

is only rinsed when a switch is made during the day between diet lemonade and lemonade. Diet

lemonade is always bottled first each day to reduce the risk of sugar contamination. The only

difference in the bottling process for the two soft drinks is the syrup.

Summary data used in developing budgets for 2022 are as follows:

a Sales:

- Lemonade, 1080 lots at £9000 selling price per lot.
- Diet lemonade, 540 lots at £8500 selling price per lot.

b Opening (1 January 2022) stock of direct materials:

- Syrup for lemonade, 80 lots at £1100 purchase price per lot.
- Syrup for diet lemonade, 70 lots at £1000 purchase price per lot.
- Containers, 200 lots at £950 purchase price per lot.
- Packaging, 400 lots at £900 purchase price per lot.

c Opening (1 January 2022) stock of finished goods:

- Lemonade, 100 lots at £5300 per lot.
- Diet lemonade, 50 lots at £5200 per lot.

d Target closing (31 December 2022) stock of direct materials:

- Syrup for lemonade, 30 lots.
- Syrup for diet lemonade, 20 lots.
- Containers, 100 lots.
- Packaging, 200 lots.

e Target closing (31 December 2022) stock of finished goods:

- Lemonade, 20 lots.
- Diet lemonade, 10 lots.

f Each lot requires 20 direct manufacturing labour-hours at the 2022 budgeted rate of £25 per

hour. Indirect manufacturing labour costs are included in the manufacturing overhead forecast.

g Variable manufacturing overhead is forecast to be £600 per hour of bottling time; bottling time

is the time the filling equipment is in operation. It takes two hours to bottle one lot of lemonade

and two hours to bottle one lot of diet lemonade. Fixed manufacturing overhead is forecast to

be £1 200 000 for 2022.

h Hours of budgeted bottling time is the sole allocation base for all fixed manufacturing overhead.

i Administration costs are forecast to be 10% of the cost of goods manufactured for 2022.

Marketing costs are forecast to be 12% of sales for 2022. Distribution costs are forecast to be

8% of sales for 2022.

Required

Assume British Beverages uses the first-in, first-out (FIFO) method for costing all stock. On the

basis of the preceding data, prepare the following budgets for 2022:

1 Revenue budget (in £)

2 Production budget (in units)

3 Direct materials usage budget (in units and £)

4 Direct materials purchases budget (in units and £)

5 Direct manufacturing labour budget

6 Manufacturing overhead costs budget

7 Closing finished goods stock budget

8 Cost of goods sold budget

9 Marketing costs budget

10 Distribution costs budget

11 Administration costs budget

12 Budgeted profit and loss account.

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CHAPTER 15

Flexible budgets, variances and management control: I

Learning objectives

Managers often quantify their plans in the form of budgets. A survey of UK firm finance professionals indicated that 72% believe that the ability to plan ahead is their most important quality. But few managers believe budgeting should be an activity that is exclusively carried out just by

After studying this chapter, you

accountants. Still, the Gartner 2021 CFO survey revealed that 18% of

should be able to:

finance leaders believe they should have full leadership over planning,

●

Describe the difference between a

budgeting and forecasting processes. ‘The Future of Planning Budgeting

static budget and a flexible budget

and Forecasting Global Survey 2017’, with responses from 850 senior

finance professionals from across the globe, indicated that more than

●

Illustrate how a flexible budget

half of CFOs and their senior finance executives agree or strongly agree

can be developed and calculate

that we will become more dependent on machine learning to drive

flexible-budget and sales-volume

more accurate forecasts. While the application of artificial intelligence

variances

and machine learning which use behavioural algorithms that enables

●

Interpret the price and efficiency

‘self-learning’ and rapidly increases forecast accuracy is presently low

variances for direct-cost input

among respondents (14%), this is expected to grow very quickly across categories

planning, budgeting and forecasting activities. A clear advantage of using

●

Explain why purchasing-

machine learning in analytics is that it allows computers to find hidden

performance measures should

insights in vast data stores (FSN, 2017).

focus on more factors than just

This chapter focuses on how flexible budgets and variances can play

price variances for inputs

a key role in management planning and control. Flexible budgets and

●

Describe how the continuous

variances help managers gain insights into why the actual results differ

improvement theme can be

from the planned performance. Each variance we calculate is the differ-

integrated into variance analysis

ence between an actual result and a budgeted amount. Organisations differ widely in how they calculate and label the budgeted amounts they

- Perform variance analysis in activity-

report in their own accounting system. Some organisations rely heavily based costing systems

on past results; others conduct detailed engineering or time-and-motion

- Describe benchmarking and how

studies. The term standard is frequently used when such studies underlie it can be used by managers in

the budgeted amounts. A standard is a carefully predetermined amount; variance analysis

it is usually expressed on a per unit basis. In practice, there is not a precise dividing line between a *budgeted amount* and a *standard amount.* We use *budgeted amount* as the more general term because some budgeted amounts may not be carefully predetermined amounts. However, all of the variances we discuss can be calculated using standard amounts or budgeted amounts. Variances assist managers in their planning and con-

trol decisions. Management by exception is the practice of concentrating

on areas not operating as anticipated and giving less attention to areas

operating as expected.

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Static budgets and flexible budgets

This chapter illustrates both static budgets and flexible budgets. A static budget is a budget that

is based on one level of output; it is not adjusted or altered after it is set, regardless of ensuing

changes in actual output (or actual revenue and cost drivers). A flexible budget is adjusted in

accordance with ensuing changes in actual output (or actual revenue and cost drivers). A flexible

budget is calculated at the end of the period when the actual output is known. A static budget is

developed at the start of the budget period based on the planned output level for the period. As

we shall see, a flexible budget enables managers to calculate a richer set of variances than does a

static budget. The budgeted amount is a benchmark; that is, it is a point of reference from which

comparisons may be made. Benchmarks include:

1 Financial variables reported in a company's own accounting system (such as Nissan's manu-

facturing cost for a Juke model). This is the focus of this chapter.

2 Financial variables not reported in a company's own accounting system (such as when Nissan

uses the estimated cost Mazda incurs to manufacture a CX-3 as the benchmark for evaluating

the cost competitiveness of its Juke product line).

3 Non-financial variables (such as Nissan's assembly-line defect rate).

A favourable variance – denoted F – is a variance that increases operating income relative to the

budgeted amount. An unfavourable variance – denoted U – is a variance that decreases operating

income relative to the budgeted amount.

Budgets, both static and flexible, can differ in their level of detail. Many organisations present

budgets with broad summary figures that can be broken down into more detailed figures via com-

puter software programs. In this book, the term *level* followed by a number denotes the amount

of detail indicated by the variance(s) isolated. Level 0 reports the least detail, Level 1 offers more

information, and so on.

The example of the Sofiya Company illustrates static budgets and flexible budgets. Sofiya

manufactures and sells a single product, a distinctive jacket that requires many materials, tailor-

ing and hand operations. Sales are made to independent clothing stores and retail chains. Sofiya

sets budgeted revenues (budgeted selling price times budgeted units sold) based on input from its

marketing personnel and on an analysis of general and industry economic conditions.

The costing system at Sofiya includes both manufacturing costs and marketing costs. There

are direct and indirect costs in each category:

Direct costs

Indirect costs

Manufacturing

Direct materials

Variable manufacturing overhead

Direct manufacturing labour

Fixed manufacturing overhead

Marketing

Direct marketing labour

Variable marketing overhead

Fixed marketing overhead

Sofiya's manufacturing costs include direct materials (all variable), direct manufacturing labour

(all variable) and manufacturing overhead (both variable and fixed). Its marketing costs (which

include distribution and customer service costs as well as advertising costs) are made up of direct

marketing labour (primarily distribution personnel, which are all variable) and marketing over-

head (both variable and fixed). The cost driver for direct materials, direct manufacturing labour

and variable manufacturing overhead is the *number of units manufactured.* The cost driver for

direct marketing labour and variable marketing overhead is the *number of units sold.* The revenue

driver is the *number of units sold.* The relevant range for the €180 selling price per jacket and

for the cost drivers in both manufacturing and marketing is from 8000 to 16 000 units. All costs

at Sofiya are either driven by output units or are fixed. We make this simplifying assumption to

highlight the basic approach to flexible budgeting.

In order to focus on the key concepts, we assume Sofiya has no opening or closing stocks.

Chapter 7 discussed some of the complexities that occur when opening or closing stocks exist.

The actual results and the static-budget amounts of Sofiya for April 2022 are as follows:

Static-budget

Actual results

amounts

Units sold

10 000

12 000

Revenues

€1 850 000

€2 160 000

Variable costs

1 120 000

1 188 000

Fixed costs

705 000

710 000

Operating profit

25 000

262 000

Exhibit 15.1 presents the Level 0 and Level 1 variance analyses for April 2022. Level 0 gives the

least-detailed comparison of the actual and budgeted operating profit. The unfavourable variance

of €237 000 is simply the result of subtracting the budgeted operating profit of €262 000 from the

actual operating profit of €25 000:

Static-budget variance = Actual results – Static-budget amount of operating profit

= €25 000 − €262 000

= €237 000 U *

*U = unfavourable effort on operating profit.

This variance is often called a static-budget variance because the number used for the budgeted

amount (€262 000) is taken from a static budget.

Level 1 analysis in Exhibit 15.1 provides managers with more detailed information on the

static-budget variance of operating profit of €237 000 U. The additional information added in

Exhibit 15.1

Static-budget-based variance analysis for Sofiya for April 2022

Level 0 analysis

Actual operating profit

€25 000

Budgeted operating profit

262 000

Static-budget variance of operating profit

237 000 U*

Level 1 analysis

Actual

Static-budget

Static

results

variances

budget

(1)

(2) = (1) − (3)

(3)

Units sold

10 000

2 000 U

12 000

Revenues

€1 850 000

€310 000 U

€2 160 000

Variable costs

1 120 000

68 000 F

1 188 000

Contribution margin

730 000

242 000 U

972 000

Fixed costs

705 000

5 000 F

710 000

Operating profit

€25 000

€237 000 U

€262 000

€237 000 U

Total static-budget variance

*F = favourable effect on operating profit; U = unfavourable effect on operating profit.

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Level 1 pertains to revenues, variable costs and fixed costs. The budgeted contribution margin

percentage of 45.0%(€972 000 ÷ €2 160 000) decreases to 39.5%(€730 000 ÷ €1 850 000)

for the actual results.

While Level 1 contains more information than Level 0, additional insights into the causes of

variances can be gained by incorporating a flexible budget into the computation of variances.

Steps in developing a flexible budget

Sofiya's five-step approach to developing a flexible budget is relatively straightforward given the

assumption that all costs are either variable with respect to output units or fixed. The five steps

are as follows.

Step 1: Determine the budgeted selling price per unit, the budgeted variable costs per unit,

and the budgeted fixed costs Each output unit (a jacket) has a budgeted selling price of €180.

The budgeted variable cost is €99 per jacket. Column 2 of Exhibit 15.2 has a breakdown of this

€99 amount. The budgeted fixed costs total €710 000 (€276 000 manufacturing and €434 000

marketing).

Step 2: Determine the actual quantity of the revenue driver Sofiya's revenue driver is the num-

ber of units sold. In April 2022, Sofiya sold 10 000 jackets.

Step 3: Determine the flexible budget for revenue based on the budgeted unit revenue and

the actual quantity of the revenue driver

Flexible-budget revenues = €180 × 10 000

= €1 800 000

Exhibit 15.2

Flexible-budget data for Sofiya for April 2022

Bugeted cost

Flexible budget Actual results for

Line item

amount per unit amount 10 000

10 000 units

(1)

(2)

(3)

(4)

Revenue

€180

€1 800 000

€1 850 000

Variable costs

Direct materials

60

600 000

688 200

Direct manufacturing labour

16

160 000

198 000

Direct marketing labour

6

60 000

57 600

Variable manufacturing overhead

12

120 000

130 500

Variable marketing overhead

5

50 000

45 700

Total variable costs

99

990 000

1 120 000

Contribution margin

€81

810 000

730 000

Fixed costs

Manufacturing overhead

276 000

285 000

Marketing overhead

–

434 000

420 000

Total fixed costs

–

710 000

705 000

Total costs

–

1 700 000

1 825 000

Operating profit

€100 000

€25 000

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Step 4: Determine the actual quantity of the cost driver(s) Sofiya's cost driver for manufactur-

ing costs is units produced. The cost driver for marketing costs is units sold. In April 2022, Sofiya

produced and sold 10 000 jackets.

Step 5: Determine the flexible budget for costs based on the budgeted unit variable costs

and fixed costs and the actual quantity of the cost driver(s)

Flexible-budget variable costs

Manufacturing

= €88 × 10 000 =

€880 000

Marketing

= €11 × 10 000 =

110 000

€990 000

Flexible-budget fixed costs

Manufacturing

=

€276 000

Marketing

=

434 000

=

€710 000

These five steps enable Sofiya to move to a Level 2 variance analysis, which helps them bet-

ter explore reasons for the €237 000 unfavourable static-budget variance of operating profit.

Exhibit 15.2 shows the flexible budget for 10 000 units (column 3) as well as the actual results for

10 000 units (column 4).

Flexible-budget variances and sales-volume variances

Exhibit 15.3 presents the Level 2 flexible-budget-based variance analysis for Sofiya. Note that the

€237 000 unfavourable static-budget variance of operating profit is now split into two categories:

a flexible-budget variance and a sales-volume variance.

Level 1

Static-budget variance

€237 000 U

Sales-volume variance

Level 2

Flexible-budget variance

€75 000 U

€162 000 U

The flexible-budget variance is the difference between the actual results and the flexible-budget

amount for the actual levels of the revenue and cost drivers. The sales-volume variance is the dif-

ference between the flexible-budget amount and the static-budget amount; unit selling prices, unit

variable costs and fixed costs are held constant. Knowing these variances helps managers better

explain the static-budget variance of €237 000 U.

Sales-volume variances

The flexible-budget amounts in column 3 of Exhibit 15.3 and the static-budget amount in column

5 are both calculated using the budgeted selling prices and budgeted costs. This variance is labelled

the ‘sales-volume variance’ because in many contexts the number of units sold is both the revenue

driver and the cost driver. For the operating profit line item:

Sales-volume variance = Flexible-budget amount – Static-budget amount

= €100 000 – €262 000

= €162 000 U

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Exhibit 15.3

Flexible-budget-based variance analysis for Sofiya for April 2022

Level 2 analysis

Flexible-budget Flexible

Sales-volume

Static

Actual results

variances

budget

variances

budget

(1)

(2) = (1) − (3)

(3)

(4) = (3) − (5)

(5)

Units sold

10 000

0

10 000

2 000 U

12 000

Revenues

€1 850 000

€50 000 F*

€1 800 000

€360 000 U

€2 160 000

Variable costs

1 120 000

130 000 U

990 000

198 000 F

1 188 000

Contribution margin

730 000

80 000 U

810 000

162 000 U

972 000

Fixed costs

705 000

5 000 F

710 000

0

710 000

Operating profit

€25 000

€75 000 U

€100 000

€162 000 U

€262 000

€75 000 U

€162 000 U

Total flexible-budget variance

Total sales-volume variance

€237 000 U

Total static-budget variance

*F = favourable effect on operating profit; U = unfavourable effect on operating profit.

In our Sofiya example, this sales-volume variance in operating profit arises solely because it sold

10 000 units, which was 2000 less than the budgeted 12 000 units.

Flexible-budget variances

The first three columns of Exhibit 15.3 compare the actual results with the flexible-budget

amounts. Flexible-budget variances are reported in column 2 for four line items in the income

statement:

Flexible-budget variance = Actual results − Flexible-budget amount

For the operating profit line item, the flexible-budget variance is €75 000 U (€25 000 – €100 000).

This variance arises because the actual selling price, unit variable costs and fixed costs differ from

the budgeted amounts. The actual and budgeted unit amounts for the selling price and variable

costs are as follows:

Actual unit amount

Budgeted unit amount

Selling price

€185

€180

Variable cost

112

99

The actual fixed cost of €705 000 is €5000 less than the budgeted €710 000 amount.

The flexible-budget variance pertaining to revenues is often called a selling-price variance

because it arises solely from differences between the actual selling price and the budgeted selling

price:

Selling-price variance = (Actual selling price − Budgeted selling price) × Actual units sold

= (€185 − €180) × 10 000

= €50 000 F

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Sofiya has a favourable selling-price variance because the actual selling price exceeds the budg-

eted amount (by €5). Marketing managers typically are best informed as to why this selling price

difference arose.

Price variances and efficiency variances for inputs

The flexible-budget variance (Level 2) captures the difference between the actual results and

the flexible budget. The sources of this variance (as regards costs) are the individual differ-

ences between actual and budgeted prices or quantities for inputs. The next two variances we

discuss – price variances and efficiency variances for inputs – analyse such differences. This

information helps managers to better understand past performance and to plan for future

performance. We call this a Level 3 analysis as it takes a more detailed analysis of the Level 2

variances.

A price variance is the difference between the actual price and the budgeted price multiplied

by the actual quantity of input in question (such as direct materials purchased or used). Price

variances are sometimes called input-price variances or rate variances (especially when those var-

iances are for direct labour). An efficiency variance is the difference between the actual quantity

of input used (such as metres of cloth of direct materials) and the budgeted quantity of input

that should have been used, multiplied by the budgeted price. Efficiency variances are sometimes

called input-efficiency variances or usage variances.

The relationship of these two variances to those we have already discussed for Sofiya is as

follows:

Level 1

Static-budget

variance

Level 2

Flexible-budget

Sales-volume

variance

variance

Level 3

Price variance

Efficiency variance

Obtaining budgeted input prices and input quantities

Sofiya's two main sources of information about budgeted input prices and budgeted input quan-

tities are:

1 *Actual input data from past periods.* Most companies have past data on actual input prices

and actual input quantities. These past amounts could be used for the budgeted amounts in a

flexible budget. Past data are typically available at a relatively low cost. The limitations of using

this source are: (a) past data include past inefficiencies, and (b) past data do not incorporate

any expected changes planned to occur in the budget period.

2 *Standards developed by Sofiya.* A standard is a carefully predetermined amount; it is usu-

ally expressed on a per unit basis. Sofiya uses time-and-motion and engineering studies

to determine its standard amounts. For example, it conducts a detailed breakdown of the

steps in making a jacket. Each step is then assigned a standard time based on work by a

skilled operator using equipment operating in an efficient manner. The advantages of using

standard amounts are that: (a) they can exclude past inefficiencies, and (b) they can take

into account expected changes in the budget period. An example of (a) is a supplier mak-

ing dramatic improvements in its ability to consistently meet Sofiya's demanding quality

requirements for the cloth material used to make jackets. An example of (b) is the acqui-

sition of new looms that operate at a faster speed and that enable work to be done with

lower reject rates.

Sofiya has developed standard inputs and standard costs for each of its variable-cost items. A

standard input is a carefully predetermined quantity of input (such as kilograms of materials or

hours of labour time) required for one unit of output. A standard cost is a carefully predetermined

cost. Standard costs can relate to units of inputs or units of outputs. Sofiya's budgeted cost for

each variable-cost item is calculated using the following formula:

Standard inputs allowed for 1 output unit × Standard cost per input unit

The variable-cost items are:

● *Direct materials*: 2.00 square metres of cloth input allowed per output unit (jacket) manufac-

tured, at €30 standard cost per square metre.

Standard cost = 2.00 × €30 = €60.00 per output unit manufactured

● *Direct manufacturing labour*: 0.80 manufacturing labour-hours of input allowed per output

unit manufactured, at €20 standard cost per hour.

Standard cost = 0.80 × €20 = €16.00 per output unit manufactured

● *Direct marketing labour*: 0.25 marketing labour-hours of input allowed per output unit sold,

at €24 standard cost per hour.

Standard cost = 0.25 × €24 = €6.00 per output unit sold

● *Variable manufacturing overhead*: allocated on the basis of 1.20 machine-hours per output unit

manufactured, at €10 standard cost per machine-hour.

Standard cost = 1.20 × €10 = €12.00 per output unit manufactured

● *Variable marketing overhead*: allocated on the basis of 0.125 direct marketing labour-hours

per output unit sold, at €40 standard cost per hour.

Standard cost = 0.125 × €40 = €5.00 per output unit sold

These standard cost computations explain how Sofiya developed the numbers in column 2 of

Exhibit 15.2.

The breakdown of the flexible-budget variance into its price and efficiency components is

important when evaluating individual managers. At Sofiya, the production manager is responsible

for the efficiency variance, while the purchasing manager is responsible for the price variance. This

separate computation of the price variance enables the efficiency variance to be calculated using

budgeted input prices. Thus, judgements about efficiency (the quantity of inputs used to produce

a given level of output) are not affected by whether actual input prices differ from budgeted input

prices. A word of caution, however, is appropriate. As will be discussed in following text, the

causes of price and efficiency variances can be interrelated. For this reason, do not interpret these

variances in isolation from each other.

Price variances and efficiency variances for inputs

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An illustration of price and efficiency variances for inputs

Consider Sofiya's three direct-cost categories. The actual cost for each of these three categories is:

Direct materials purchased and used

Direct materials costs

€688 200

Square metres of cloth input purchased and used

22 200

Actual price per metre

€31

Direct manufacturing labour

Direct manufacturing labour costs

€198 000

Manufacturing labour-hours of input

9 000

Actual price per hour

€22

Direct marketing labour

Direct marketing labour costs

€57 600

Marketing labour-hours of input

2 304

Actual price per hour

€25

For simplicity, we assume here that direct materials used is equal to direct materials purchased.

The actual results and the flexible-budget amounts for each category of direct costs for the

10 000 actual output units in April 2022 are:

Actual

Flexible

Flexible-budget

results

budget

variances

Direct materials

€688 200

€600 000

(10 000 × €60)

€88 200 U

Direct manufacturing labour

198 000

160 000

(10 000 × €16)

38 000 U

Direct marketing labour

57 600

60 000

(10 000 × €6)

2 400 F

Total

€943 800

€820 000

€123 800 U

We now use these Sofiya Company data to illustrate the input-price and input-efficiency variances.

Consider first the input-price variances.

Price variances

The formula for calculating a price variance is:

Price variance = (Actual price of input − Budgeted price of input) × Actual quantity of input

Price variances for each of Sofiya’s three direct-cost categories are:

□□ **Actual**

Budgeted □

□

□

□

□□

□ **price −**

price □

Actual

□

□

□

□

□

□□

quantity

Input-price

Direct-cost category

□ **of input**

of input

□

□□ ×

of input

=

variance

Direct materials

(€31 − €30)

×

22 200

= €22 200 U

Direct manufacturing labour

(€22 − €2)

×

9 000

=

18 000 U

Direct marketing labour

(€25 − €24)

×

2 304

=

2 304 U

All three price variances are unfavourable (they reduce operating profit) because the actual

price of each direct-cost input exceeds the budgeted price; that is, Sofiya incurred more cost per

input unit than was budgeted.

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Always consider a broad range of possible causes for price variances. For example, Sofiya's

unfavourable direct materials-price variance could be due to one or more of the following reasons:

● Sofiya's purchasing manager negotiated less skilfully than was assumed in the budget.

● Sofiya's purchasing manager bought in smaller lot sizes than budgeted even though quantity

discounts were available for the larger lot sizes.

● Materials prices unexpectedly increased because of disruptive weather conditions.

● Budgeted purchase prices for Sofiya's materials were set without careful analysis of the market.

Sofiya's response to a materials-price variance will be vitally affected by the presumed cause of the

variance. Assume it decides an unfavourable variance is due to poor negotiating by its purchasing

officer. Sofiya may decide to invest more in training this officer in negotiations, or it may decide

to employ a more skilful purchasing officer.

When interpreting materials-price variances, Sofiya's managers should consider any change

in the relationship with the company's suppliers. For example, assume that Sofiya moves to a

long-term relationship with a single supplier of material. Sofiya and the supplier agree to a single

purchase price per unit for all material purchases in the next six months. It is likely that price

variances will be minimal for this material because all purchases will be made from this supplier.

Efficiency variances

Consider now the efficiency variance. Computation of efficiency variances requires measurement

of inputs for a given level of output. For any actual level of output, the efficiency variance is the

difference between the input that was actually used and the input that should have been used to

achieve that actual output, holding input price constant:

□

Budgeted quantity

□

□□□

Efficiency

□□ Actual quantity of input allowed □□ Budgeted price

= □□

–

□□ ×

variance

□ of input used

□

for actual output □□

of input

□

□

□□

units achieved □□□

The idea here is that an organisation is inefficient if it uses more inputs than budgeted for the

actual output units achieved, and it is efficient if it uses less inputs than budgeted for the actual

output units achieved.

The efficiency variances for each of Sofiya's direct-cost categories are:

□

Budgeted input allowed □

Budgeted

Direct-cost

□ **Actual**

□

–

□

□

□□□

price of

Efficiency

category

□ **input used**

for actual output units

□

□□

×

input

= variance

Direct materials

[22 200 metres − (10 000 units × 2.00 metres)] × €30

(22 200 metres − 20 000 metres) × €30

= €66 000 U

Direct

[9000 hours − (10 000 units × 0.80 hours)] × €20

manufacturing

labour

(9000 hours − 8000 hours) × €20

= €20 000 U

Direct marketing

[2304 hours − (10 000 units × 0.25 hours)] × €24

labour

(2304 hours − 2500 hours) × €24

=

€4 704 F

The two manufacturing efficiency variances (direct materials and direct manufacturing labour)

are both unfavourable because more input was used than was budgeted, resulting in a decrease

in operating profit. The marketing efficiency variance is favourable because less input was used

than was budgeted, resulting in an increase in operating profit.

As with price variances, Sofiya's managers need to consider a broad range of possible reasons

for efficiency variances arising. For example, Sofiya's unfavourable direct manufacturing labour

variance could be due to one or more of the following reasons:

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● Sofiya's personnel manager took on underskilled workers.

● Sofiya's production scheduler inefficiently scheduled work, resulting in more direct manufac-

turing labour time per jacket.

● Sofiya's maintenance department did not properly maintain machines, resulting in more direct

manufacturing labour time per jacket.

● Budgeted time standards were set without careful analysis of the operating conditions and the

employees’ skills.

Suppose Sofiya determines that the unfavourable variance is due to poor machine maintenance.

It may decide to set up a team consisting of plant machine engineers and machine operators to

develop a maintenance schedule so that in the future, jackets can be sewn in shorter times.

Presentation of price and efficiency variances for inputs

Note how the sum of the price variance and the efficiency variance equals the flexible-budget

variance:

Price

Efficiency

Flexible-budget

variance

+

variance

=

variance

Direct materials

€22 200 U

€66 000 U

€88 200 U

Direct manufacturing labour

18 000 U

20 000 U

38 000 U

Direct marketing labour

2 304 U

4 704 F

2 400 F

Exhibit 15.4 illustrates a convenient way to integrate the actual and budgeted input information

used to calculate the price and efficiency variances for direct materials. This exhibit assumes that

materials purchased equals materials used.

Overview of variance analysis

Exhibit 15.5 presents a comprehensive road map of where we have been. The Level 0 and Level 1

analyses are reproductions of Exhibit 15.1. Level 2 is a reproduction of Exhibit 15.3. We have just

discussed price and efficiency variances, which are Level 3.

Exhibit 15.4

Columnar presentation of variance analysis: direct material costs

for Sofiya for April 2022

Level 3 analysis

Flexible budget (Budgeted

Actual costs incurred

Actual input

input allowed for actual output

(Actual input × Actual price)

× Budgeted price

achieved × Budgeted price)

(1)

(2)

(3)

(22 200 × €31)

(22 200 × €30)

(22 200 × €30)

€688 200

€666 000

€600 000

€22 200 U*

€66 000 U

Price variance

Efficiency variance

€88 200 U

Flexible-budget variance

*F = favourable effect on operating profit; U = unfavourable effect on operating profit.

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Exhibit 15.5

Overview of variance analysis for Sofiya for April 2022

Level 0 analysis

Actual operating profit

€25 000

Budgeted operating profit

262 000

Static-budget variance of operating profit

€237 000 U*

Level 1 analysis

Actual results

Static-budget variances

Static budget

(1)

(2) = (1) − (3)

(3)

Units sold

10 000

2 000 U

12 000

Revenues (sales)

€1 850 000

€310 000 U

€2 160 000

Variable costs

1 120 000

68 000 F

1 188 000

Contribution margin

730 000

242 000 U

972 000

Fixed costs

705 000

5 000 F

710 000

Operating profit

€25 000

€237 000 U

€262 000

€237 000 U

Static-budget variance

Level 2 analysis

Actual

Flexible-budget

Flexible

Sales-volume

Static

results

variances

budget

variances

budget

(1)

(2) = (1) − (3)

(3)

(4) = (3) − (5)

(5)

Units sold

10 000

0

10 000

2 000 U

12 000

Revenues (sales)

€1 850 000

€50 000 F

€1 800 000

€360 000 U

€2 160 000

Variable costs

1 120 000

130 000 U

990 000

198 000 F

1 188 000

Contribution margin

730 000

80 000 U

810 000

162 000 U

972 000

Fixed costs

705 000

5 000 F

710 000

0

710 000

Operating profit

€25 000

€75 000 U

€100 000

€162 000 U

€262 000

€75 000 U

€162 000 U

Total flexible-budget variance

Total sales-volume variance

€237 000 U

Static-budget variance

Level 3 analysis

Revenue variance by

Sales-volume

customers

Cost variances†

variances‡

Retail chains

€0 F

Price

Efficiency

Sales-quantity

variance

variance

variances

Independent stores

50 000 F

Sales-price variances

50 000 F Direct materials

€22 200 U €66 000 U

Sales-mix variances

Direct manufacturing labour

18 000 U

20 000 U

Direct marketing labour

2 304 U

4 704 F

* F = favourable effect on operating profit; U = unfavourable effect on operating profit.

† Chapter 16 contains further discussion of Level 3 cost-variance analysis.

‡ These variances are covered in Chapter 17.



Impact of stocks

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Some managers refer to proceeding through successively more detailed data as ‘drilling-down’

(or ‘peeling the onion’). The growing use of online data collection is increasing the number of

databases that have this drill-down capability.

Impact of stocks

Our Sofiya Company illustration assumed the following:

1 All units are manufactured and sold in the same accounting period. There are no work-in-

progress or finished-goods stocks at either the start or the end of the accounting period.

2 All direct materials are purchased and used in the same accounting period. There are no direct

materials stocks at either the start or the end of the period.

Both assumptions can be relaxed without changing the key concepts introduced in this chap-

ter. However, changes in the computation or interpretation of variances would be required when

opening or closing stocks exist.

Suppose direct materials are purchased sometime prior to their use and that direct materials

stocks exist at the start or end of the accounting period. Managers typically want to pinpoint

variances at the earliest possible time so that their decisions can be best informed by the variances.

For direct materials price variances, the purchase date will almost always be the earliest possible

time to isolate them. As a result, many organisations calculate direct materials price variances

using the quantities purchased in an accounting period. At the end of this chapter we illustrate

how to use two different times (purchase time and use time) to pinpoint direct materials variances.

Concepts in action

Starbucks maintains a focus on direct-cost variances

Starbucks is the largest coffeehouse company in the world,

with over 33 000 plus stores across 84 countries and a work-

force exceeding 380 000. The company reported net earn-

ings of $4.2 billion in 2021 on revenues of $29.02 billion.

Starbucks recognises that macro-economic conditions affect

customer purchases that are discretionary: ‘Our customers

may have less money for discretionary purchases and may

stop or reduce their purchases of our products or trade-

down to Starbucks or competitors’ lower-priced products

as a result of job losses, foreclosures, bankruptcies, increased

fuel and energy costs, higher interest rates, higher taxes,

reduced access to credit and economic uncertainty.’ COVID-

19 lockdowns caused Starbucks to suffer a general 10% sales decrease, and a 50% decrease in China where quarantine

measures were especially strict.

For Starbucks, profitability depends on making each high-quality beverage at the lowest possible costs. As a result,

an intricate understanding of direct costs is critical. Variance analysis helps managers assess and maintain profitability

at desired levels. In each Starbucks store, the two key direct costs are materials and labour. Materials costs at Starbucks

include coffee beans, milk, flavouring syrups, pastries, paper cups and lids. To reduce budgeted costs for materials,

Starbucks focused on two key inputs: coffee and milk. For coffee, Starbucks avoids waste and spoilage by no longer

brewing decaffeinated and darker coffee blends in the afternoon and evening, when store traffic is slower. Instead,

baristas have been instructed to brew a pot only when a customer ordered it. With milk prices rising (and making up

around 10% of Starbucks' cost of sales), the company has switched to 2% milk, which is healthier and costs less, and

redoubled efforts to reduce milk-related spoilage.

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Labour costs at Starbucks, which make up in costs almost a quarter of company revenue annually, have been

another area of variance focus. Many stores employ fewer baristas and, in some stores, Starbucks has adopted many

'lean' production techniques. With 30% of baristas' time involved in walking around behind the counter, reaching

for items, and blending drinks, Starbucks tries to make its drink-making processes more efficient. But, while Star-

bucks closely monitors costs, it is also embarking on other strategies to elevate its brand. For instance in China, each

Starbucks store is to have a unique page on Meituan platforms, where customers can access Starbucks Delivers and

Starbucks Now services to order food and beverages online, use the '1971 Salon' booking service, and check local

events on a digital community board. The company is also having more ‘drive-thru’ units recognising that the Covid

pandemic has altered the way consumers shop. Still, continued focus on both direct-cost variances remains critical

to the company’s future success particularly during periods of economic uncertainty.

Sources: Kline, D. (2018) ‘Starbucks puts its high-end strategy to the test’ (www.fool.com/investing/2017/09/11/starbucks-puts-its-high-end-strategy-to-the-

test.aspx); www.statista.com/statistics/219502/starbucks-net-income/; https://investor.starbucks.com/financial-data/annual-reports/default.aspx; Sherman, N.

(April 28, 2020) ‘Cars out, snacks in as virus impacts US profits’, BBC News; ‘Starbucks pioneers innovations bridging physical and digital experiences’,

17 January 2022 (https://stories.starbucks.com/asia/stories/2022/starbucks-pioneers-innovations-bridging-physical-and-digital-experiences/).

Management uses of variances

Performance measurement using variances

A survey of 154 finance executives from Fortune 500 companies revealed that all respondents use

variance analysis where current-year budget are compared to current-year actual results at year-

end and 80% look at prior-year actual and current-year actual variances at year-end (Conine and

McDonald 2022). The companies analysing volume, price and product mix variances (discussed

in Chapter 19) were high in proportion (94%, 87% and 81% respectively).

A key use of variance analysis is in performance evaluation. Two attributes of performance

are commonly measured:

● Effectiveness – the degree to which a predetermined objective or target is met.

● Efficiency – the relative amount of inputs used to achieve a given level of output.

Be careful to understand the cause(s) of a variance before using it as a performance measure.

Assume that a Sofiya purchasing manager has just negotiated a deal that results in a favourable

price variance for materials. The deal could have achieved a favourable variance for any or all of

three reasons:

1 The purchasing manager bargained effectively with suppliers.

2 The purchasing manager accepted lower-quality materials at a lower price.

3 The purchasing manager secured a discount for buying in bulk. However, she bought higher

quantities than necessary for the short run, which resulted in excessive levels of stock.

If the purchasing manager's performance is evaluated solely on materials-price variances, then

only reason 1 would be considered acceptable, and the evaluation will be positive. Reasons 2 and

3 would be considered unacceptable, and will probably cause the company to incur additional

costs, such as higher materials scrap costs and higher storage costs, respectively.

Performance measures increasingly focus on reducing the total costs of the company as a whole.

In the purchasing manager example, the company may ultimately lose more money because of

reasons 2 and 3 than it gains from reason 1. Conversely, manufacturing costs may be deliberately

increased (for example, because higher costs are paid for better materials or more direct manu-

facturing labour time) in order to obtain better product quality. In turn, the costs of the better

product quality may be more than offset by reductions in customer service costs.

If any single performance measure (for example, a labour efficiency cost variance or a con-

sumer rating report) receives excessive emphasis, managers tend to make decisions that maxim-

ise their own reported performance in terms of that single performance measure. Such actions

may conflict with the organisation’s overall goals. This faulty perspective on performance arises

because top management has designed a performance measurement and reward system that does

not adequately emphasise total organisational objectives.

Continuous improvement

Variances and flexible budgets can be used to measure specific types of performance goal such

as continuous improvement. For example, continuous improvement can be readily incorporated

into budgets and thus into variances by the use of a continuous improvement budgeted cost. This

is a budgeted cost that is successively reduced over succeeding time periods. The budgeted direct

materials cost for each jacket that Sofiya Company manufactured in April 2022 is €60 per unit.

The budgeted cost used in variance analysis for subsequent periods could be based on a targeted

1% reduction each period:

Prior month’s

Reduction in

Revised

Month

budgeted amount

budgeted amount

budgeted amount

April 2022

–

–

€60.00

May 2022

€60.00

€0.600 (0.01 × €60.00)

59.40

June 2022

59.40

0.594 (0.01 × €59.40)

58.81

July 2022

58.81

0.588(0.01 × €58.81)

58.22

The source of the 1% reduction in budgeted direct materials costs could be efficiency improve-

ments or price reductions. By using continuous improvement budgeted costs, an organisation

signals the importance of constantly seeking ways to reduce total costs. For example, managers

could avoid unfavourable materials-efficiency variances by continuously reducing materials waste.

Products in the initial months of their production may have higher budgeted improvement rates

than those that have been in production for, say, three years. Improvement opportunities may be

much easier to identify when products have just started in production. Once the easy opportuni-

ties have been identified (‘the low-hanging fruit picked’), much more ingenuity may be required

to identify successive improvement opportunities.

Variance analysis and organisational learning

Organisations adopting a total value-chain approach to analysing variances are recognising the

diversity of the possible sources of variances. Consider an unfavourable materials-efficiency var-

iance in the production area of an organisation. Possible causes of this variance include:

- poor design of products or processes

- poor quality or inadequate availability of materials from suppliers
- poor work in the manufacturing area
- inadequate training of the workforce
- inappropriate assignment of labour or machines to specific jobs
- congestion due to scheduling a large number of rush orders.

This list is far from exhaustive. However, it does indicate that the cause of a variance in one part

of the value chain (production in our example) can be actions taken in other parts of the value

chain (such as product design or marketing). Note how improvements in early stages of the value

chain (such as in product design) can sizably reduce the magnitude of variances in subsequent

stages of the value chain.

The most important task in variance analysis is to understand why variances arise and then to

use that knowledge to promote learning and improve performance. For instance, in the preced-

ing list of examples, we may seek improvements in product design, in the timeliness of supplier

deliveries, in the commitment of the manufacturing workforce to do the job right the first time,

and so on. Variance analysis should not be a tool to play the blame game. Rather, it should be an

essential ingredient that promotes learning in the organisation.

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When to investigate variances

When should the causes of variances be investigated? Frequently, managers base their answer on

subjective judgements, or rules of thumb. For critical items, a small variance may prompt a swift

follow-up. For other items, a minimum euro variance or a certain percentage of variance from

budget may be necessary to prompt an in-depth investigation. Of course, a 4% variance in direct

materials costs of €1 million may deserve more attention than a 20% variance in repair costs of

€10 000. Therefore, rules such as ‘investigate all variances exceeding €5000 or 25% of budgeted

cost, whichever is lower’ are common. Variance analysis is subject to the same cost–benefit-

context test as all other phases of a management control system. For instance, a change in man-

agement style can have an impact on reported variances and their repercussions.

Management accounting systems have traditionally implied that a budgeted amount is a single

acceptable measure. Practically, managers realise that the budget is a band or range of possible

acceptable outcomes and they consequently expect variances to fluctuate randomly within certain

normal limits. By definition, a random variance *per se* is within this band or range and thus calls

for no corrective action by managers. Random variances are attributable to chance rather than to

management’s implementation decisions.

Financial and non-financial performance measures

Almost all organisations use a combination of financial and non-financial performance measures

rather than relying exclusively on either type. Consider our Sofiya Company illustration. In its

cutting room, fabric is laid out and cut into pieces, which are then matched together and assem-

bled. Control is often exercised at the cutting room level by focusing on non-financial measures

such as the number of square metres of cloth used to produce 1000 jackets or the percentage of

jackets started and completed without requiring any rework. Production managers at Sofiya are

also likely to use financial measures to evaluate the overall cost efficiency with which operations

are being run and to help guide decisions about, say, changing the mix of inputs used in manufac-

turing jackets. Financial measures are often critical in an organisation because they summarise the

economic impact of diverse physical activities in a way managers readily understand. Moreover,

managers are often evaluated on results measured against financial measures.

Concepts in action

Chipotle's required focus on material cost variances

Chipotle is a fast-casual-restaurant chain that has served

burritos for nearly 30 years. The company reported a net

income of $176 million in 2017, up from $22.9 million in

2016 but far below 2015's reported income of $475 million.

The company acknowledged in 2017 of the risk that 'Our

average restaurant sales and profitability will continue to fall

short of our past results unless we can significantly increase

comparable restaurant sales, and there are material risks

to our ability to do so.' For Chipotle, profitability depends

on making each burrito at the lowest possible cost. In each

Chipotle store, the two key direct costs are labour and mate-

rials costs. Labour costs include wages for restaurant man-

agers and staff, along with benefits such as health insurance. Materials costs include the 'critical seven' expensive

food ingredients – steak, carnitas, barbacoa, chicken, cheese, guacamole and sour cream – and items such as foil,

paper bags and plastic silverware. The company recognised that these input prices have been going up: 'Increased

labour costs due to factors such as competition for workers and labour market pressures, increased minimum wage

requirements. . . may continue to adversely impact our operating costs.' In addition: 'The cost of many basic foods for

humans and animals, including corn, wheat, rice and cooking oils, has increased markedly in some years, resulting

in upward pricing pressures on almost all of our raw ingredients including chicken, beef, tortillas and rice. In 2017, a

significant rise in avocado prices adversely impacted our food costs for most of the year.'

To reduce labour costs, Chipotle often makes subtle recipe shifts to find the right balance between taste and cost.

For example, it uses pre-chopped tomatoes shipped in plastic bags to make salsa because chopping tomatoes by

hand takes too much labour. In the past, tweaks like that lowered Chipotle's labour costs from 24.7% of revenue to

22.0%. At the same time, however, materials costs rose from 30.5% of revenue to 34.6% due to the company's focus on

naturally raised ingredients. Responsibly raised meat and fresh local produce cost Chipotle more than conventional

ingredients, which reduces profitability. As a result, each Chipotle store aggressively manages portion control. While

employees gladly oblige customers asking for extra rice, beans or salsa, they are trained to be stingy with the 'critical

seven' food ingredients. These measures have lowered adverse materials-cost variances. Cheese and some vegetables

arrive in stores pre-cut and shredded, while pork and barbacoa beef are now pre-cooked and delivered in sealed

bags. With future profitability dependent on lowering its materials-cost variances, Chipotle's 'food with integrity' will

need to be managed very closely going forward.

Source: Nassauer, S. (2015) 'Inside Chipotle's kitchen: what's really handmade', *The Wall Street Journal,* 24 February; https://seekingalpha.com/filings/

pdf/12529300.pd.

Flexible budgeting and activity-based costing

Activity-based costing (ABC) systems focus on individual activities as the fundamental cost

objects. ABC systems classify the costs of various activities into a cost hierarchy: output-unit

level, batch level, product sustaining and facility sustaining. The two direct-cost categories in the

Sofiya Company example discussed earlier in this chapter are examples of output-unit-level costs.

In this section, we show how the basic principles and concepts of flexible budgets and variance

analysis presented earlier in the chapter can be applied to other levels of the cost hierarchy. We

focus on batch-level costs. Batch-level costs are resources sacrificed on activities that are related

to a group of units of product(s) or service(s) rather than to each individual unit of product or

service.

Relating batch costs to product output

Consider Lyco Brass Works, a manufacturer of decorative brass taps. Lyco specialises in manufac-

turing a tap called Jacutap used in jacuzzis. Lyco produces Jacutaps in batches. For each product

line, Lyco dedicates materials-handling labour to bring materials to the manufacturing area,

transport work in progress from one work centre to the next, and take the finished product to the

shipping area. Hence materials-handling labour costs for Jacutaps are direct costs of Jacutaps.

Because the materials for a batch are moved together, materials-handling labour costs vary with

the number of batches rather than the number of units in a batch. Materials-handling labour

costs are direct and variable batch-level costs.

Information regarding Jacutaps for 2022 follows:

Static-budget

Actual

amounts

amounts

1 Units of Jacutaps produced and sold

180 000

151 200

2 Batch size (units per batch)

150

140

3 Number of batches (Line 1 ÷ Line 2)

1 200

1 080

4 Materials-handling labour-hours per batch

5

5.25

5 Total materials-handling labour-hours (Line 3 × Line 4)

6 000

5 670

6 Cost per materials-handling labour-hour

€14

€14.50

7 Total materials-handling labour cost (Line 5 × Line 6)

€84 000

€82 215

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To prepare the flexible budget for materials-handling labour costs, Lyco starts with the actual

units of output produced, 151 200 units, and proceeds in the following steps:

Step 1: Using the budgeted batch size, calculate the number of batches in which the actual

output units should have been produced At the budgeted batch size of 150 units per batch, Lyco

should have produced the 151 200 units of output in 1008 batches (151 200 ÷ 150).

Step 2: Using the budgeted materials-handling labour-hours per batch, calculate the number of

materials-handling labour-hours that should have been used At the budgeted quantity of 5 hours

per batch, 1008 batches should have required 5040 materials-handling labour-hours (1008 × 5).

Step 3: Using the budgeted cost per materials-handling labour-hour, calculate the flex-

ible- budget amount for materials-handling labour-hours The flexible-budget amount

is 5040 materials-handling labour-hours × €14, the budgeted cost per materials-handling

labour-hour = €70 560.

Note how the flexible-budget calculations for materials-handling costs focus on batch-level

quantities (materials-handling labour-hours) rather than on output-unit-level amounts (such as

materials-handling labour-hours per unit of output). The flexible-budget variance can then be

calculated as follows:

Flexible-budget variance = Actual costs − Flexible-budget costs

= 5670 × €14.50 − 5040 × €14

= €82 215 − €70 560

= €11 655 U

The unfavourable variance indicates that materials-handling labour costs were €11 655 higher

than the flexible-budget target.

Price and efficiency variances

Insight into the possible reasons for this €11 655 unfavourable variance can be gained by exam-

ining the price and efficiency components of the flexible-budget variance.

Price variance = (Actual price of input − Budgeted price of input)× Actual quantity of input

= (€14.50 − €14)× 5670 = €0.50 × 5670 = €2835 U

The unfavourable price variance for materials-handling labour indicates that the actual cost

per materials-handling labour-hour (€14.50) exceeds the budgeted cost per materials-handling

labour-hour (€14). This variance could be due to (1) Lyco’s human resources manager negotiating

less skilfully than was planned in the budget, or (2) wage rates increasing unexpectedly due to

scarcity of labour.

□□

□

□

Budgeted quantity □

□

Actual

□□

Efficiency variance = □

□

□ quantity of −

□

□

of input allowed □ × Budgeted price of input

□

□

□

□□

□□ input used

for actual output □□□

= (5670 − 5040) × €14

= 630 × €14

= €8820 U

The unfavourable efficiency variance indicates that the actual number of materials- handling

labour-hours (5670) exceeded the number of materials-handling labour-hours that Lyco should

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have used (5040) for the number of units it produced. Two reasons for the unfavourable effi-

ciency variance are (1) smaller actual batch sizes of 140 units instead of the budgeted batch

sizes of 150 units; this results in Lyco producing the 151 200 units in 1080 batches instead of in

1008 (151 200 ÷ 150) batches; and (2) higher actual materials-handling labour-hours per batch of

5.25 hours instead of budgeted materials-handling labour-hours per batch of 5 hours.

Reasons for smaller-than-budgeted batch sizes could include (1) quality problems if batch sizes

exceed 140 taps, or (2) high costs of carrying inventory.

Reasons for longer actual materials-handling labour-hours per batch could include (1) ineffi-

cient layout of the Jacutap product line relative to the plan, (2) materials-handling labour having

to wait at work centres before picking up or delivering materials, (3) unmotivated or inexperienced

employees, or (4) inappropriate materials-handling time standards.

Identifying the reasons for the efficiency variance helps Lyco's managers to develop a plan for

improving materials-handling labour efficiency.

Focus on hierarchy

The key idea is to focus the flexible-budget quantity computations at the appropriate level of

the cost hierarchy. Because materials handling is a batch-level cost, the flexible-budget quantity

calculations focused at the batch level – the quantity of materials-handling labour-hours that

Lyco should have used based on the number of batches it should have taken to produce the actual

quantity of 151 200 units. If a cost had been a product-sustaining cost, the flexible-budget quan-

tity computations would focus at the product-sustaining level.

An illustration of journal entries using standard costs

Control feature of standard costs

We now show journal entries when standard costs are used. For illustrative purposes, we focus on

direct materials and direct manufacturing labour.

We will continue with the data in the Sofiya Company illustration with one exception. Assume

that during April 2022, Sofiya purchases 25 000 square metres of materials. Recall that the actual

quantity used is 22 200 metres and that the standard quantity allowed for the actual output

achieved is 20 000 metres. The actual purchase price was €31 per square metre, while the standard

price was €30.

Note that in each of the following entries, unfavourable variances are always debits and favourable

variances are always credits.

Entry 1a Isolate the direct materials-price variance at the time of purchase by debiting Materials

Control at standard prices. This is the earliest date possible to isolate this variance.

1a

Materials control

(25 000 metres × €30)

€750 000

Direct materials-price variance

(25 000 metres × €1)

25 000

Creditors control

775 000

(25 000 metres × €31)

To record direct materials purchased.

Entry 1b Isolate the direct materials-efficiency variance at the time of usage by debiting Work-in-

Progress Control at standard input quantities allowed for actual output units achieved at standard

input prices.

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1b Work-in-progress control

(20 000 metres × €30)

€600 000

Direct materials-efficiency variance

(2200 metres × €30)

66 000

Materials control

€666 000

(22 200 metres × €30)

To record direct materials used.

Entry 2 Isolate the direct manufacturing labour price and efficiency variances at the time this

labour is used by debiting Work-in-Progress Control at standard quantities allowed for actual

output units achieved at standard input prices. Note that Wages Payable Control measures the

payroll liability and hence is always at actual wage rates.

2

Work-in-progress control

(8000 hours × €20)

€160 000

Direct manufacturing labour price variance

(9000 hours × €2)

18 000

Direct manufacturing labour efficiency

variance (1000 hours × €20)

20 000

Wages payable control

(9000 hours × €22)

€198 000

To record liability for direct manufacturing

labour costs.

A major advantage of this standard costing system is its emphasis on the control feature of

standard costs. All variances are isolated at the earliest possible time, when managers can make

informed decisions based on those variances.

End-of-period adjustments

Chapter 3 discussed two main approaches to recognising the under- or overallocated manufac-

turing overhead at the end of a period:

● the adjusted allocation-rate approach, which adjusts every job cost record for the difference

between the allocated and actual indirect cost amounts;

● the proration approach, which makes adjustments to one or more of the following end-

of- period account balances: materials, work in progress, finished goods and cost of goods

sold.

Price and efficiency variances can also be disposed of using these same two approaches.

Benchmarking and variance analysis

The budgeted amounts in the variance formulas discussed in this chapter are *benchmarks* (points

of reference from which comparisons may be made). The term benchmarking is often used to

refer to the continuous process of measuring products, services and activities against the best

levels of performance. These best levels of performance may be found in the organisation using

internal benchmarking information or by using external benchmarks from competing organi-

sations or from other organisations having similar processes. Consider Gillette, which is well

known for its razor-blade products. Gillette sells five times as many blades as its nearest com-

petitor. Given that the profit margin on razor blades is approximately 40% – the most profitable

consumer product in the world – this category is clearly an important contributor to Gillette's

overall corporate profits. The high profit margins are in part sustained by Gillette learning

about the cost structure of its competitors. Gillette operates on a 'zero overhead growth' policy.

This requires every Gillette division head to compare their division's costs with a top industry

competitor. Each division must decide how to align itself with industry benchmarks. As a result,

Human Resource costs have been found to exceed competitors' costs by 20% and its finance divi-

sion costs are 30–40% higher. This has spurred Gillette divisions to seek ways of bringing down

their overhead costs and to further heighten their profit margins as a result. Many consulting

firms now also offer benchmarking services. Here we discuss information provided by one such

service and then note how the variance computations discussed in this chapter can incorporate

this information.

Market Insights (MI), based in Copenhagen, analyses cost information submitted by hospitals

to various Danish regulatory bodies. MI develops benchmark reports that show how the cost level

at one hospital compares with that at numerous other Danish hospitals. Reports can be prepared

at the total hospital level (for example, cost per patient-day) or at a specific diagnostic-group level

(for example, cardiology, orthopaedics or gynaecology cost per patient).

Exhibit 15.6 illustrates an MI report for a client hospital. Panel A shows that the client hospi-

tal's costs per case is 10% above the average for comparable hospitals. Panel B shows an extract

of an MI report at the diagnostic-group level. This report shows that the client hospital has a cost

per stroke patient of €33 700 compared with a market average among all hospitals of €31 300.

The cost level at this client hospital is well above many hospitals. Cost benchmark reports are

attention directing in nature. An individual hospital administrator may well be able to justify an

above-average cost level by documenting above-average quality levels or revenue levels. However, in

many cases, hospitals with above-average costs have no documentable superiority in their service

quality levels, success in surgery operations or revenue per patient-day.

Exhibit 15.6 highlights how hospitals can differ sizably on costs. An administrator of a hospi-

tal with above-average costs potentially has much to learn from administrators at hospitals with

below-average costs. Be cautious, however, in using benchmark reports such as Exhibit 15.6. The

reliability of individual hospital cost data used in benchmark reports varies widely. Many hospi-

tals have not invested heavily in refining their cost accounting systems. In addition, cost figures

for individual diagnostic groups require numerous cost allocations, which also vary widely in

reliability.

Cost reports like Exhibit 15.6 provide an external benchmark that forces the administrator to

ask *why* cost levels differ among hospitals and *how* best practices can be transferred from the

more efficient to the less efficient hospitals.

Evaluating the overall performance of a hospital or its personnel requires analysing other

factors in addition to costs. These factors include the perceived quality of service to patients; the

success rate of operations (for example, how many patients who have undergone surgery as a

result of a stroke survive?); and the morale of the doctors, nurses and other staff. In many cases,

however, cost factors have been given too little weighting in the past, in part because of the lack

of reliable information on cost relationships in this sector of the economy.

Benchmark reports based on the costs of other companies can be developed for many activities

and products. For example, the Sofiya Company could estimate (possibly with the aid of con-

sultants) the materials cost of the jackets manufactured by its competitors. The materials-cost

estimate of the lowest-cost competitor could be used as the budgeted amounts in its variance

computations. An unfavourable materials-efficiency variance would signal that Sofiya has a higher

materials cost than ‘best cost practice’ in its industry. The magnitude of the cost difference would

be of great interest to Sofiya. It could prompt Sofiya to do an extensive search into how to bring

its own cost structure in line with that of the lowest in the industry.

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Exhibit 15.6

Cost benchmark reports for client hospital by Market Insights

Panel A: Cost comparisons at hospital level

Comparator average = 100

How to read this chart:

Hospital E

0.69

This chart shows the client hospital's

Hospital C

0.70

relative-case costs performance

Hospital J

0.70

versus comparator hospitals. The

Hospital H

0.73

client hospital is benchmarked with

Hospital M

0.86

the average-case costs of its peers

Hospital N

0.97

at the DRG level.

Hospital D

1.01

Hospital B

1.03

Hospital K

1.08

Client hospital

1.10

Example:

Hospital G

1.13

Hospital I

1.16

On an overall costs per case basis,

after adjusting for case mix, the client

Hospital L

1.17

hospital’s cost is 10% higher than the

Hospital F

1.17

comparator group average. There are

Hospital A

1.19

nine hospitals that have lower overall

Hospital O

1.21

case costs than the client hospital.

Costs per case index

Panel B: Cost comparisons at diagnostic-group level*

Client

Market

25th

Average of lowest-cost

Diagnostic group

hospital

average

percentile

quartile (0–25th)

Stroke

€33 700

€31 300

€21 900

€20 500

Respiratory disorders

66 800

53 700

44 400

38 400

Simple pneumonia

37 100

29 500

23 300

22 000

Heart catheterisation

24 800

21 200

20 100

17 100

* The cost amounts refer to the insurance premium per month that an insuree would have to pay to the client

hospital.

Summary

The following points are linked to the chapter's learning objectives.

1 A static budget is a budget that is based on one level of output; when variances are calculated at the end of the

accounting period, no adjustments are made to the amounts in the static budget. A flexible budget is a budget that

is developed using budgeted revenue or cost amounts; when variances are calculated, the budgeted amounts are

adjusted (flexed) to recognise the actual level of output and the actual quantities of the revenue and cost drivers.

Flexible budgets help managers gain more insight into the causes of variances than do static budgets.

2 A five-step procedure can be used to develop a flexible budget. Where all costs are either variable with respect to

output units or fixed, these five steps require only information about budgeted selling price, budgeted variable cost

per output unit, budgeted fixed costs, and the actual quantity of output units achieved. The static-budget variance

can be broken into a flexible-budget variance (the difference between the actual result and the flexible-budget

amount) and a sales-volume variance. The sales-volume variance arises because the actual output units differ from

the budgeted output units.

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3 Budgeted input prices and input quantities can be developed from past data (with or without adjustments) or by

developing standards based on time-and-motion studies, engineering studies, and so on. The computation of price

variances and efficiency variances helps managers gain insight into two different (but not independent) aspects of

performance. Price variances focus on the difference between actual and budgeted input prices. Efficiency vari-

ances focus on the difference between actual inputs used and the budgeted inputs allowed for the actual output

achieved.

4 Price variances capture only one aspect of a manager's performance. Other aspects include the quality of the inputs

the manager purchases and his or her ability to get suppliers to deliver on time.

5 Managers can use continuous improvement budgeted costs in their accounting system to highlight to all employ-

ees the importance of continuously seeking ways to reduce total costs and learning from variance investigations

to improve organisational performance.

6 The Level 1, 2 and 3 framework can be applied to variance analysis of activity costs (such as set-up costs) to gain

insight into why actual activity costs differ from those in the static budget or flexible budget. Interpreting cost

variances for different activities requires an understanding of whether the costs are output-unit-driven or are of a

batch-level, product-sustaining or facility-sustaining kind.

7 Benchmarking is the continuous process of measuring products, services and activities against the best levels of

performance. Benchmarking enables companies to use the best levels of performance within their organisation

or by competitors or other external companies to gauge the performance of their own managers.

References and further reading

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CHAPTER 15

Assessment material

Review questions

15.1 What is a benchmark? Give an example of three types of benchmark of interest to managers.

15.2 What is the key question in deciding which variances should be calculated and analysed?

15.3 Why might managers find a Level 2 flexible-budget analysis more informative than a Level 1

static-budget analysis?

15.4 'Performance may be both effective and efficient, but either condition can occur without the

other.' Do you agree? Give an example of effectiveness. Give an example of efficiency.

15.5 List four reasons for using standard costs.

15.6 Describe why direct materials price and direct materials efficiency variances may be calculated

with reference to different points in time.

15.7 'There are many costs associated with acquiring and using materials over and above materials

purchase costs.' Give three examples.

15.8 How might the continuous improvement theme be incorporated into the process of setting budg-

eted costs?

15.9 Why might an analyst examining variances in the production area look beyond that business

function for explanations of those variances?

15.10 Comment on the following statement made by a plant supervisor: 'Meetings with my plant

accountant are frustrating. All he wants to do is pin the blame for the many variances he reports.'

Exercises

Basic level

15.11 Flexible budget (20–30 minutes)

Abulafia Srl manufactures tyres for the Formula 1 motor racing circuit. For August 2022 Abulafia

budgeted to manufacture and sell 3000 tyres at a variable cost of €74 per tyre and a total fixed

cost of €54 000. The budgeted selling price was €110 per tyre. Actual results in August 2022 were

2800 tyres manufactured and sold at a selling price of €112 per tyre. The actual total variable costs

were €229 600, and the actual total fixed costs were €50 000.

Required

1 Prepare a performance report (akin to Exhibit 15.3) that uses a flexible budget and a static

budget.

2 Comment on the results in requirement 1.

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***15.12 Materials and manufacturing labour variances** (15 minutes)

Consider the following data collected for Helsingør:

Direct

Direct

manufacturing

materials

labour

Cost incurred: Actual inputs × actual prices

DKK 200 000

DKK 90 000

Actual inputs × standard prices

214 000

86 000

Standard inputs allowed for actual

outputs × standard prices

225 000

80 000

Required

Calculate the price, efficiency and flexible-budget variances for direct materials and direct man-

ufacturing labour.

15.13 Professional labour variances, efficiency comparisons (25–30 minutes)

Sharmila Khan is manager of TaxExperts.co.uk, a firm that provides assistance in the preparation of individual tax returns via the internet. Because of the highly seasonal nature of her business,

Sharmila employs staff on a monthly basis from two accounting placement firms – Professional

Assist (PA) and Office Support (OS). In July 2022, TaxExperts.co.uk took on 12 staff members from PA and 10 from OS. PA is the prestige firm in its area. OS is a recently formed firm.

Sharmila budgets the following for July 2022:

PA staff

OS staff

Budgeted hourly rate

£45

£40

Budgeted time per tax return in hours

0.40

0.50

Actual results for July 2022 were as follows:

PA staff

OS staff

Actual hourly rate

£48

£42

Actual time per tax return in hours

0.42

0.46

Number of tax returns completed

4608

3600

Required

1 Calculate professional labour price and efficiency variances for (a) the 12 PA staff, and (b) the

10 OS staff employed in July 2022.

2 Comment on the efficiency of the PA and OS staff TaxExperts.co.uk employed.

3 What factors other than efficiency might Khan consider in deciding whether to employ staff

from PA or OS?

15.14 Comprehensive variance analysis (30–40 minutes)

AKEI is an elite desk manufacturer. At the start of May 2022, the following budgeted unit amounts

(based on a standard costing system) related to its manufacture of executive desks (made out of

oak):

Direct materials: 16 square metres of oak per desk at €20 per square metre

Direct manufacturing labour: 3 hours per desk at €30 per direct manufacturing labour-hour

Budgeted production for May 2022 was 700 executive desks. There were no opening stocks of

direct materials or finished goods on 1 May 2022. Work in progress is minimal.

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Actual results for May 2022 are as follows:

Direct materials purchased (12 640 square metres)

€259 120

Direct materials used (11 850 square metres)

?

Direct manufacturing labour (2325 hours at €31 per hour)

?

Actual production in May 2022 is 750 executive desk units. The purchase price for oak wood

remained unchanged throughout May 2022.

Required

1 Prepare a detailed flexible-budget variance analysis for May 2022 covering direct materials and

direct manufacturing labour.

2 Give two explanations for each of the variances you calculate in requirement 1.

Intermediate level

15.15 Flexible budget (15 minutes)

The budgeted prices for direct materials, direct manufacturing labour and direct marketing (dis-

tribution) labour per attaché case are €40, €8 and €12, respectively. The chairman is pleased with

the following performance report:

Actual costs

Static budget

Variance

Direct materials

€364 000

€400 000

€36 000 F

Direct manufacturing labour

78 000

80 000

2 000 F

Direct marketing (distribution)

labour

110 000

120 000

10 000 F

Required

Actual output was 8800 attaché cases. Is the chairman's pleasure justified? Prepare a revised

performance report that uses a flexible budget and a static budget. Assume all three direct costs

items are variable costs.

15.16 Price and efficiency variances (20–30 minutes)

Ched Ltd manufactures Cheddar cheese pies. For January 2022, it budgeted to purchase and use

15 000 kg of Cheddar cheese at £0.89 per kg; budgeted output was 60 000 pies. Actual purchase

and use for January 2022 was 16 000 kg at £0.82 per kg; actual output was 60 800 pies.

Required

1 Calculate the flexible-budget variance.

2 Calculate the price and efficiency variances.

3 Comment on the results in requirements 1 and 2.

15.17 Flexible budget preparation and analysis (25–30 minutes)

Norland-Norge AS produces corporate notebooks. Each notebook is designed for an individual

customer. The company's operating budget for September 2022 included these data:

Number of notebooks

15 000

Selling price per book

NKR 20

Variable costs per book

NKR 8

Total fixed costs for the month

NKR 145 000

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The actual results for September 2022 were:

Number of notebooks produced and sold

12 000

Average selling price per book

NKR 21

Variable costs per book

NKR 7

Total fixed costs for the month

NKR 150 000

The managing director of the company observed that the operating profit for September was much

less than anticipated, despite a higher-than-budgeted selling price and a lower-than- budgeted var-

iable cost per unit. You have been asked to provide explanations for the disappointing September

results.

Norland-Norge develops its flexible budget on the basis of budgeted revenue per output unit and

variable costs per output without a detailed analysis of budgeted inputs.

Required

1 Prepare a Level 1 analysis of the September performance.

2 Prepare a Level 2 analysis of the September performance.

3 Why might Norland-Norge find the Level 2 analysis more informative than the Level 1 analysis?

Explain your answer.

15.18 Price and efficiency variances, journal entries (30 minutes)

Drogheda Chemical Ltd has set-up the following standards per finished output unit for direct

materials and direct manufacturing labour.

Direct materials: 10 kg at €3.00 per kg

€30.00

Direct manufacturing labour: 0.5 hour at €20.00 per hour

€10.00

The number of finished output units budgeted for March 2022 was 10 000; 9810 units were

actually produced.

Actual results in March 2022 were:

Direct materials: 98 073 kg used

Direct manufacturing labour: 4900 hours

€102 900

Assume that there were no opening stocks of either direct materials or finished units.

During the month, materials purchases amounted to 100 000 kg, at a total cost of €310 000. Price

variances are isolated upon purchase. Efficiency variances are isolated at the time of usage.

Required

1 Calculate the March 2022 price and efficiency variances of direct materials and direct manu-

facturing labour. Comment on these variances.

2 Prepare journal entries to record the variances in requirement 1.

3 Why might Drogheda Chemical Ltd calculate materials price variances and materials efficiency

variances with reference to different points in time?

15.19 Continuous improvement (continuation of Exercise 15.18) (20 minutes)

Drogheda Chemical adopts a continuous improvement approach to setting monthly standards'

costs. Assume the direct materials standard quantity input of 10 kg per output unit and the direct

manufacturing labour quantity input of 0.5 hours per output unit pertain to January 2022. The

standard amounts for February 2022 are 0.997 of the January standard amount. The standard

amounts for March 2022 are 0.997 of the February standard amount. Assume the same informa-

tion for March 2022 as in Exercise 15.18 except for these revised standard amounts.

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Required

1 Calculate the March 2022 standard quantity input amounts per output unit for direct materials

and direct manufacturing labour.

2 Calculate the March 2022 price and efficiency variances of direct materials and direct manu-

facturing labour.

***15.20 Flexible-budget preparation** (20–30 minutes)

The managing partner of Hoofdorp Music Box Fabricators has become aware of the disadvan-

tages of static budgets. She asks you to prepare a flexible budget for October 2022 for the main

style of music box. The following partial data are available for the actual operations in August

2022 (a recent typical month):

Boxes produced and sold

4 500

Direct material costs

€90 000

Direct manufacturing labour costs

€67 500

Depreciation and other fixed manufacturing costs

€50 700

Average selling price per box

€70

Fixed marketing costs

€81 350

Assume no opening or closing stocks of music boxes.

A 10% increase in the selling price is expected in October. The only variable marketing cost is a

commission of €5.50 per unit paid to the manufacturers' representatives, who bear all their own

costs of travelling, entertaining customers, and so on. A patent royalty of €2 per box manufac-

tured is paid to an independent design firm. Salary increases that will become effective in October

are €12 000 per year for the production supervisor and €15 000 per year for the sales manager. A

10% increase in direct materials prices is expected to become effective in October. No changes

are expected in direct manufacturing labour wage rates or in the productivity of the direct manu-

facturing labour personnel. Hoofdorp uses a normal costing system and does not have standard

costs for any of its inputs.

Required

1 Prepare a flexible budget for October 2022, showing budgeted amounts at each of three output

levels of music boxes: 4000, 5000 and 6000 units. (Use the flexible-budget approach of devel-

oping budgeted revenue and variable costs on a budgeted per output unit basis.)

2 Why might Hoofdorp Music Box Fabricators find a flexible budget more useful than a static

budget? Explain.

15.21 Flexible-budget variances for finance function activities (30 minutes)

Sam Chase is the Finance Director of Flowers.co.ke, an internet company that enables custom-

ers to order home deliveries of flowers by accessing its website. Flowers.co.ke has a network of

florists (‘strategic partners’) who do the physical delivery of flowers. Flowers.co.ke has a group

of representatives that continually visit florists and nurseries. This group monitors product and

service quality and explores new products or new partners.

Chase is concerned with the efficiency and effectiveness of the finance function at Flowers.co.ke.

He collects the following information for three finance activities in 2022:

Budgeted

Budgeted

Actual total

total cost total volume Actual cost volume of

Finance activity

Activity measure

of activity

of activity

of process

activity

Creditors

Number of invoices

KSh580 000

200 000

KSh594 020

212 150

Debtors

Number of remittances

639 000

1 000 000

711 000

948 000

Travel and expenses

Number of expense reports

15 200

2 000

13 986

1 890

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The budgeted amounts are based on an analysis of costs in past periods at Flowers.co.ke. The

output measure is the number of deliveries, which is assumed to be the same as the number of

remittances. Debtors is an output-unit-level-driven cost, whereas creditors and travel and expense

are batch-driven costs.

Required

1 Prepare a flexible-budget-based report explaining difference between budgeted and actual costs

for each of the three finance activities in 2022. Comment on the results.

2 Why might the variances computed in requirement 1 pertain to efficiency but not effectiveness?

3 How might Chase monitor the effectiveness of the three finance processes in this exercise?

15.22 Finance function activities, benchmarking (continuation of Exercise 15.21) (20 minutes)

Sam Chase of Flowers.co.ke receives a brochure from the Hackett Group, a consulting firm

specialising in benchmarking. He asks the Hackett Group to provide benchmark data from its

recent study of the finance function at over 100 retail companies (both traditional retail and

Internet-based retail). Hackett's 'world-class' cost benchmarks for Flowers.co.ke's three finance

activities are:

Finance activity

World-class cost performance

Creditors

KSh0.71 per invoice

Debtors

KSh0.10 per remittance

Travel and expenses

KSh1.58 per expense report

Required

1 What new insights might arise with the Hackett benchmark data using the budgeted amounts

in Exercise 15.21?

2 Assume you are in charge of travel and expense report processing. What concerns might you

have with Sam Chase using the Hackett benchmark of KSh1.58 per expense report as the key

to evaluate your performance next period?

15.23 Price and efficiency variances, problems in standard setting, benchmarking (30–40 minutes)

Poitou-Chemises SARL manufactures shirts for retail chains. Armand Plessis, the accountant,

is becoming increasingly disenchanted with Poitou-Chemises' six-month-old standard costing

system. The budgeted amounts for both its direct materials and direct manufacturing labour are

drawn from its standard costing system. The budgeted and actual amounts for July 2022 were:

Budgeted

Actual

Shirts manufactured

4 000

4 488

Direct materials cost

€20 000

€20 196

Direct materials units used (rolls of cloth)

400

408

Direct manufacturing labour costs

€18 000

€18 462

Direct manufacturing labour-hours

1 000

1 020

There were no opening or closing stocks of materials.

Armand observes that in the past six months he has rarely seen an unfavourable variance of any

magnitude. The standard costing system is based on a study of the operations conducted by an

independent consultant. He decides to play detective and makes some unobtrusive observations

of the workforce at the plant. He notes that even at their current output levels, the workers seem

to have a lot of time to discuss football, sitcoms and cooking recipes.

At a recent industry conference on ‘Benchmarking and Competitiveness’, Françoise Daubigné,

the accountant of Textiles-Georges-Grassens, told Armand that Textiles-Georges-Grassens had

employed the same independent consultant to design a standard costing system. However, the

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company dismissed him after two weeks because Textiles-Georges-Grassens employees quickly

became aware of the consultant observing their work.

At the industry conference, Armand participated in seminars on ‘benchmarking for the fabric

industry’. A consultant for France-Solutions SA showed how she could develop six-month bench-

mark reports on the estimated costs of Poitou-Chemises’ major competitors. She indicated that

she was already examining the estimated cost of shirts manufactured by the four largest importers

into Europe. These importers had taken much business from Poitou-Chemises in recent years. This

information would soon be available by subscribing to the France-Solutions monthly service.

Required

1 Calculate the price and efficiency variances of Poitou-Chemises for direct materials and direct

manufacturing labour in July 2022.

2 Describe the types of action the employees at Textiles-Georges-Grassens may have taken to

reduce the accuracy of the standards set by the independent consultant. Why would employees

take those actions? Is this behaviour ethical?

3 Describe how Poitou-Chemises might use information from France-Solutions when computing

the variances in requirement 1.

4 Discuss the pros and cons of Poitou-Chemises using the France-Solutions information to

increase its cost competitiveness.

Advanced level

***15.24 Flexible budget preparation, service sector** (45 minutes)

Münzel GmbH helps prospective homeowners of substantial means to find low-cost financing

and assists existing homeowners in refinancing their current loans at lower interest rates. Münzel

works only for customers with excellent borrowing potential. Hence, Münzel is able to obtain a

loan for every customer with whom it decides to work.

Münzel charges clients 0.5% of the loan amount it arranges. In 2016, the average loan amount

per customer was €199 000. In 2017, the average loan amount was €200 210. In its 2022 flexible

budgeting system, Münzel assumes the average loan amount will be €200 000.

Budgeted cost data per loan application for 2022 are:

- Professional labour: 6 budgeted hours at a budgeted rate of €40 per hour
- Loan filing fees: budgeted at €100 per loan application

● Credit checks: budgeted at €120 per loan application

● Courier mailings: budgeted at €50 per loan application.

Office support (the costs of leases, secretarial workers and others) is budgeted to be €31 000 per

month. Münzel GmbH views this amount as a fixed cost.

Required

1 Prepare a static budget for November 2022 assuming 90 loan applications.

2 Actual loan applications in November 2022 were 120. Other actual data for November 2022

were:

● Professional labour: 7.2 hours per loan application at €42 per hour

● Loan filing fees: €100 per loan application

● Credit checks: €125 per loan application

● Courier mailings: €54 per loan application.

Office support costs for November 2022 were €33 500. The average loan amount for November

2022 was €224 000. Münzel received its 0.5% fee on all loans. Prepare a Level 2 variance analysis

of Münzel GmbH for November 2022. Münzel's output measure in its flexible budgeting system

is the number of loan applications.

3 Calculate professional labour price and efficiency variances for November 2022. (Calculate

labour price on a per-hour basis.)

4 What factors would you consider in evaluating the effectiveness of professional labour in

November 2022?

15.25 CIMA Performance Operations, section C, November 2014 (40 minutes)

A company manufactures and sells a single product. The company operates a standard marginal

costing system that enables the reporting of planning and operational variances.

The original standard contribution per unit of the product for October, which was used to estab-

lish the budgeted contribution for the month, was as follows:

£

Selling price

60

Direct material

1.5 kg @ £10 per kg

(15)

Direct labour

2 hours @ £15 per hour

(30)

Contribution

15

Other information for October

Sales and production quantities:

Budgeted sales and production

40 000 units

Actual sales and production

42 000 units

A change in the product specification was implemented at the start of October which required

20% additional material for each unit. The standard cost shown above was not revised to reflect

this change.

1 Actual direct material purchased and used was 78 000 kg at £9.90 per kg.

2 The labour rate shown in the standard cost above was overestimated. The correct standard

labour rate for the grade of labour required was £14.60 per hour. The actual rate paid was

£15.20 per hour and actual hours worked were 86 000 hours.

The actual selling price per unit was £62.

There was no opening inventory of raw materials or finished goods.

Required

1 Prepare a statement for October that reconciles the budgeted contribution with the actual

contribution. Your statement should show the variances in as much detail as possible.

2 Discuss the performance of the company for October. Your discussion should give one possible

reason for each of the operational variances calculated in part (a).

3 Explain why separating variances into their planning and operational elements should improve

performance management.

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CHAPTER 16

Flexible budgets, variances and

management control: II

Overhead or indirect costs are a major area of concern for many

organisations. Chemical, paper, steel and telecommunications companies,

Learning objectives

for example, incur sizeable costs to construct and maintain their physical plant and equipment and other aspects of their infrastructure. Such

After studying this chapter, you

costs are included in the indirect costs of the individual products or

should be able to:

services they produce and sell. Companies like Leboncoin.fr, Sapo.pt

- Explain differences in the planning

and Daraz.pk invest large amounts in software that enable them to

of variable-overhead costs and the

provide a broad range of services to their customers. These costs are

planning of fixed-overhead costs

part of their overhead costs. This chapter covers methods of planning and controlling overhead costs, allocating these costs to products, and

- Compute spending and efficiency

analysing overhead variances.

variances for variable-overhead

The previous chapter emphasised the direct-cost categories of direct

costs

materials and direct manufacturing labour. Here, the overhead categories

-

Illustrate how to calculate the

of variable and fixed manufacturing overhead are stressed. Please

budgeted fixed-overhead rate

proceed slowly as you study this chapter. Trace the data to the analysis in

-

Understand why we measure the

a systematic way. In particular, note how fixed manufacturing overhead is

production-volume variance

accounted for in one way for the planning and control purpose and in a

-

Explain how a 4-variance analysis

different way for the stock costing purpose.

can provide an integrated overview

of overhead cost variances

-

Explain the differing roles of

cost-allocation bases for fixed

manufacturing overhead when

(a) planning and controlling, and

(b) valuing stock

- Prepare journal entries for

variable- and fixed-overhead

variances

- Explain how flexible-budget

variances can be used in

activity-based costing

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Planning of variable- and fixed-overhead costs

Variances bring together the planning and control functions of management and facilitate

‘ management by exception’. Management by exception is a practice whereby managers focus

more closely on areas that are not operating as expected and less closely on areas that are. Let's say

actual costs are much higher than originally budgeted for an activity in an organisation, variances

can be presented to managers to find out why and correct the problem to reduce future scrap and

rework. If a positive variance occurs, such as lower-than-planned costs, managers try to under-

stand the reasons for the decrease and see if altered practices can be continued and implemented

by other units. Variances are also used for evaluating performance and to motivate managers.

Sometimes variances suggest that the company should consider a change in strategy. For example,

large negative variances caused by excessive defect rates for a new product may cause managers

to investigate and modify the product design. Variances also help managers make more informed

predictions about the future and thereby improve the quality of decision-making. A survey by the

United Kingdom's Chartered Institute of Management Accountants found that it was easily the

most popular costing tool used by organisations of all sizes.

We continue the Chapter 15 analysis of the Sofiya Company. Chapter 15 illustrated how a

static-budget variance can be divided into a flexible-budget variance and a sales-volume variance.

This chapter focuses on understanding flexible-budget variances for overhead costs and their

causes.

Sofiya's cost structure illustrates why it views the planning of overhead costs as important.

The following percentages of total static-budget costs (see column 4 of Exhibit 15.2) are based

on Sofiya's budget for 12 000 output units for April 2022:

Variable-

Fixed

Total

overhead

overhead

overhead

costs

costs

costs

Manufacturing

7.59%

14.54%

22.13%

Marketing

3.16

22.87

26.03

Total

10.75%

37.41%

48.16%

Total overhead costs amount to almost half (48.16%) of Sofiya's total budgeted costs at 12 000

output units for April 2022. Clearly, Sofiya can greatly improve its profitability by effective plan-

ning of its overhead costs, both variable and fixed.

Planning variable-overhead costs

Among Sofiya's variable manufacturing overhead costs are energy, engineering support, indi-

rect materials and indirect manufacturing labour. Effective planning of variable-overhead costs

involves undertaking only value-added variable-overhead activities and then managing the cost

drivers of those activities in the most efficient way. A value-added cost is one that, if eliminated,

would reduce the value customers obtain from using the product or service. A non-value-added

cost is one that, if eliminated, would not reduce the value customers obtain from using the prod-

uct or service. Consider the cost of sewing needles used in the sewing of jackets manufactured

by Sofiya. Sewing is an essential element of manufacturing a jacket. Hence, costs associated with

sewing (for example, sewing needles) would be classified as adding value. In contrast, consider

the cost of a warehouse that stores rolls of cloth to be used in case of an emergency (if, say, a

supplier fails to meet the delivery schedule). A jacket sewn from cloth stored in a warehouse is no

different from a jacket sewn from cloth delivered by a supplier directly to the production floor.

Hence, costs associated with warehousing are likely to be viewed as ‘non-value-adding’. There is

a continuum between value-added costs and non-value-added costs. Many overhead cost items

are in a grey, uncertain area between value-adding and non-value-adding costs.

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Chapter 16 Flexible budgets, variances and management control: II

Planning fixed-overhead costs

Effective planning of fixed-overhead costs includes undertaking only value-added fixed-overhead

activities and then determining the appropriate level for those activities. For Sofiya, examples

in manufacturing include depreciation or leasing costs on plant and equipment, some adminis-

trative costs (for example, the plant manager's salary), and property taxes. Frequently, the most

critical issue is how much plant and equipment to acquire. Consider Sofiya's leasing of weaving

machines, each of which has a fixed cost per year. Failure to lease sufficient machine capacity will

result in an inability to meet demand and thus in lost sales of jackets. In contrast, if Sofiya greatly

overestimates demand, it will incur additional fixed leasing costs on machines that are not fully

utilised during the year.

At the start of an accounting period, management will probably have made most of the key

decisions that determine the level of fixed-overhead costs to be incurred. In contrast, day-to-day,

ongoing management decisions play a larger role in determining the level of variable-overhead

costs incurred in that period.

Sofiya company data

The Sofiya Company summary information for April 2022 that we use in this chapter is as follows:

Overhead category

Actual

Flexible-budget Static-budget

results

amount

amount

(for 10 000 (for 12 000

output units) output units)

Variable manufacturing overhead

€130 500

€120 000

€144 000

Fixed manufacturing overhead

285 000

276 000

276 000

Variable marketing overhead

45 700

50 000

60 000

Fixed marketing overhead

420 000

434 000

434 000

Developing budgeted variable-overhead rates

Sofiya uses a three-step approach when developing its variable-overhead rate:

Step 1: Identify the costs to include in the variable-overhead cost pool(s) Sofiya groups all of

its variable manufacturing overhead costs in a single cost pool. Costs in this pool include energy,

engineering support, indirect materials and indirect manufacturing labour.

Step 2: Select the cost-allocation base(s) Sofiya's operating managers believe that machine-hours

are an important driver of variable manufacturing overhead costs and decided to use this measure

as the cost-allocation base.

Step 3: Estimate the budgeted variable-overhead rate(s) Several approaches can be used in

this step. One approach is to adjust the past actual variable-overhead cost rate per unit of the

allocation base – for example, an adjustment to take into account expected inflation. A second

approach is to use standard costing.

Sofiya uses the standard costing approach to develop its April 2022 budgeted variable overhead

cost rate of €30 per machine-hour and also its budgeted machine-hour rate of 0.40 hours per

actual output unit. These input amounts are used to calculate the budgeted variable manufactur-

ing overhead rate per unit:

Budgeted inputs allowed

Budgeted costs per

×

= 0.40 × €30

per output unit

input unit

= €12 per output unit

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Variable-overhead cost variances

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Variable-overhead cost variances

We now illustrate how the budgeted variable manufacturing overhead rate is used in computing

Sofiya’s variable manufacturing overhead cost variances. The following data are for April 2022:

Flexible-budget

Static-budget

amount

amount

(for 10 000

(for 12 000

Cost item/allocation base

Actual results

output units)

output units)

1 Variable manufacturing

€130 500

€120 000

€144 000

overhead costs

2 Variable manufacturing

29

30

30

overhead costs per

machine-hour [(1) ÷ (5)]

3 Variable manufacturing

13.05

12

12

overhead costs per output

unit [(1) ÷ (4)]

4 Output units (jackets)

10 000

10 000

12 000

5 Machine-hours

4 500

4 000

4 800

Static-budget and flexible-budget analyses

The Level 1 static-budget variance for variable manufacturing overhead cost is shown in

Exhibit 16.1:

Variable-overhead

Actual

Static-budget

=

–

= €130 500 − €144 000

static-budget variance

results

amount

= €130 500 F

Additional insight into the ability of Sofiya’s managers to control variable manufacturing over-

head can be gained by moving to the Level 2 flexible-budget analysis also shown in Exhibit 16.1.

The budgeted amounts in Level 2 recognise that 10 000 output units were produced instead of the

budgeted 12 000 output units. The April 2022 flexible budget for variable manufacturing overhead

is €120 000 (0.4 × 10 000 × €30).

The variable manufacturing overhead sales-volume variance arises solely because the actual

number of output units sold by Sofiya differs from the budgeted number of output units sold:

Variable-overhead

Flexible-budget

Static-budget

=

–

= €120 000 − €144 000

sales-volume variance

amount

amount

= €24 000 F

The variable manufacturing overhead flexible-budget variance arises because Sofiya’s actual

variable manufacturing overhead cost differs from that budgeted for the actual output units sold:

Variable-overhead

Actual

Flexible-budget

=

−

= €130 500 − €144 000

flexible-budget variance

results

amount

= €13 500 U

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Exhibit 16.1

Static- and flexible-budget analysis of variable manufacturing overhead costs for the Sofiya Company for April 2022

Level 1 analysis

Actual

Static-budget

Static

results

variance

budget

(1)

(2) = (1) — (3)

(3)

Cost driver: Number of units

manufactured

10 000

2000 U*

12 000

Variable manufacturing

overhead

(0.40 × 12 000 × €30)

€130 500

€144 000

€13 500 F

Static-budget variance

Level 2 analysis

Flexible-

Sales-

Actual

budget

Flexible

volume

Static

results

variance

budget

variance

budget

(1)

(2) = (1) — (3)

(3)

(4) = (3) — (5)

(5)

Cost driver:

Number of units

manufactured

10 000

–

10 000

2000 U

12 000

Variable

(0.40 ×

(0.40 ×

manufacturing

10 000 × €30)

12 000 × €30)

overhead

€130 500

€120 000

€144 000

€10 500 U

€24 000 F

Flexible-budget variance

Sales-volume variance

€13 500 F

Static-budget variance

* F = favourable effect on operating profit; U = unfavourable effect on operating profit.

This €10 500 unfavourable flexible-budget variance shows that Sofiya's actual variable manufac-

turing overhead exceeded the flexible-budget amount by €10 500 for the 10 000 jackets actually

produced in April 2022.

We now discuss how managers can gain additional insight by splitting the Level 2 variable

manufacturing overhead flexible-budget variance into its Level 3 efficiency and price (labelled

spending when dealing with overhead) variances. Exhibit 16.2 is the columnar presentation of

these Level 3 efficiency and spending variances.

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Exhibit 16.2

Columnar presentation of variance analysis: variable

manufacturing overhead for the Sofiya Company

Level 3 analysis

Flexible budget

(Budgeted input allowed

Actual costs

for actual output

incurred

Actual input

achieved

(1)

× Budgeted rate (2)

× Budgeted rate) (3)

(4500 × €29)

(4500 × €30)

(0.40 × 10 000 × €30)

€130 500

€135 000

€120 000

€4500 F*

€15 000 U

Spending variance

Efficiency variance

€10 500 U

Flexible-budget variance

* F = favourable effect on operating profit; U = unfavourable effect on operating profit.

Variable-overhead efficiency variance

The variable-overhead efficiency variance measures the efficiency with which the cost-allocation

base is used. The formula is:

□□ Actual units of

Budgeted units of □

□

□

□

□□□

Variable

□ variable-overhead

variable-overhead

□

□

□

□□

Budgeted

□

overhead

□□ cost allocation base

cost allocation base

□

□□□ × variable-overhead

= □

–

effciency

□

used for actual

allowed for actual □

□

□□□ cost allocation rate

□

□

variance

□

output units

output units

□

□

□

□□

□□

achieved

achieved

□□□

=[4500 – (10 000×0.40)]×€30

=(4500 – 4000)×€30 = 500×€30

= €15 000 U

The variable-overhead efficiency variance is calculated similarly to the efficiency variance

described in Chapter 15 for direct-cost items. But the interpretation of the Chapter 15 and 16

efficiency variances differs. In Chapter 15, input-efficiency variances for direct-cost items are

based on differences between actual inputs used and the budgeted inputs allowed for actual out-

puts achieved. In Chapter 16 efficiency variances for variable-overhead costs are based on the

efficiency with which the *cost-allocation base* is used. Sofiya's unfavourable variable-overhead

efficiency variance of €15 000 means that actual machine-hours (the cost-allocation base) were

higher than the budgeted machine-hours allowed to manufacture 10 000 jackets. Possible causes

of this higher-than-budgeted machine-hour usage include the following:

● Sofiya's workers were less skilful in the use of machines than budgeted.

● Sofiya's production scheduler inefficiently scheduled jobs, resulting in higher-than-budgeted

machine usage.

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● Sofiya's machines were not maintained in good operating condition.

● Budgeted machine time standards were set without careful analysis of the operating conditions.

● Sofiya promised a distributor a rushed delivery, which resulted in higher machine usage than

budgeted.

Management's response to this €15 000 unfavourable variance would be guided by which cause(s)

best describes the April 2022 results.

The use of cotton thread for sewing jackets illustrates the difference between the efficiency

variance for direct-cost inputs and the efficiency variance for variable-overhead cost categories.

If Sofiya classifies cotton thread as a direct-cost item, the direct materials efficiency variance

will indicate whether more or less cotton thread per jacket is used than was budgeted for the

actual output achieved. In contrast, if Sofiya classifies cotton thread as an indirect-cost item, the

variable manufacturing overhead efficiency variance will indicate whether Sofiya used more or

fewer machine-hours (the cost-allocation base for variable manufacturing overhead) than were

budgeted for the actual output achieved. Any variation in cotton thread usage other than that

budgeted to vary with respect to machine-hours will be shown in the variable manufacturing

overhead spending variance.

Variable-overhead spending variance

The variable-overhead spending variance is the difference between the actual amount of vari-

able overhead incurred and the budgeted amount allowed for the actual quantity of the

variable-over-head allocation base used for the actual output units achieved. The formula for the

variable-over-head spending variance is:

□□

Actual

□

Actual quantity of

□

Variable

□

Budgeted

□

□□

□ variable-overhead

□□

variable-overhead

overhead

□

□

= □□ cost per unit of

variable-overhead

–

□□□ × cost allocation base

spending

□□

cost per unit of □

□

□

□

cost allocation

□

used for actual

variance

□

□□□

□□□

base

cost base

□

output units achieved

□

=(€29 – €30)×4500

= –€1×4500 = €4500 F

Sofiya operated in April 2022 with a lower-than-budgeted variable-overhead cost per machine-

hour. Hence, there is a favourable variable-overhead spending variance.

The variable-overhead spending variance is calculated similarly to the price variance described

in Chapter 15 for direct-cost items such as direct materials. Do not assume, however, that the

causes of these two variances are the same. Two main causes could explain a variable-overhead

spending variance of €4500 F at Sofiya:

● **Cause A.** The actual prices of individual items included in variable overhead differ from their

budgeted prices – for example, the April 2022 purchase price of energy, indirect materials or

indirect manufacturing labour was less than budgeted prices.

● **Cause B.** The actual usage of individual items included in variable overhead differs from the

budgeted usage – for example, the budgeted usage of energy, indirect materials or indirect

manufacturing labour was less than the usage assumed in setting the €30 budgeted variable

manufacturing overhead rate per machine-hour.

Cause A has implications for the purchasing area of Sofiya. Cause B has implications for the

production area of Sofiya. Distinguishing between these two causes for a variable-overhead spend-

ing variance requires detailed information about the budgeted prices and the budgeted quantities

of the individual line items in the variable-overhead cost pool.

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The following is a summary of the variable manufacturing overhead variances calculated in

this section.

Static-budget variance

Level 1

€13 500 F

Flexible-budget variance

Sales-volume variance

Level 2

€10 500 U

€24 000 F

Spending variance

Efficiency variance

Level 3

€4500 F

€15 000 U

The key cause of Sofiya's unfavourable flexible-budget variance is that the actual use of

machine-hours is higher than budgeted.

Developing budgeted fixed-overhead rates

Fixed-overhead costs are, by definition, a lump sum that does not change in total despite changes

in a cost driver. While total fixed costs are frequently included in flexible budgets, they remain

the same total amount within the relevant range regardless of the output level chosen to 'flex'

the variable costs and revenues. The three steps in developing Sofiya Company's budgeted fixed-

overhead rate are as follows.

Step 1: Identify the costs in the fixed-overhead cost pool(s) This is the numerator of the budg-

eted rate computation. For Sofiya, fixed manufacturing overhead costs include depreciation,

plant-leasing costs, property taxes, plant manager's salary and some administrative costs, all of

which are included in a single cost pool. Sofiya's budget is €276 000 for April 2022.

Step 2: Estimate the budgeted quantity of the allocation base(s) This is the denominator of

the budgeted rate computation. It is termed the denominator level. Sofiya uses machine-hours as

its allocation base. It budgets to manufacture 12 000 jackets in April 2022. The budgeted number

of machine-hours to manufacture 12 000 jackets is 4800 (12 000 × 0.40) budgeted machine-hours

per output unit).

Step 3: Calculate the budgeted fixed-overhead rate(s)

Budgeted fixed−

overhead rate

Budgeted fixed-overhead costs

€276 000

=

=

per unit of

Budgeted quantity of allocation base units

4800 machine-hours

allocation base

= €57.50 per machine-hours

In manufacturing settings, the denominator level is commonly termed the production denominator

level or the production denominator volume.

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Fixed-overhead cost variances

The Level 1 static-budget variance for Sofiya's fixed manufacturing overhead is €9000 U:

Fixed-overhead

Actual

Static-budget

static-budget variance = results −

amount

= €285 000−€76 000

= €9000 U

The actual results for fixed manufacturing overhead are in Exhibit 15.2. The static-budget amount

for fixed manufacturing overhead is based on 12 000 output units. Given that it is for a fixed cost,

this same €276 000 would be the budgeted amount for all output levels in the relevant range. There

is no ‘flexing’ of fixed costs.

The formula for the fixed manufacturing overhead flexible-budget variance is as follows:

Fixed-overhead

Actual

Flexible-budget

=

–

flexible-budget variance

results

amount

= €285 000 − €276 000

= €9000 U

The fixed-overhead flexible-budget variance is the same as the fixed-overhead static-budget var-

iance. Why? Because there is no ‘flexing’ of fixed costs. For Level 3 analysis (decomposing the

flexible-budget variance into its efficiency and spending components), all of the flexible-budget

variance is attributed to the spending variance because this is precisely why this variance arises

for fixed costs.

The €9000 unfavourable variance simply means that Sofiya spent more on fixed manufacturing

overhead in April 2022 than it budgeted.

Static-budget variance

Level 1

€9000 U

Flexible-budget variance

Sales-volume variance

Level 2

€9000 U

Never a variance

Spending variance

Efficiency variance

Level 3

€9000 U

Never a variance

A summary of the Levels 1, 2 and 3 variance analyses for Sofiya's fixed manufacturing overhead

in April 2022 is as follows:

There is never a sales-volume variance in Level 2 for fixed-overhead costs. Why? Because budg-

eted fixed costs are, by definition, unaffected by sales-volume changes. Similarly, there is never

an efficiency variance in Level 3 for fixed-overhead costs. After all, a manager cannot be more or

less efficient in dealing with a given amount of fixed costs.

Production-volume variance

The variances discussed so far in this chapter are presented in Exhibit 16.3 – Panel A for var-

iable costs and the first three columns of Panel B for fixed costs. We now discuss a new var-

iance for fixed-overhead costs (shown on the right-hand side of Exhibit 16.3, Panel B).

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Exhibit 16.3

Variance analysis: variable and fixed manufacturing overhead for the

Sofiya Company

Panel A: Variable manufacturing overhead

Flexible budget (Budgeted input*

Actual costs

allowed for actual output

incurred

Actual input* × Budgeted rate

achieved × Budgeted rate)

(1)

(2)

(3)

(4500 × €30)

(0.40 × 10 000 × €30)

€130 500

€135 000

€120 000

€4500 F†

€15 000 U

Spending variance

Efficiency variance

€10 500 U

Flexible-budget variance

€10 500 U

Under- or overallocated variable overhead

(Total variable-overhead variance)

Panel B: Fixed manufacturing overhead

Allocated (Budgeted

Same lump

Same lump

input*

Actual

sum regardless

sum regardless

allowed for actual output

costs incurred

of output level

of output

achieved × Budgeted

(1)

(2)

level (3)

rate) (4)

(0.40 × 10 000 × €57.50)

€285 000

€276 000

€276 000

€230 000

€9000 U

€46 000 U

Spending variance

Never a variance Production-volume variance

€9000 U

€46 000 U

Flexible-budget

Production-volume variance

variance

€55 000 U

Under- or overallocated fixed overhead

(Total fixed-overhead variance)

* For overhead costs, input refers to units of cost-allocation base.

† F = favourable effect on operating profit; U = unfavourable effect on operating profit.

The production-volume variance is the difference between budgeted fixed overhead and the fixed

overhead allocated. Fixed overhead is allocated based on the budgeted fixed overhead rate times the

budgeted quantity of the fixed-overhead allocation base for the actual output units achieved. Other

terms for this variance include denominator-level variance and output-level overhead variance.

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The formula for the production-volume variance, expressed in terms of allocation base units

(machine-hours for Sofiya), is:

Production-

Budgeted

 Fixed overhead allocated using

Budgeted fixed

volume

=

fixed

– □

□

□ budgeted input allowed for

–

□

□

□

□

overhead rate □

variance

overhead

□

□□ actual output units achieved

□□

= €276 000 − (10.40 × 10 000 × €57.50)

= €276 000 − (4000 × €57.50)

= €276 000 − €230 000

= €46 000 U

The amount used for budgeted fixed overhead will be the same lump sum shown in the static

budget and also in any flexible budget within the relevant range. Fixed-overhead costs allocated

is the sum of the individual fixed-overhead costs allocated to each of the products manufactured

during the accounting period.

Panel A of Exhibit 16.3 does not have the column 4 shown for Panel B. Why? Because column

4 does not apply to variable-overhead costs. The amount of variable overhead allocated is always

the same as the flexible-budget amount.

Interpreting the production-volume variance

The production-volume variance arises whenever actual production differs from the denominator

level used to calculate the budgeted fixed-overhead rate. We calculate this rate because stock costing

and some types of contract require fixed-overhead costs to be expressed on a unit-of-output basis.

The production-volume variance results from ‘unitising’ fixed costs. Be careful not to attribute much

economic significance to this variance. The most common misinterpretation is to assume this vari-

ance measures the economic cost of producing and selling 10 000 units rather than the 12 000 budg-

eted for April. This assumption does not consider why Sofiya sold only 10 000 units. Assume that

a new competitor had gained market share by pricing below what Sofiya charged its customers. To

sell the budgeted 12 000 units, Sofiya may have had to reduce its own selling price on all 12 000 units.

Suppose it decided that selling 10 000 units at a higher price yielded higher operating profit than

selling 12 000 units at a lower price. The production-volume variance does not take into account

such information. Hence, it would be misleading to interpret the €46 000 unfavourable amount as

Sofiya's economic cost of selling 2000 units less than the budgeted quantity of 12 000 units for April.

Integrated analysis of overhead cost variances

Exhibit 16.3 illustrates the four variances explained in this chapter. When all four variances are

presented, it is called a *4- variance analysis.*

4-variance analysis

Spending

Efficiency

Production-volume

variance

variance

variance

Variable

manufacturing

€4500 F

€15 000 U

Never a variance

overhead

Fixed

manufacturing

€9000 U

Never a variance

€46 000 U

overhead

The four variances in this presentation are the two variable manufacturing overhead variances and

the two fixed manufacturing overhead variances. Note also that there are two instances of ‘Never

a variance’. Why? The efficiency variance pertains only to variable manufacturing overhead. There

can be no efficiency for fixed manufacturing overhead because this amount is a lump sum regard-

less of the output level. The production-volume variance pertains only to fixed manufacturing

overhead. It arises because the lump sum is required to be allocated to individual output units for

stock costing (and, in some cases, for contract reimbursement).

3-variance analysis

Spending

Efficiency

Production-

variance

variance

volume variance

Total manufacturing

€4500 U

€15 000 U

€46 000 U

overhead

The two spending variances from the 4-variance analysis have been combined in the 3-variance

analysis. The only loss of information in the 3-variance analysis is the overhead spending variance

area – only one spending variance is reported instead of separate variable- and fixed-overhead

spending variances. 3-Variance analysis is sometimes called combined variance analysis, because

it combines variable- and fixed-cost variances when reporting overhead cost variances.

2-variance analysis

Flexible-budget

Production-volume

variance

variance

Total manufacturing overhead

€19 500 U

€46 000 U

The spending and efficiency variances from the 3-variance analysis have been combined under

the 2-variance analysis.

1-variance analysis

Total overhead variance

Total manufacturing overhead

€65 500 U

The single variance of €65 500 U in 1-variance analysis is the sum of the flexible-budget variance

and the production-volume variance under 2-variance analyses. Using figures from Exhibit 16.3,

the total overhead variance is the difference between the total actual manufacturing over-

head incurred (€130 500 + €285 000 = €415 500) and the manufacturing overhead allocated

(€120 000 + €230 000 = €350 000) to the actual output units produced. The €65 500 unfavour-

able total manufacturing overhead variance for the Sofiya Company in April 2022 is largely the

result of the €46 000 unfavourable production-volume variance. Using the 4-variance analysis

presentation, the next largest amount (after the €46 000) is the €15 000 unfavourable variable-over-

head efficiency variance. This variance arises from the additional 500 machine-hours used in April

2022 above the 4000 machine-hours allowed to manufacture the 10 000 jackets. The two spending

variances (€4500 F and €9000 U) partially offset each other.

The variances in Sofiya's 4-variance analysis are not necessarily independent of each other. For

example, Sofiya may purchase lower-quality machine fluids (giving rise to a favourable spending

variance); this results in the machines taking longer to operate than budgeted (giving rise to an

unfavourable efficiency variance).

Different purposes of manufacturing overhead cost analysis

Different types of cost analysis may be appropriate for different purposes. Consider the planning

and control purpose and the stock costing for financial reporting purpose. Panel A of Exhibit 16.4

depicts variable manufacturing overhead for each purpose; Panel B depicts fixed manufacturing

overhead for each purpose.

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Exhibit 16.4

Behaviour of variable and fixed manufacturing overhead costs for planning

and control and for stock costing

Panel A: Variable manufacturing overhead costs

Graph 1: Planning and control purpose

Graph 2: Stock costing purpose

€250 000

€250 000

Allocate at rate of

€12 per output unit

200 000

200 000

150 000

150 000

100 000

100 000

50 000

50 000

5000 10 000 15 000 20 000

5000 10 000 15 000 20 000

Output units

Output units

Panel B: Fixed manufacturing overhead costs

Graph 3: Planning and control purpose

Graph 4: Stock costing purpose

€400 000

€400 000

Allocate at rate of

€23 per output unit

300 000

300 000

200 000

200 000

100 000

100 000

5000 10 000 15 000 20 000

5000 10 000 15 000 20 000

Output units

Output units

Variable manufacturing overhead costs

Sofiya’s variable manufacturing overhead is shown in Panel A of Exhibit 16.4 as being variable with

respect to output units (jackets) produced for both the planning and control purpose (graph 1) and

the stock costing purpose (graph 2). The greater the number of output units manufactured, the

higher the budgeted total variable manufacturing overhead costs and the higher the total variable

manufacturing overhead costs allocated to output units.

Graph 1 of Exhibit 16.4 presents an overall picture of how total variable overhead might

behave. Of course, variable overhead consists of many items, including energy costs, repairs,

indirect labour, and so on. Managers help control variable-overhead costs by budgeting each line

item and then investigating possible causes for any significant variances.

Fixed manufacturing overhead costs

Panel B of Exhibit 16.4 (graph 3) shows that for the planning and control purpose, fixed overhead

costs do not change in the 8000-unit to 16 000-unit output range. Consider a monthly leasing cost

of €20 000 for a building under a three-year leasing agreement. Managers control this fixed leasing

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cost at the time the lease is signed. During any month in the leasing period, management can do little

to change this €20 000 lump-sum payment. Contrast this description of fixed overhead with how

these costs are depicted for the stock costing purpose, graph 4 of Panel B. Under generally accepted

accounting principles, fixed manufacturing costs are capitalised as part of stock on a unit-of-out-

put basis. Every output unit that Sofiya manufactures will increase the fixed overhead allocated to

products by €23 (€57.50 per machine-hour × 0.40 machine-hours per output unit). Managers

should not use this unitisation of fixed manufacturing overhead costs for their planning and control.

The denominator level in each graph in Exhibit 16.4 is expressed in output units produced.

Alternatively, we could also have expressed this denominator in terms of input units. For Sofiya,

machine-hours would be the chosen denominator, as this is the allocation base for both variable

and fixed manufacturing overhead costs.

Journal entries for overhead costs and variances

Recording overhead costs

The Wallace Company job-costing example (Chapter 3) used a single manufacturing overhead

control account. This chapter illustrates separate variable and fixed manufacturing overhead

control accounts. Each overhead control account requires its own overhead allocated account.

Consider the following journal entries for the Sofiya Company. Recall that for April 2022:

Flexible-budget

amount

Allocated

Actual results

(10 000 units)

amount

Variable manufacturing

€130 500

€120 000*

€120 000*

overhead

Fixed manufacturing

285 000

276 000†

230 000‡

overhead

* 0.40 × 10 000 × €30 × €120 000.

† €276 000 is the budgeted fixed manufacturing overhead.

‡ 0.40 × 10 000 × €57.50 × €230 000.

The budgeted variable-overhead rate is €30 per machine-hour. The denominator level for fixed

manufacturing overhead is 4800 machine-hours of input with a budgeted rate of €57.50 per

machine-hour. Sofiya uses 4-variance analysis.

During the accounting period, actual variable-overhead and actual fixed-overhead costs are

accumulated in separate control accounts. As each unit is manufactured, the budgeted variable- and

fixed-overhead rates are used to record the amounts in the respective overhead allocated accounts.

Entries for variable manufacturing overhead for April 2022 are:

1 Variable Manufacturing Overhead Control

130 500

Creditors Control and other accounts

130 500

To record actual variable manufacturing overhead

costs incurred.

2 Work-in-Progress Control

120 000

Variable Manufacturing Overhead Allocated

120 000

To record variable manufacturing overhead cost

allocated

(0.40 × 10 000 × €30).

3 Variable Manufacturing Overhead Allocated

120 000

Variable Manufacturing Overhead Efficiency Variance

15 000

Variable Manufacturing Overhead Control

130 500

Variable Manufacturing Overhead Spending

4 500

Variance

To isolate variances for the accounting period.

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Entries for fixed manufacturing overhead are:

1 Fixed Manufacturing Overhead Control

285 000

Wages Payable, Accumulated Depreciation, etc.

285 000

To record actual fixed-overhead costs incurred.

2 Work-in-Progress Control

230 000

Fixed Manufacturing Overhead Allocated

230 000

To record fixed manufacturing overhead costs

allocated

(0.40 × 10 000 × €57.50).

3 Fixed Manufacturing Overhead Allocated

230 000

Fixed Manufacturing Overhead Spending Variance

9 000

Fixed Manufacturing Production-Volume Variance

46 000

Fixed Manufacturing Overhead Control

285 000

To isolate variances for the accounting period.

The end-of-period adjustments for these variances are now discussed.

Overhead variances and end-of-period adjustments

Chapter 5 outlined the adjusted allocation rate approach and the proration approach to handling

the end-of-period difference between manufacturing overhead incurred and manufacturing over-

head allocated. Consider Sofiya's variable manufacturing overhead. The budgeted rate was €30

per machine-hour. The actual rate is €29 per machine-hour.

Under the adjusted allocation rate approach, Sofiya would adjust the job record of every job

worked on during the year. This adjustment, in effect, would entail using the actual rate per

machine-hour of €29 instead of the budgeted rate of €30. Then, Sofiya would accordingly recal-

culate the closing stock and cost of goods sold for the accounting period. This approach has

several benefits. Individual job records are restated to show actual costs accurately. Also, closing

stock and cost of goods sold would accurately show actual variable overhead incurred. A similar

approach could be used to restate the fixed manufacturing overhead in job records. Provided all

accounting records are on compatible computer systems, the adjusted allocation rate approach

can often be done in a low-cost and timely manner.

The proration approach is used where managers view the adjusted allocation rate approach as

not being cost-effective. The three main options for disposing of variances under this approach

are:

● proration based on the allocated overhead amount (before proration) in the closing balances

of Stock and Cost of Goods Sold;

● proration based on total closing balances (before proration) in Stock and Cost of Goods Sold;

● immediate write-off to Cost of Goods Sold.

Sofiya could use any one of these options when prorating the €10 500 of underallocated vari-

able manufacturing overhead (and the €55 000 of underallocated fixed manufacturing overhead).

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Concepts in action

Variance analysis and standard costing: helping Sandoz manage

overhead costs

Sandoz, the $9.7 billion generics division of Swiss-based Novartis AG, is the world's third largest generic drug manu-

facturer. The company serves the needs of 520 million patients worldwide Market pricing pressure means that Sandoz

operates on razor-thin margins. As a result, the company must ensure that managers have a full and accurate under-

standing of its costs, including accounting for overhead costs. Sandoz uses standard costing and variance analysis to

manage its overhead costs.

Sandoz prepares a yearly overhead budget based on a detailed production plan, planned overhead spending, and

other factors. Sandoz then uses activity-based costing to assign budgeted overhead costs to different work centres (for

example, mixing, blending, tableting, testing and packaging). Finally, overhead costs are assigned to products based on

the activity levels required by each product at each work centre. The resulting standard product cost is used in product

profitability analysis and as a basis for making pricing decisions. The two main focal points in Sandoz's performance

analyses are overhead absorption analysis and manufacturing overhead variance analysis.

Each month, Sandoz uses absorption analysis to compare actual production and actual costs to the standard costs

of processed inventory. The monthly analysis evaluates two key trends:

1 Are costs in line with the budget? If not, the reasons are examined and the accountable managers are notified.

2 Are production volume and product mix conforming to plan? If not, Sandoz reviews and adjusts machine capacities

and the absorption trend is deemed to be permanent.

Manufacturing overhead variances are examined at the work centre level. These variances help to determine when

equipment is not running as expected so it can be repaired or replaced. Variances also help in identifying inefficiencies

in processing and set-up and cleaning times, which leads to more efficient ways to use equipment. In spite of its tight

cost controls, Sandoz faces heavy price competition and the parent company's CEO Vas Narasimhan has sought to

shift the company toward lower volume but higher priced medicines for several years. Following low profit growth

figures and strategic re-thinking, Novartis has been considering 'de-integrating' Sandoz CEO and possibly being sold

following a $25 billion bid from investment groups in 2022.

Sources: Novartis AG (2015) Form 20-F (Basel, Switzerland: Novartis AG); IMS Institute for Healthcare Informatics/Generic Pharmaceutical Association, Generic Drug Savings in the United States, November 2015; Conversations with, and documents prepared by, Tobias Hestler and Chris Lewis of Sandoz 2016; Kansteiner, F. (2022) 'Novartis' Sandoz reportedly the target of $25B buyout bid from Carlyle and Blackstone, 1 February (https://www.fiercepharma.

com/pharma/novartis-sandoz-reportedly-target-26b-buyout-bid-from-carlyle-and-blackstone); Burger, L. (2021) 'Novartis may divest generic unit Sandoz as price pressures mount', 26 October (https://www.reuters.com/business/novartis-more-bullish-cosentyx-entresto-sales-q3-profit-rises-2021-10-26/).

Engineered, discretionary and infrastructure costs

From a planning and control standpoint, managers often find it useful to classify costs in gen-

eral, and overhead costs in particular, into three main categories: engineered, discretionary and

infrastructure.

● Engineered costs result specifically from a clear cause-and-effect relationship between costs

and output. In the Sofiya Company example, direct materials and direct manufacturing labour

are examples of engineered direct costs, while energy, indirect materials and indirect support

labour are examples of engineered overhead costs. Each of these costs increases in a specific

way as the units manufactured (jackets) increase. Consider, in particular, the costs of leasing

machines. This is a fixed cost in the short run, but it is also an example of an engineered

cost. Why? Because, over time, there is a clear cause-and-effect relationship between output,

machine-hours of capacity required, and machine leasing costs. Thus, engineered costs can be

variable or fixed costs.

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Exhibit 16.5

Differences between engineered and discretionary costs

	Engineered costs	Discretionary costs
1 Process or activity	a Detailed and physically observable	a Black box (knowledge of process is sketchy or unavailable)
	b Repetitive	b Non-repetitive or non-routine
2 Level of uncertainty	Moderate or small (shipping or manufacturing settings)	Great (R&D or advertising settings)

Source: This exhibit is a modification of one suggested by H. Itami.

● Discretionary costs have two important features: (1) they arise from periodic (usually yearly)

decisions regarding the maximum outlay to be incurred, and (2) they have no clearly measurable

cause-and-effect relationship between costs and outputs. There is often a delay between the

acquisition of a resource and its eventual use. Examples of discretionary costs include adver-

tising, executive training, R&D, health care and management consulting, and corporate staff

department costs such as legal, human resources and public relations. The most noteworthy

aspect of discretionary costs is that managers are seldom confident that the 'correct' amounts

are being spent. The founder of Lever Brothers, an international consumer-products company,

once noted, 'Half the money I spend on advertising is wasted; the trouble is, I don't know which

half.' Exhibit 16.5 sets out the differences between engineered and discretionary costs.

● Infrastructure costs arise from having property, plant and equipment, and a functioning organ-

isation. Examples are depreciation, long-run lease rental and the acquisition of long-run tech-

nical capabilities. The period between when infrastructure costs are committed to and acquired

and when they are eventually used is very long. Careful long-range planning, rather than day-

to-day monitoring, is the key to managing infrastructure costs. Frequently, there is also a high

level of uncertainty about the outputs (cash inflows) resulting from the capital-expenditure

decisions.

Financial and non-financial performance measures

The overhead variances discussed in this chapter are examples of financial performance measures.

Managers also find that non-financial measures provide useful information. Examples of meas-

ures that Sofiya would find useful in planning and controlling its overhead costs are:

1 Actual indirect materials usage in metres per machine-hour, compared with budgeted indirect

materials usage in metres per machine-hour

2 Actual energy usage per machine-hour, compared with budgeted energy usage per machine-hour

3 Actual machining time per job, compared with budgeted machining time per job.

These performance measures, like the variances discussed in this chapter, are best viewed as atten-

tion directors, not problem solvers. These performance measures would probably be reported on

the manufacturing floor on a daily, or even hourly, basis. The manufacturing overhead variances

we discussed in this chapter capture the financial effects of items such as 1, 2 and 3 above, which

in many cases first appear as non-financial performance measures.

Both financial and non-financial performance measures are key inputs when evaluating the

performance of managers. Exclusive reliance one or the other usually fails to provide a broader

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picture for managerial action. At times, qualitative input complements quantitative information

that is financial and non-financial. And there are situations where qualitative anecdotal informa-

tion informs whether the quantitative indicators represent reality sufficiently well. For example,

Jeff Bezos, CEO of Amazon and the world's first centi-billionaire, says: 'We have so many met-

rics . . . and the thing I have noticed is that when the anecdotes and the data disagree, the anecdotes

are usually right. There's something wrong with the way you're measuring.' (Gapper 9 May 2018)

Actual, normal and standard costing

Chapter 3 presented two possible combinations of actual and budgeted direct-cost rates and

actual and budgeted indirect-cost rates. Exhibit 16.6 presents these two costing systems along with

a third system – standard costing – discussed in Chapters 15 and 16. Standard costing is a costing

method that traces direct costs to a cost object by multiplying the standard price(s) or rate(s) times

the standard inputs allowed for actual outputs achieved, and allocates indirect costs on the basis

of the standard indirect rate(s) times the standard inputs allowed for the actual outputs achieved.

With a standard costing system, the costs of every product or service planned to be worked on

during that period can be calculated at the start of that period. This feature enables a simplified

recording system to be used. No record need be kept of the actual costs of items used or of the

actual quantity of the cost-allocation base used on individual products or services worked on

during the period. Once standards have been set, the costs of operating a standard costing system

can be low relative to an actual or normal costing system.

Suppose the Sofiya Company is analysing its marketing overhead costs. It uses a 4 -variance

analysis of its marketing overhead costs. The following information was collected for April 2022.

1 Variable marketing overhead is allocated to products using budgeted direct marketing labour-

hours per jacket. Fixed marketing overhead is allocated to products on a per-jacket basis.

2 Budgeted amounts for April 2022 are:

a Direct marketing labour-hours: 0.25 hours per jacket

b Variable marketing overhead rate: €20 per direct marketing labour-hour

c Fixed marketing overhead: €434 000

d Output, which is used as the denominator level of output: 12 000 jackets.

3 Actual results for April 2022 are:

a Variable marketing overhead: €45 700

b Fixed marketing overhead: €420 000

c Direct marketing labour-hours: 2304

d Actual output: 10 000 jackets.

Exhibit 16.6

Actual, normal and standard costing methods

Actual costing

Normal costing

Standard costing

Direct costs

Actual direct price/rate

Actual direct price/rate

Standard direct

× Actual quantity of

× Actual quantity of

price/rate × Standard

direct-cost input

direct-cost input

inputs allowed for actual

outputs achieved

Overhead (indirect) costs

Actual indirect rate

Budgeted indirect

Standard indirect price

× Actual quantity

rate × quantity of cost-

rate × Standard inputs

of cost-allocation base

allocation base

allowed for actual outputs

achieved

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Suppose we wish to present an analysis of the April 2022 marketing overhead costs using

the format shown in both panels of Exhibit 16.3. Exhibit 16.7 is the columnar presentation of

variances.

Exhibit 16.7

Variance analysis: variable and fixed marketing overhead for the Sofiya

Company

Panel A: Variable marketing overhead

Flexible budget

(Budgeted input*

Actual costs

Actual input*

allowed for actual output

incurred

× Budgeted rate

achieved × Budgeted rate)

(1)

(2)

(3)

(2304 × €20)

(0.25 × 10 000 × €20)

€45 700

€46 080

€50 000

€380 F†

€3920 F

Spending variance

Efficiency variance

€4300 F

Flexible-budget variance

€4300 F

Under- or overallocated variable overhead

Panel B: Fixed marketing overhead

Allocated

Same lump sum

(Budgeted input*

Actual costs

regardless of Same lump sum regardless

allowed for actual output

incurred

output level

of output level

achieved × Budgeted rate)

(1)

(2)

(3)

(4)

(1 × 10 000 × €36.1667)

€420 000

€434 000

€434 000

€361 667

€14 000 F

€72 333 U

Spending variance Never a variance Production-volume variance

€14 000 F

€72 333 U

Flexible-budget variance

Production-volume

variance

€58 333 U

Under- or overallocated fixed overhead

* For overhead costs, input refers to units of cost-allocation base.

† F = favourable effect on operating profit; U = unfavourable effect on operating profit.

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The budgeted fixed marketing overhead rate is €36.1667 (rounded) per jacket. These variances

can be summarised as follows:

Spending

Efficiency

Production-volume

variance

variance

variance

Variable marketing overhead

€380 F

€3920 F

Never a variance

Fixed marketing overhead

€14 000 F

Never a variance

€58 333 U

We would also like to determine why variances occurred in marketing overhead costs.

● *Variable marketing overhead spending variance* (€380 F). The reasons for this variance include:

● Lower-than-expected prices for line items in the variable marketing overhead budget, such

as lower wage rates for marketing support staff, lower prices for long-distance telephone

calls and lower prices for petrol used by salespeople.

● Lower-than-expected usage of line items in the variable marketing overhead budget, such as

fewer marketing support staff, fewer long-distance telephone calls and fewer litres of petrol

per direct marketing labour-hour.

● *Variable marketing overhead efficiency variance* (€3920 F). The reason for this variance is

more productive use of the cost-allocation base (direct marketing labour-hours); 2304 direct

marketing labour-hours were used, compared with a budgeted 2500 hours. Perhaps marketing

personnel classified as direct labour were more efficient, maybe because of a new incentive

plan, a better training programme, or greater-than-expected continuous improvement.

● *Fixed marketing overhead spending variance* (€14 000 F). The possible reasons for this variance

include:

● Lower-than-expected prices for line items in the fixed marketing overhead budget. Perhaps

a marketing department supervisor resigned and was replaced by a lower-paid supervisor,

or maybe a building lease was renegotiated at a lower-than-budgeted amount.

● Lower-than-expected usage of line items in the fixed marketing overhead budget, such as the

marketing salesforce renting five rather than six cars and thus reducing the fixed monthly

car rental payment.

● *Production-volume variance* (€72 333 U). This variance arises because the output level (sales)

was 10 000 jackets rather than 12 000 jackets. One explanation is that marketing sales personnel

were much less effective than budgeted. Other explanations include a downturn in the economy,

poor-quality work at Sofiya's manufacturing plant, a new competitor entering the market, and

a reduction in tariffs, resulting in the import of lower-cost jackets.

How might Sofiya plan and control its marketing overhead costs? The main approaches to plan-

ning and controlling are: variable and fixed.

● Working creatively at the design stage to avoid non-value-added activities (for example,

double-checking marketing mailings).

● Working on reducing the rate per cost driver or the number of cost driver units per output. For

example, marketing managers could exert tighter control over the price of department purchases.

● Monitoring variances on an ongoing basis.

● Assigning responsibilities for the marketing variance to managers who will promote the pro-

ductivity of the marketing staff.

The main approaches to planning and controlling fixed marketing overhead costs are:

● Planning capacity needs in detail, including providing incentives for managers to estimate their

budgeted usage in an unbiased way.

● Having marketing managers make careful, cost-conscious planning decisions on individual line items.

Day-to-day monitoring of variances is likely to play only a minor role in the control of fixed

marketing overhead costs.

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Activity-based costing and variance analysis

ABC systems classify costs of various activities into a cost hierarchy – output-unit level, batch

level, product sustaining, and facility sustaining. The basic principles and concepts for variable

and fixed manufacturing overhead costs presented earlier in the chapter can be extended to ABC

systems. In this section, we illustrate variance analysis for variable and fixed batch-level set-up

overhead costs. Batch-level costs are resources sacrificed on activities that are related to a group

of units of product(s) or service(s) rather than to each individual unit of product or service.

We continue the Chapter 15 example of Lyco Brass Works, which manufactures Jacutaps, a line

of decorative brass taps for jacuzzis. Lyco manufactures Jacutaps in batches. To manufacture a

batch of Jacutaps, Lyco must set-up the machines and moulds. Set-up costs are batch-level costs

because they are associated with batches rather than individual units of products. Doing set-ups

is a skilled activity. Hence, a separate Set-up Department is responsible for setting up machines

and moulds for different types of Jacutap. Lyco regards set-up costs as overhead costs of products.

Set-up costs consist of some costs that are variable and some costs that are fixed with respect

to the number of set-up-hours. Variable costs of set-ups consist of wages paid to hourly set-up

labour and indirect support labour, costs of maintenance of set-up equipment, and costs of indi-

rect materials and energy used during set-ups. Fixed set-up costs consist of costs of engineers,

supervisors and set-up equipment leases.

Information regarding Jacutaps for 2022 follows:

Static-budget

Actual

amounts

amounts

1 Units of Jacutaps produced and sold

180 000

151 200

2 Batch size (units/batch)

150

140

3 Number of batches (Line 1 ÷ Line 2)

1 200

1 080

4 Set-up-hours per batch

6

6.25

5 Total set-up-hours (Line 3 × Line 4)

7 200

6 750

6 Variable overhead cost per set-up-hour

€20

€21

7 Variable set-up overhead costs (Line 5 × Line 6)

€144 000

€141 750

8 Total fixed set-up overhead costs

€216 000

€220 000

Flexible budget and variance analysis for variable set-up overhead

wcosts

To prepare the flexible budget for variable set-up overhead costs, Lyco starts with the actual units

of output produced, 151 200 units, and proceeds in the following steps.

Step 1: Using the budgeted batch size, calculate the number of batches that should have been

used to produce the actual output Lyco should have manufactured the 151 200 units of output

in 1008 batches (151 200 ÷ 150).

Step 2: Using budgeted set-up-hours per batch, calculate the number of set-up-hours that

should have been used At the budgeted quantity of 6 set-up-hours per batch, 1008 batches

should have required 6048 set-up-hours (1008 × 6).

Step 3: Using the budgeted variable cost per set-up-hour, calculate the flexible budget for

variable set-up overhead costs The flexible-budget amount is 6048 set-up-hours × €20 per

setup-hour = €120 960.

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Exhibit 16.8

Variable set-up overhead variance analysis for Lyci Brass Works

2022

Flexible budget (Budgeted input allowed for actual output × Budgeted rate	Actual costs Actual input incurred

× Budgeted rate)

(1)

(2)

(3)

(6750 × €21)

(6750 × €20)

(6048 × €20)

€141 750

€135 000

€120 960

€6750 U*

€14 040 U

Spending variance

Efficiency variance

€20 790 U

Flexible-budget variance

* F = favourable effect on operating profit; U = unfavourable effect on operating profit.

Exhibit 16.8 presents the variances for variable set-up overhead costs in columnar form.

Flexible-budget

variance for

Actual

Flexible-budget

=

–

variable set-up

costs

costs

overhead coasts

= 6750×€21−6048×€20

= €141 750−€120 960

= €20 790 U

The flexible-budget variance for variable set-up overhead costs can be subdivided into efficiency

and spending variances.

□□

Budgeted units of □□

Variable

Actual units of

□□

□□

Budgeted

□

□□

overhead

variable-overhead

variable-overhead

□□

□□□

variable

= □

×

effciency

□ cost-allocation base − cost allocation base

□

□□

□

□

□

used for

allowed for

overhead

□□

variance

□□

□

□

□

□

actual output

actual output

rate

□

□□□

= (6750 − 6048)×€20

= 702×€20

= €14040 U

The unfavourable variable set-up overhead efficiency variance of €14 040 arises because the

actual number of set-up-hours (6750) exceeds the number of set-up-hours that Lyco should have

used (6048) for the number of units it produced. Two reasons for the unfavourable efficiency var-

iance are (1) smaller actual batch sizes of 140 units instead of budgeted batch sizes of 150 units,

which results in Lyco producing the 151 200 units in 1080 batches instead of 1008 batches, and

(2) higher actual set-up-hours per batch of 6.25 hours instead of the budgeted set-up-hours per

batch of 6 hours.

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Explanations for smaller-than-budgeted batch sizes could include (1) quality problems if batch

sizes exceed 140 taps, or (2) high costs of carrying inventory. Explanations for longer actual set-

up-hours per batch could include: (1) problems with equipment, (2) demotivated or inexperienced

employees, or (3) inappropriate set-up-time standards.

Variable

□□ Actual variable

Budgeted variable □□

Actual quantity of

□

□□

overhead

□□ overhead cost per

overhead cost per □□

variable overhead

= □□

–

□□ ×

spending

□□

unit of cost-

unit of cost-

□□

cost-allocation base

□

□□

variance

□□ allocation base

allocation base □□

used for actual output

□

□

= (€21−€20)×6750

= €1×6750

= €6750 U

The unfavourable spending variance indicates that Lyco operated in 2022 with a higher-

than-budgeted variable overhead cost per set-up-hour. Two main reasons that could contribute

to the unfavourable spending variance are (1) the actual prices of individual items included in

variable overhead, such as set-up labour, indirect support labour, or energy, are higher than the

budgeted prices, and (2) the actual quantity usage of individual items such as indirect support

labour and energy increase more than the increase in set-up-hours, due perhaps to set-ups becom-

ing more complex because of equipment problems. Thus, equipment problems could lead to

an unfavourable efficiency variance because set-up-hours increase, but it could also lead to an

unfavourable spending variance because each set-up-hour requires more resources from the set-up

cost pool than the budgeted amounts.

Identifying the reasons for the variances is important because it helps managers plan for cor-

rective action. We now consider fixed set-up overhead costs.

Flexible budget and variance analysis for fixed set-up overhead costs

For fixed set-up overhead costs, the flexible-budget amount equals the static-budget amount of

€216 000. Why? Because there is no ‘flexing’ of fixed costs.

Fixed set-up

overhead

Actual

Flexible-budget

=

–

flexible-budget

costs

costs

variance

= €220 000−€216 000

= €4000 U

The fixed set-up overhead spending variance is the same amount as the fixed overhead

flexible-budget variance (because fixed overhead costs have no efficiency variance).

Fixed set-up

overhead

Actual

Flexible-budget

=

–

spending

costs

costs

variance

= €220 000 − €216 000

= €4000 U

The unfavourable fixed set-up overhead spending variance could be due to lease costs of new

set-up equipment, or higher salaries paid to engineers and supervisors. Lyco may have incurred

these costs to alleviate some of the difficulties it was having in setting up machines.

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To calculate the production-volume variance, Lyco first computes the budgeted cost-allocation

rate for fixed set-up overhead costs using the four-step approach described below.

Step 1: Choose the time period used to calculate the budget Lyco uses a period of 12 months

(the year 2022).

Step 2: Select the cost-allocation base to use in allocating fixed overhead costs to the cost

object(s) Lyco uses budgeted set-up-hours as the cost-allocation base for fixed set-up overhead

costs. Budgeted set-up-hours for 2022 per the static budget are 7200 hours.

Step 3: Identify the fixed overhead costs associated with the cost-allocation bas Lyco's fixed

set-up overhead cost budget for 2022 is €216 000.

Step 4: Calculate the rate per unit of the cost-allocation base used to allocate fixed overhead

costs to the cost object(s) Dividing the €216 000 from step 3 by the 7200 set-up-hours from

step 2, Lyco estimates a fixed set-up overhead cost rate of €30 per set-up-hour:

Budgeted total costs

Budgeted fixed

in overhead cost pool

set-up overhead =

cost rate

Budgeted total quantity of

cost-allocation base

€216 000

= 7200set-up-hours

= €30 per set-up-hours

Production-volume

Budgeted

Fixed set-up overhead

variance for fixed

fixed set-up

allocated using budgeted

=

–

set-up overhead

overhead

input allowed for

costs

costs

actual output units produced

= €216 000 − (1008 batches × 6 hours per batch) × €30

= €216 000 − (6048 × €30) = €216 000 − €181 440

= €34 560 U

Exhibit 16.9 presents the variances for fixed set-up overhead costs in columnar form.

During 2022 Lyco planned to produce 180 000 units of Jacutaps but actually produced only

151 200 units. The unfavourable production-volume variance measures the amount of extra fixed

set-up costs that Lyco incurred for set-up capacity it planned to use but did not. One interpreta-

tion is that the unfavourable €34 560 production-volume variance represents inefficient utilisation

of set-up capacity. However, Lyco may have earned higher operating income by selling 151 200

units at a higher price than what it would have earned by selling 180 000 units at a lower price.

The production-volume variance should be interpreted cautiously because it does not consider

such information.

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Exhibit 16.9

Fixed set-up overhead variance analysis: Lyco Brass Works for 2018

Flexible budget:

same lump sum

Allocated

(as in static budget)

(Budgeted input

Actual costs

regardless of

allowed for

incurred

budgeted output level

actual output × Budgeted rate)

(1)

(2)

(3)

(1008† batches × 6 hours/batch × €30)

(6048 × €30)

€220 000

€216 000

€181 440

€4000 U*

€34 560 U

Spending variance

Production-volume variance

€4000 U

Flexible-budget variance

*U = unfavourable effect on operating profit.

†1008 batches = 151 200 units ÷ 150 units per batch.

Summary

The following points are linked to the chapter's learning objectives.

1 Planning of variable-overhead costs involves undertaking only value-added variable-cost activities and then effi-

ciently managing the cost drivers of those activities. Planning of fixed-overhead costs includes undertaking only

value-added fixed-cost activities and then determining the appropriate level of those activities, given the expected

demand and the level of uncertainty pertaining to that demand.

2 When the flexible budget for variable overhead is developed, a spending overhead variance and an efficiency

variance can be calculated. The variable-overhead spending variance is the difference between the actual amount

of variable overhead incurred and the budgeted amount that is allowed for the actual quantity of the variable-

overhead allocation base used for the actual output units achieved. The variable overhead efficiency variance

measures the efficiency with which the cost-allocation base is used; this is a different type of efficiency variance

from that calculated in Chapter 15 for direct-cost items, such as direct materials.

3 The budgeted fixed-overhead rate is calculated by dividing the budgeted fixed-overhead costs by the budgeted

quantity of allocation base units.

4 The production-volume variance measures the difference between the budgeted fixed overhead and the fixed

overhead allocated on the basis of actual output produced. Usually, production-volume variances are not a good

measure of the opportunity cost of unused capacity. For example, the plant capacity level may exceed the budgeted

level, hence some unused capacity may not be included in the denominator. Moreover, the production- volume

variance focuses only on costs. It does not take into account any price changes necessary to spur extra demand

that would in turn make use of any idle capacity.

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5 A 4-variance analysis presents spending and efficiency variances for variable-overhead costs and spending and

production-volume variances for fixed-overhead costs. By analysing these four variances together, managers can

consider possible interrelationships among them. These variances collectively measure differences between actual

and budgeted amounts for output level, selling prices, variable costs and fixed costs.

6 For planning and control, fixed manufacturing overhead is a lump sum that is unaffected by the budgeted quantity

of the fixed-overhead allocation base. In contrast, for stock costing the unitised fixed manufacturing overhead rate

will be affected by the budgeted quantity of the fixed-overhead allocation base.

7 The separate analysis of variable- and fixed-overhead costs requires the use of separate variable- and fixed-

overhead control accounts and separate variable- and fixed-overhead allocated accounts. At the end of each

accounting period, any variances for variable- or fixed-overhead costs can be disposed as illustrated in Chapter 5.

8 Flexible budgeting in activity-based costing systems enables insight into why activity costs differ from those

budgeted.

Reference and further reading

Gapper, J. (9 May 2018) Memo from Amazon: tell a good story (https://www.ft.com/content/386e57b2-

52a9-11e8-b3ee-41e0209208ec)

CHAPTER 16

Assessment material

Review questions

16.1 What are the steps in planning variable-overhead costs?

16.2 How does the planning of fixed-overhead costs differ from the planning of variable-overhead

costs?

16.3 What are the steps in developing a budgeted variable-overhead cost rate?

16.4 Budgeting for variable manufacturing overhead requires a knowledge of cost drivers. Name three

possible cost drivers.

16.5 Both financial and non-financial measures are used to control variable manufacturing overhead.

Give two examples of each type of measure.

16.6 Assume variable manufacturing overhead is allocated using machine-hours. Give three possible

reasons for a €25 000 favourable variable-overhead efficiency variance.

16.7 Describe the difference between a direct materials efficiency variance and a variable manufactur-

ing overhead efficiency variance.

16.8 Why is the flexible-budget variance the same amount as the spending variance for fixed manufac-

turing overhead?

16.9 Explain how 4-variance analysis differs from 1-, 2- and 3-variance analyses.

16.10 The 4-variance analysis format shows ‘never a variance’ for two areas. Which two areas? Why?

Exercises

Basic level

***16.11 Variable manufacturing overhead, variance analysis** (20 minutes)

Lavertezzo Srl is a manufacturer of designer suits. The cost of each suit is the sum of three variable

costs (direct material costs, direct manufacturing labour costs and manufacturing overhead costs)

and one fixed-cost category (manufacturing overhead costs). Variable manufacturing overhead

cost is allocated to each suit on the basis of budgeted direct manufacturing labour-hours per suit.

For June 2022, each suit is budgeted to take 4 labour-hours. Budgeted variable manufacturing

overhead cost per labour-hour is SFr 12. The budgeted number of suits to be manufactured in

June 2022 is 1040.

Actual variable manufacturing overhead costs in June 2022 were SFr 52 164 for 1080 suits started

and completed. There was no opening or closing stock of suits. Actual direct manufacturing

labour-hours for June were 4536.

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Required

1 Calculate the static-budget variance, the flexible-budget variance and the sales-volume variance

for variable manufacturing overhead.

2 Comment on the results.

Intermediate level

16.12 Fixed manufacturing overhead, variance analysis (continuation of Exercise 16.11)

(20 minutes)

Lavertezzo allocates fixed manufacturing overhead to each suit using budgeted direct manufactur-

ing labour-hours per suit. Data pertaining to fixed manufacturing overhead costs for June 2022

are budgeted, SFr 62 400, and actual, SFr 63 916.

Required

1 Calculate the spending variance and the flexible-budget variance for fixed manufacturing over-

head. Comment on these results.

2 Calculate the production-volume variance for June 2022. What inferences can Lavertezzo draw

from this variance?

16.13 Comprehensive review of Chapters 15 and 16, static budget (15 minutes)

L'Evénement du Dimanche budgets to produce 300 000 copies of its monthly newspaper for

August 2022. It is budgeted to run 15 000 000 print pages in August with 50 print pages per news-

paper. Actual production in August 2022 was 320 000 copies with 17 280 000 print pages run. Each

paper was only 50 print pages, but quality problems with paper led to many pages being unusable.

Variable costs comprise direct materials, direct labour, and variable indirect costs. Variable and

fixed indirect costs are allocated to each copy on the basis of print pages. The driver for all vari-

able costs is the number of print pages. Data pertaining to August 2022 are:

Budgeted

Actual

Direct materials

SFr 180 000

SFr 224 640

Direct labour costs

45 000

50 112

Variable indirect costs

60 000

63 936

Fixed indirect costs

90 000

97 000

Data pertaining to revenues for *L'Evénement du Dimanche* in August 2022 are:

Budgeted

Actual

Circulation revenue

SFr 140 000

SFr 154 000

Advertising revenue

360 000

394 600

L'Evénement du Dimanche sells for SFr 0.50 per copy in 2022. No change from this budgeted price

of SFr 0.50 per copy occurred in August 2022. The actual direct labour rate in August 2022 was

SFr 29.00 per hour. Actual and budgeted pages produced per direct labour-hour in August 2022

were 10 000 print pages. Copies produced but not sold have no value. Advertising revenue covers

payments from all advertising sources.

Required

1 Present a static-budget variance (Level 1) report for *L'Evénement du Dimanche.*

2 Comment on the results in requirement 1.

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16.14 Engineered and discretionary overhead costs (20 minutes)

Willem Nijmegen manages the warehouse of Stientje NV, a mail-order firm. Nijmegen is con-

cerned about controlling the fixed costs of the 20 workers who collect merchandise in the ware-

house and bring it to the area where orders are assembled for shipment. Each employee works 180

hours per month at a budgeted cost of €15 per hour. Studies show that it takes an average of 12

minutes for a worker to locate an article of merchandise and move it to the order assembly area,

and that the average order is for two different articles. In August, Stientje processed 8500 orders.

Actual costs were €56 000.

Required

1 Calculate the spending and production-volume variances for Stientje using an engineered over-

head cost approach.

2 Calculate the spending and production-volume variances for Stientje using a discretionary

overhead cost approach.

3 Comment on the differences in the approaches to controlling costs under requirements 1 and 2.

16.15 Standard Costing (From ACCA Financial Information for Management, Part 1, June 2005)

(40 minutes)

Murgatroyd Ltd, which manufactures a single product, uses standard absorption costing.

A summary of the standard product cost is as follows:

£ per unit

Direct materials

15

Direct labour

20

Fixed overheads

12

Budgeted and actual production for last month were 10 000 units and 9000 units respectively. The

actual costs incurred were:

£

Direct materials

138 000

Direct labour

178 000

Fixed overheads

103 000

Required

1 Prepare a statement that reconciles the standard cost of actual production with its actual cost

for last month and highlights the total variance for each of the three elements of cost.

2 Last month 24 000 litres of direct material were purchased and used by the company. The

standard allows for 2.5 litres of the material, at £6 per litre, to be used in each unit of product.

Provide an appropriate breakdown of the total direct materials cost variance included in your

statement in 1.

3 Explain who in the company should be involved in setting:

a the standard price; and

b the standard quantity for direct materials.

16.16 Variance calculations (From ACCA Financial Information for Management, Part 1, June 2004)

(25 minutes)

Coledale Ltd manufactures and sells product CC. The company operates a standard marginal

costing system. The standard cost card for CC includes the following:

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Exercises

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£ per unit

Direct material

20

Direct labour (6 hours at £ 7.50 per hour)

45

Variable production overheads

27

92

The budgeted and actual activity levels for the last quarter were as follows:

Budget units

Actual units

Sales

20 000

19 000

Production

20 000

21 000

The actual costs incurred last quarter were:

£

Direct material

417 900

Direct labour (124 950 hours)

949 620

Variable production overheads

565 740

Required

1 Calculate the *total* variances for direct material, direct labour and variable production

overheads.

2 Provide an appropriate breakdown of the total variance for direct labour calculated in 1.

3 Suggest TWO possible causes for EACH variance calculated in 2.

16.17 Cost behaviour issues (From ACCA Financial Information for Management, Part 1, June 2004)

(25 minutes)

Braithwaite Ltd manufactures and sells a single product. The following data have been extracted

from the current year's budget:

Contribution per unit

£ 8

Total weekly fixed costs

£ 10 000

Weekly profit

£ 22 000

Contribution to sales ratio

40%

The company's production capacity is not being fully utilised in the current year and three possible

strategies are under consideration. Each strategy involves reducing the unit selling price on all

units sold with a consequential effect on the budgeted volume of sales. Details of each strategy

are as follows:

Reduction in unit weekly

Expected increase in

Strategy

selling price %

sales volume over budget %

A

2

10

B

5

18

C

7

25

The company does not hold stocks of finished goods.

Required

1 Calculate for the current year:

a the selling price per unit for the product; and

b the weekly sales (in units).

2 Determine, with supporting calculations, which one of the three strategies should be adopted

by the company in order to maximise weekly profits.

3 Briefly explain the practical problems that a management accountant might encounter in sep-

arating costs into their fixed and variable components.

16.18 Variance calculation (From CIMA Management Accounting Pillar Managerial Level Paper,

November 2006) (20 minutes)

PP Ltd operates a standard absorption costing system. The following information has been

extracted from the standard cost card for one of its products:

Budgeted production

1500 units

Direct material cost:

7 kg × £4.10

£28.70 per unit

Actual results for the period were as follows:

Production

1600 units

Direct material (purchased and used):

12 000 kg × £ 52 200

It has subsequently been noted that due to a change in economic conditions the best price that

the material could have been purchased for was £4.50 per kg during the period.

Required

1 Calculate the material price planning variance.

2 Calculate the operational material usage variance.

Advanced level

16.19 Manufacturing overhead, variance analysis (30–40 minutes)

Mondragon SA assembles its CardioX product at its Toledo plant. Manufacturing overhead (both

variable and fixed) is allocated to each CardioX unit using budgeted assembly-time hours. Budg-

eted assembly time per CardioX product is 2 hours. The budgeted variable manufacturing over-

head cost per assembly-time hour is €40. The budgeted number of CardioX units to be assembled

in March 2022 is 8000. Budgeted fixed manufacturing overhead costs are €480 000.

Actual variable manufacturing overhead costs for March 2022 were €610 500 for 7400 units actu-

ally assembled. Actual assembly-time hours were 16 280. Actual fixed manufacturing overhead

costs were €503 420.

Required

1 Conduct a 4-variance analysis (Exhibit 16.3) for Mondragon's Toledo plant.

2 Comment on the results in requirement 1.

3 How does the planning and control of variable manufacturing overhead costs differ from that

of fixed manufacturing overhead costs?

16.20 Spending and efficiency overhead variances, service sector (20–25 minutes)

Danskmat AS operates a home meal delivery service. It has agreements with 20 restaurants to pick

up and deliver meals to customers who phone or fax in orders. Danskmat is currently examining

its overhead costs for May 2022.

Variable-overhead costs for May 2022 were budgeted at DKK 20 per hour of home delivery time.

Fixed-overhead costs were budgeted at DKK 240 000. The budgeted number of home deliveries

in May 2022 was 8000. Delivery time, the allocation base for variable- and fixed-overhead costs,

is budgeted to be 0.80 hour per delivery.

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Actual results for May 2022 were:

Variable overhead

DKK 141 740

Fixed overhead

DKK 276 000

Number of home deliveries

7 460

Hours of delivery time

5 595

Customers are charged DKK 120 per delivery. The delivery driver is paid DKK 70 per delivery.

Danskmat receives a 10% commission on the meal costs that the restaurants charge the customers

who use Danskmat.

Required

1 Calculate spending and efficiency variances for Danskmat's variable and fixed overhead in May

2022. Comment on the results.

2 How might Danskmat manage its variable-overhead costs differently from the way it manages

its fixed-overhead costs?

16.21 Total overhead, 3-variance analysis (35–50 minutes)

The Olsson-Langkilde Air Force Base has an extensive repair facility for jet engines. It developed

standard costing and flexible budgets to account for this activity. Budgeted variable overhead at

a level of 8000 standard monthly direct labour-hours was SEK 64 000; budgeted total overhead

at 10 000 standard direct labour-hours was SEK 197 600. The standard cost allocated to repair

output included a total overhead rate of 120% of standard direct labour cost.

Total overhead incurred for October was SEK 249 000. Direct labour costs incurred were SEK 202

440. The direct labour price variance was SEK 9640 U. The direct labour flexible-budget variance

was SEK 14 440 U. The standard labour price was SEK 16 per hour. The production-volume var-

iance was SEK 14 000 F.

Required

1 Calculate the direct labour efficiency variance and the spending, efficiency and production-

volume variances for overhead. Also, calculate the denominator level.

2 Describe how individual variable manufacturing overhead items are controlled from day to day.

Also, describe how individual fixed manufacturing overhead items are controlled.

16.22 Comprehensive review of Chapters 15 and 16, flexible budget (continuation of Exercise

16.13) (40 minutes)

Required

1 Prepare a comprehensive set of variances for each of the four categories of cost of *L'Evénement*

du Dimanche.

2 Comment on the results in requirement 1. What extra insights are available with a flexible-budget

analysis over that of a static-budget analysis?

16.23 Flexible budgets, 4-variance analysis (CMA, adapted) (15–25 minutes)

Nolton-Ragnvald AS uses a standard costing system. It allocates manufacturing overhead (both

variable and fixed) to products on the basis of standard direct manufacturing labour-hours

(DLH). Nolton develops its manufacturing overhead rate from the current annual budget. The

manufacturing overhead budget for 2022 is based on budgeted output of 720 000 units requiring

3 600 000 direct manufacturing labour-hours. The company is able to schedule production uni-

formly throughout the year.

A total of 66 000 output units requiring 315 000 direct labour-hours was produced during May

2022. Manufacturing overhead (MOH) costs incurred for May amounted to NOK 375 000. The

actual costs as compared with the annual budget and 1/12 of the annual budget are shown below.

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Annual manufacturing overhead budget 2022

Per

Monthly

Actual

Per

DLH

MOH

MOH

Total

output

input

budget,

costs for

amount

unit

unit

May 2022

May 2022

Variable MOH

Indirect mfg

NOK 900 000

NOK 1.25 NOK 0.25

NOK 75 000

NOK 75 000

labour

Supplies

1 224 000

1.70

0.34

102 000

111 000

Fixed MOH

Supervision

648 000

0.90

0.18

54 000

51 000

Utilities

540 000

0.75

0.15

45 000

54 000

Depreciation

1 008 000

1.40 0.28 84 000

84 000

Total

NOK 4 320 000

NOK 6.00 NOK 1.20 NOK 360 000

NOK 375 000

Required

Calculate the following amounts for Nolton-Ragnvald for May 2022:

1 Total manufacturing overhead costs allocated.

2 Variable manufacturing overhead spending variance.

3 Fixed manufacturing overhead spending variance.

4 Variable manufacturing overhead efficiency variance.

5 Production-volume variance.

Be sure to identify each variance as favourable (F) or unfavourable (U).

16.24 Review of Chapters 15 and 16, 3-variance analysis (CPA, adapted) (30–50 minutes)

Madetoja Oy's job-costing system has two direct-cost categories: direct materials and direct

manufacturing labour. Manufacturing overhead (both variable and fixed) is allocated to products

on the basis of standard direct manufacturing labour-hours (DLH). At the beginning of 2022,

Madetoja adopted the following standards for its manufacturing costs:

Input

Cost per output unit

Direct materials

3 kg at €5.00 per kg

€15.00

Direct manufacturing labour

5 hours at €15.00 per hour

75.00

Manufacturing overhead

Variable

€6.00 per DLH

30.00

Fixed

€8.00 per DLH

40.00

Standard manufacturing cost

per output unit

€160.00

The denominator level for total manufacturing overhead per month in 2022 is 40 000 direct

manufacturing labour-hours. Madetoja's flexible budget for January 2022 was based on this

denominator level. The records for January indicate the following:

Direct materials purchased

25 000 kg at €5.20 per kg

Direct materials used

23 100 kg

Direct manufacturing labour

40 100 hours at €14.60 per hour

Total actual manufacturing overhead €600 000

(variable and fixed)

Actual production

7800 output units

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Required

1 Prepare a schedule of total standard manufacturing costs for the 7800 output units in January

2022.

2 For the month of January 2022, calculate the following variances, indicating whether each is

favourable (F) or unfavourable (U):

a Direct materials price variance, based on purchases

b Direct materials efficiency variance

c Direct manufacturing labour price variance

d Direct manufacturing labour efficiency variance

e Total manufacturing overhead spending variance

f Variable manufacturing overhead efficiency variance

g Production-volume variance. Level 2 analysis

Flexible-

Sales-

Actual

budget

Flexible

volume

Static

results

variance

budget

variance

budget

(1)

(2) = (1) - (3)

(3)

(4) = (3) - (5)

(5)

Cost driver:

Number of units

manufactured

10 000

–

10 000

2000 U

12 000

Variable

(0.40 ×

(0.40 ×

manufacturing

10 000 × €30)

12 000 × €30)

overhead

€130 500

€120 000

€144 000

€10 500 U

€24 000 F

Flexible-budget variance

Sales-volume variance

€13 500 F

Static-budget variance

* F = favourable effect on operating profit; U = unfavourable effect on operating profit.

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CHAPTER 17

Measuring yield, mix and quantity effects

Comparing actual results with budgets can help managers evaluate

operations and focus on areas that deserve more attention. Chapters 15

Learning objectives

and 16 illustrated various uses of variance information relating to direct

materials, direct manufacturing labour, direct marketing labour,

After studying this chapter, you

manufacturing overhead and marketing overhead. While Chapters 15

should be able to:

and 16 focused on a single input in each cost category (for example, only

- Distinguish between variance

one direct material), this chapter considers multiple inputs in each cost analysis procedures where inputs

category (for example, many types of direct materials). Also, we discuss cannot be substituted for one

revenue and sales mix and quantity analysis for companies with multiple another and those where inputs

products.

can be so substituted

- Understand how direct materials yield and mix variances highlight trade-offs among material inputs
- Explain direct manufacturing labour yield and mix variances
- Describe the insight gained from dividing the sales-volume variance into the sales-mix and sales-quantity variances

- Explain how market-size and

market-share variances provide

different explanations for a

sales-quantity variance

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Input variances

Here we focus on variance analysis for inputs in manufacturing organisations. Manufacturing

processes often require that a number of different direct materials and different direct manu-

facturing labour skills be combined to obtain a unit of finished product. In the case of some

materials and labour skills, this combination must be exact. For example, the manager of an HP

plant that assembles laptop computers prespecifies the make of chip to be used in each computer.

Substituting an Intel chip for a TSMC chip will alter the final product. We refer to these materials

as *non-substitutable* materials. In the case of other materials, a manufacturer has some leeway in

combining the materials. For example, to manufacture fertilisers, Chambal Fertilisers can com-

bine materials (for example, elemental phosphorus and acids) in varying proportions. Elemental

phosphorus and acids are *substitutable* materials.

When inputs are substitutable, *mix* refers to the relative proportion or combination of the

different inputs used within an input category such as direct materials or direct manufacturing

labour to produce a quantity of finished output. *Yield* refers to the quantity of finished output

units produced from a budgeted or standard mix of inputs within an input category. Yield and

mix variances are useful when examining direct materials and direct-labour inputs. Consider, for

example, the production of ice-cream. Ice-creams contain multiple material ingredients. Nut 'n

Crunch ice-cream, for example, has milk, cream, cocoa, chocolate, caramel and different kinds

of nuts. Managing the total quantity and mix of ingredients is essential to making high-quality

ice-cream at a competitive cost. Direct materials yield and mix variances help managers to achieve

these goals. Recall from Chapter 15 that a *variance* is the difference between an actual result and a

budgeted amount, when that budgeted amount is a financial variable reported by the accounting

system. Budgeted figures discussed in this chapter can be obtained from:

● internally generated actual costs from the most recent accounting period, sometimes adjusted

for expected improvement;

● internally generated *standard* costs based on best performance standards or *currently attain-*

able standards;

● externally generated *target* cost numbers based on an analysis of the cost structures of the

leading competitors in an industry.

Direct materials yield and mix variances

When we initially examined materials and labour variances in Chapter 15, we saw that managers

sometimes make trade-offs between price and efficiency variances. For example, an orange-juice

bottler may use oranges whose juice content is lower than budgeted if their price is significantly

lower than the price of oranges with the budgeted juice content. The yield and mix variances

calculated in this section provide additional insight into the effect that yield and mix factors have

on operating income. Yield and mix variances divide the efficiency variance calculated in Chapter

15; hence, we start by reviewing efficiency and price variances.

Direct materials efficiency and price variances

Consider a specific example of multiple direct materials inputs and a single product output.

Lia Ltd makes cider. To produce cider of the desired consistency, colour and taste, Lia mixes

three types of apples grown in three different regions: Golden Delicious from Brittany, British

Coxes from Kent, and Jonagold from Italy. Lia's production standards require 1.6 tonnes of

apples to produce 1 tonne of cider, with 50% of the apples being Golden Delicious, 30%

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British Coxes, and 20% Jonagold. The direct materials input standards to produce 1 tonne

of cider are:

0.80 (50% of 1.6) tonne of Golden Delicious at €70 per tonne

€56.00

0.48 (30% of 1.6) tonne of British Coxes at €80 per tonne

38.40

0.32 (20% of 1.6) tonne of Jonagold at €90 per tonne

28.80

Total standard cost of 1.6 tonnes of apples

€123.20

Budgeted cost per tonne of apples is €123.20 ÷ 1.6 tonnes = €77.

Because Lia uses fresh apples to make cider, no stocks of apples are kept. Purchases are made

as needed, so all price variances relate to apples purchased and used. Actual results for June 2022

show that a total of 6500 tonnes of apples were used to produce 4000 tonnes of cider:

3250 tonnes of Golden Delicious at actual cost of €70 per tonne

€227 500

2275 tonnes of British Coxes at actual cost of €82 per tonne

186 550

975 tonnes of Jonagold at actual cost of €96 per tonne

93 600

6500 tonnes of apples

507 650

Standard cost of 4000 tonnes of cider at €123.20 per tonne

492 800

Total variance to be explained

€14 850 U

Given the standard ratio of 1.6 tonnes of apples to 1 tonne of cider, 6400 tonnes of apples should be used

to produce 4000 tonnes of cider. At the standard mix, the quantities of each type of apple required are:

Golden Delicious

0.50 × 6400 = 3200 tonnes

British Coxes

0.30 × 6400 = 1920 tonnes

Jonagold

0.20 × 6400 = 1280 tonnes

Exhibit 17.1 presents the familiar approach to analysing the flexible-budget direct materials

variance discussed in Chapter 15. The direct materials price and efficiency variances are calculated

separately for each input material and then added together. The variance analysis prompts Lia to

investigate the unfavourable price and efficiency variances – why did they pay more for the apples

and use greater quantities than they should have? Were the market prices of apples higher, in

Exhibit 17.1

Direct materials price and efficiency variances for Lia Ltd for

June 2022

Flexible budget

Actual costs

(Budgeted inputs

incurred

allowed for actual

(Actual inputs

Actual inputs

outputs achieved

× Actual prices)

× Budgeted prices

× Budgeted prices)

(1)

(2)

(3)

Golden Delicious

3250 × 70 = 227 500

3250 × 70 = 227 500

3200 × 70 = 224 000

British Coxes

2275 × 82 = 186 550

2275 × 80 = 182 000

1920 × 80 = 153 600

Jonagold

975 × 96 = 93 600

975 × 96 = 87 750

1280 × 90 = 115 200

€507 650

€497 250

€492 800

€10 400 U* €4450 U

Total price variance Total efficiency variance

€14 850 U

Total flexible-budget variance

* U = unfavourable effect on operating profit.

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general, or could the Purchasing Department have negotiated lower prices? Did the inefficiencies

result from inferior apples or from problems in processing?

The analysis in Exhibit 17.1 may suffice when the three direct materials used are not substitutes.

Managers control each individual input, and no discretion is permitted regarding the substitution

of materials inputs. For example, there is often a specified mix of parts needed for the assembly

of cars, radios and washing machines. A car needs both an engine and a gear box – one cannot

be substituted for the other. In these cases, all deviations from the input–output relationships are

due to efficient or inefficient usage of individual direct materials. Thus, the price and efficiency

variances individually calculated for each material typically provide the information necessary

for decisions.

The role of direct materials yield and direct materials mix variances

Managers sometimes do have discretion to substitute one material for another. For example, the man-

ager of Lia's cider plant has some leeway in combining Golden Delicious, British Coxes and Jonagold

without affecting quality. We will assume that to maintain quality, the mix percentages of each type of

apple can vary only up to 5% in the standard mix. For example, the percentage of British Coxes in the

mix can vary between 25% and 35% (30% ± 5%). When inputs are substitutable, direct materials

efficiency improvement relative to budgeted costs can come from two sources: (1) using less input to

achieve a given output, and (2) using a cheaper mix to produce a given output. The direct materials

yield and mix variances divide the efficiency variance into two variances: the yield variance focusing

on total inputs used and the mix variance focusing on how the inputs are combined.

Given that the budgeted input mix is unchanged, the total direct materials yield variance is the

difference between two amounts: (1) the budgeted cost of direct materials based on the actual total

quantity of all direct materials inputs used, and (2) the flexible-budget cost of direct materials

based on the budgeted total quantity of direct materials inputs for the actual output achieved.

Given that the actual total quantity of all direct materials inputs used is unchanged, the total direct

materials mix variance is the difference between two amounts: (1) the budgeted cost for the actual

direct materials input mix, and (2) the budgeted cost if the budgeted direct materials input mix

had been unchanged.

Exhibit 17.2 presents the total direct materials yield and mix variances for Lia Ltd. We start

with column 3 and work our way to column 1.

Total direct materials yield variance

Compare columns 3 and 2 of Exhibit 17.2. Column 3 calculates the flexible-budget cost based on

the budgeted cost of the budgeted total quantity of all inputs used (6400 tonnes of apples) for the

actual output achieved (4000 tonnes of cider) times the budgeted input mix (Golden Delicious,

50%; British Coxes, 30%; Jonagold, 20%). Column 2 also calculates costs using the budgeted

input mix and the budgeted prices. The *only* difference in the two columns is that column 3 uses

the *budgeted total quantity of all inputs used* (6400 tonnes), while column 2 uses the *actual total*

quantity of all inputs used (6500 tonnes). Hence, the difference in costs between the two columns

is the total direct materials yield variance, due solely to differences in actual and budgeted total

input quantity used. The total direct materials yield variance is the sum of the direct materials

yield variances for each input.

□□

Budgeted total □

□

□

□

□□

□

Actual total

quantity of all □

□

□□

Budgeted

Budgeted

Direct materials

□□

□

□ quantity of all

direct materials □□□

direct materials

price of

yield variance for = □□

–

□

□

□ ×

×

□ direct materials

inputs allowed □□

each input

input mix

direct materials

□□

□□

□

□

□

inputs used

for actual

□

percentage

input

□

□

□

□

□

□

□

output achieved □

□

□□

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Exhibit 17.2

Total direct materials yield and mix variances for Lia Ltd for June 2022

Flexible budget

(Budgeted total quantity

(Actual total quantity

(Actual total quantity

of all inputs allowed for

of all inputs used

of all inputs used

actual output achieved

× Actual input mix)

× Budgeted input mix)

× Budgeted input mix)

× Budgeted prices

× Budgeted prices

× Budgeted prices

(1)

(2)

(3)

Golden Delicious

6500 × 0.50 × 70 =

6500 × 0.50 × 70 =

6400 × 0.50 × 70 =

227 500

227 500

224 000

British Coxes

6500 × 0.35 × 80 =

6500 × 0.30 × 80 =

6400 × 0.30 × 80 =

182 000

156 000

153 600

Jonagold

6500 × 0.15 × 90 =

6500 × 0.20 × 90 =

6400 × 0.20 × 90 =

87 750

117 000

115 200

€497 250

€500 500

€492 800

€3250 F* €7700 U

Total mix variance Total yield variance

€4450 U

Total efficiency variance

The direct materials yield variances are:

Golden Delicious

(6500 − 6400) × 0.50 × €70 = 100 × 0.50 × €70 =

€3500 U

British Coxes

(6500 − 6400) × 0.30 × €80 = 100 × 0.30 × €80 =

2400 U

Jonagold

(6500 − 6400) × 0.20 × €90 = 100 × 0.20 × €90 =

1800 U

Total direct materials yield variance

€7700 U

The total direct materials yield variance is unfavourable because Lia uses 6500 tonnes of apples

rather than the 6400 tonnes that it should have used to produce 4000 tonnes of cider. Holding

constant the budgeted mix and budgeted prices of apples, the budgeted cost per tonne of apples

in the budgeted mix is €77 per tonne. The unfavourable yield variance represents the budgeted

cost of using 100 more tonnes of apples (6500 − 6400) × €77 = €7700 U.

Total direct materials mix variance

Compare columns 2 and 1 in Exhibit 17.2. Both columns calculate cost using the actual total

quantity of all inputs used (6500 tonnes) and budgeted input prices (Golden Delicious, €70;

British Coxes, €80; and Jonagold, €90). The only difference is that column 2 uses *budgeted input*

mix (Golden Delicious, 50%; British Coxes, 30%; and Jonagold, 20%), and column 1 uses *actual*

input mix (Golden Delicious, 50%; British Coxes, 35%; Jonagold, 15%). The difference in costs

between the two columns is the total direct materials mix variance, attributable solely to differ-

ences in the mix of inputs used. The total direct materials mix variance is the sum of the direct

materials mix variances for each input.

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□□

Actual

Budgeted

□□

Actual total

Budgeted

□

□□

Direct materials mix

□□ direct materials

direct materials □□

quantity of all

price of

= □□

–

□□ ×

×

variance for each input

□□

input mix

input mix

□□□ direct materials direct materials

□□

□

□

□

□

percentage

percentage

□□

inputs used

input

□

□

The direct materials mix variances are:

Golden Delicious

(0.50 − 0.50) × 6500 × €70 = 0 × 6500 × €70

= €0

British Coxes

(0.35 − 0.30) × 6500 × €80 = 0.05 × 6500 × €80

= 26 000 U

Jonagold

(0.15 − 0.20) × 6500 × €90 = (− 0.05) × 6500 × €90 = 29 250 F

Total direct materials mix variance

= €3 250 F

The favourable total direct materials mix variance (3250 F) occurs because the average budgeted

cost per tonne of apples in the actual mix [€497 250 (Exhibit 17.2, column 1) ÷ 6500 = €76.50]

is less than the average budgeted cost per tonne of apples in the budgeted mix [€500 500

(Exhibit 17.2, column 2) ÷ 6500 = €77]. The favourable mix variance represents the dif-

ference in cost of the budgeted mix and the actual mix for the 6500 tonnes of apples used

(€76.50 − €77) × 6500 = €3250F. The total direct materials mix variance helps managers under-

stand how total budgeted costs change as the actual direct materials mix varies from the budgeted

mix. The mix variance of an individual input is favourable (unfavourable) if Lia uses a smaller

(greater) percentage of that input in its actual mix relative to the budgeted mix. The individual var-

iances help managers identify the reasons why the total mix variance is favourable – substituting

some lower (budgeted) priced British Coxes (€80 per tonne) in place of the more costly Jonagold

(€90 per tonne) while using the budgeted mix of Golden Delicious reduces costs.

How should we interpret the analysis in Exhibit 17.2? The total direct materials yield variance

is €7700 U, and the total direct materials mix variance is €3250 F. There was a trade-off among

ingredients (perhaps because of the high cost or lack of availability of Jonagold) that reduced

the (budgeted) cost of the mix of inputs used but hurt yield. That is, the benefit of the cheaper

mix was more than offset by the lower yield. This analysis helps Lia's managers to understand

that using the cheaper mix of inputs in the future will only be worthwhile if they can improve

yield. Managers would need to understand the reasons for the poor yield – for example, did the

poor yield result from inadequate testing of the apples received, from lax quality control during

processing, or simply from using a cheaper mix? Identifying these reasons enables managers to

find ways to overcome these problems and improve performance.

The direct materials variances calculated in Exhibits 17.1 and 17.2 can be summarised as

follows:

Total flexible budget

direct materials variance

€14 850 U

Total direct materials

Total direct materials

price variance

efficiency variance

€10 400 U

€4450 U

Total direct materials

Total direct materials

mix variance

yield variance

€3250 F

€7700 U

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Direct manufacturing labour yield and mix variances

Direct manufacturing labour variances are calculated in much the same way as direct materials

variances. We again use the Lia Ltd example to illustrate direct manufacturing labour price,

efficiency, yield and mix variances. Lia has three grades of direct manufacturing labour: Grade 1,

Grade 2 and Grade 3. Budgeted costs for June 2022 follow:

3000

hours of Grade 3 labour at €24 per hour

€72 000

2100

hours of Grade 2 labour at €16 per hour

33 600

900

hours of Grade 1 labour at €12 per hour

10 800

6000

total hours

€116 400

Actual results for June 2022 show that the work was completed in 5900 hours:

3245

hours of Grade 3 labour at €23 per hour

€74 635

1770

hours of Grade 2 labour at €18 per hour

31 860

885

hours of Grade 1 labour at €13 per hour

11 505

5900

total hours

118 000

Budgeted costs

116 400

Total direct manufacturing labour variance to be explained

€1600 U

Exhibit 17.3 presents the direct manufacturing labour price and efficiency variances for each

employee category and in total. The total price variance is unfavourable (€1180 U) because of the

higher wage rates paid to Grade 1 and Grade 2 labour. Managers would want to understand why the

wage rates were higher – for example, did the higher rate result from a general shortage of Grade 2

Exhibit 17.3

Direct manufacturing labour price and efficiency variances for

Lia Ltd for June 2022

Flexible budget

Actual costs

(Budgeted inputs

incurred

allowed for actual

(Actual inputs

Actual inputs

outputs achieved

× Actual prices)

× Budgeted prices

× Budgeted prices)

(1)

(2)

(3)

Grade 3 labour

3245 × 23

3245 × 24

3000 × 24

= 74 635

= 77 880

= 72 000

Grade 2 labour

1770 × 18

1770 × 16

2100 × 16

= 31 860

= 28 320

= 33 600

Grade 1 labour

885 × 13

885 × 12

900 × 12

= 11 505

= 10 620

= 10 800

€118 000

€116 820

€116 400

€1180 U* €420 U

Total price variance Total efficiency variance

€1600 U

Total flexible-budget variance

* U = unfavourable effect on operating profit.

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Exhibit 17.4

Direct manufacturing labour yield and mix variances for Lia Ltd for June 2022

Flexible budget

(Budgeted total quantity

(Actual total quantity

(Actual total quantity

of all inputs allowed for

of all inputs used

of all inputs used

actual output achieved

× Actual input mix)

× Budgeted input mix)

× Budgeted input mix)

× Budgeted prices

× Budgeted prices

× Budgeted prices

(1)

(2)

(3)

Grade 3 labour

5900 * 0.55 * €24

5900 * 0.50 * €24

6000 * 0.50 * €24

= €77 880

= €70 800

= €72 000

Grade 2 labour

5900 * 0.30 * €16

5900 * 0.35 * €16

6000 * 0.35 * €16

= 28 320

= 33 040

= 33 600

Grade 1 labour

5900 * 0.15 * €12

5900 * 0.15 * €12

6000 * 0.15 * €12

= 10 620

= 10 620

= 10 800

€116 820

€114 460

€116 400

€2360 U* €1940 F

Total mix variance Total yield variance

€420 U

Total efficiency variance

* F = favourable effect on operating profit; U = unfavourable effect on operating profit.

labour or from factors specific to Lia? The total efficiency variance is unfavourable (€420 U), primar-

ily because of the greater number of hours worked by Grade 3 labour. The budgeted costs of these

hours were only partially offset by the fewer hours worked by Grade 1 and Grade 2 labour and the

fewer total hours worked. Lia's managers would want to explore the reasons for the unfavourable

efficiency variance – for example, was it caused by absenteeism, labour turnover, processing problems

or the change in the mix of workers? To further understand this last issue, the unfavourable total

direct manufacturing labour efficiency variance of €420 may be divided into yield and mix variances

in the same way that we divided the direct materials efficiency variance in the preceding section.

Keeping the budgeted input mix unchanged, the total direct manufacturing labour yield variance

is the difference between two amounts: (1) the budgeted cost of direct manufacturing labour based

on the actual total quantity of all direct manufacturing labour used, and (2) the flexible-budget

cost of direct manufacturing labour based on the budgeted total quantity of direct manufacturing

labour for the actual output achieved. Taking the actual total quantity of all direct manufacturing

labour used as given, the total direct manufacturing labour mix variance is the difference between

two amounts: (1) the budgeted cost of inputs in the actual mix of direct manufacturing labour,

and (2) the budgeted cost of inputs in the budgeted mix of direct manufacturing labour.

Exhibit 17.4 presents the computations for the *total direct manufacturing labour yield* and

mix variances for Lia Ltd in columnar format. These variances can also be calculated as follows:

□□

Actual

Budgeted

□

□

□

□

□□

□ total quantity

quantity of all

□□

Budgeted direct

Budgeted

□

Direct manufacturing

□

□

□

□

□ of all direct

direct manufacturing □□□

manufacturing

price of direct

labour yield vairance =□□

□

□

□ ×

×

□ manufacturing −

labour inputs

□□

labour input

manufacturing

for each input

□□

□□

□

□

□ labour inputs

allowed for actual □□

mix percentage

labour input

□□

□

□

□

□

used

output achieved

□

□

□□

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The direct manufacturing labour yield variances are:

Grade 3 labour

(5900 − 6000) × 0.50 × €24 = (− 100) × 0.50 × €24

€1200 F

Grade 2 labour (5900 − 6000) × 0.35 × €16 = (− 100) × 0.35 × €16

560 F

Grade 1 labour (5900 − 6000) × 0.15 × €12 = (− 100) × 0.15 × €12

180 F

Total direct manufacturing labour yield variance

€1940 F

□□

Actual

Budgeted direct □

□

□□□ Actual total quantity

Budgeted

Direct manufacturing

□□ manufacturing

manufacturing □

□

□

□

□□

of all direct

price of direct

labour mix vairance =□□ labour input −

labour input □

□

□□ ×

×

□

□□

manufacturing

manufacturing

for each input

□□

mix

mix

□

□

□□□

labour inputs used

labour input

□□ percentage

percentage

□

□

□□

The direct manufacturing labour mix variances are:

Grade 3 labour

(0.55 − 0.50) × 5900 × €24 = 0.05 × 5900 × €24

= €7080 U

U

Grade 2 labour

(0.30 − 0.35) × 5900 × €16 = (− 0.05) × 5900 × €16

= 4720 F

F

Grade 1 labour

(0.15 − 0.15) × 5900 × €12 = 0 × 5900 × €12

=

= € 7080

0U

Total direct manufacturing labour mix variance

€2360 U

The unfavourable mix variance occurs because a greater proportion of work was done by the

more costly Grade 3 labour. Grade 3 labour accounted for 55% of the total actual direct manu-

facturing labour-hours but had been budgeted to handle only 50%. Grade 2 labour did a smaller

proportion of the work. Lia may have altered the mix of workers for reasons of availability or to

achieve greater efficiency despite the higher costs. As a result of the change in mix, the average

budgeted cost per direct manufacturing labour-hour in the actual mix [€116 820 (Exhibit 17.4,

column 1) ÷ 5900 = €19.80] was higher than the average budgeted cost per direct manufacturing

labour-hour in the budgeted mix [€114 460 (Exhibit 17.4, column 2) ÷ 5900 = €19.40]. The mix

variance helps managers understand how budgeted costs change as the actual mix varies from the

budgeted mix. The favourable yield variance indicates that the work was completed faster – in

5900 actual total hours compared with 6000 budgeted total hours. Perhaps this result is due to

the extra time spent by Grade 3 labour. But did the mix-versus-yield trade-off reduce cost? No,

because the overall direct manufacturing labour efficiency variance is unfavourable. The analysis

helps managers understand that shifting to a higher skills mix will only be worthwhile if the

total time taken can be further reduced. Managers would then have to consider ways to achieve

this goal.

Revenue and sales variances

We now examine how variances that use revenue information as a key output can be calculated.

Special attention is paid to companies with multiple products or services.

The revenue variances we discuss are most frequently called sales variances, in large part

because sales are the single largest component of revenue for many companies. For example,

sales of new or used vehicles in a motorcar dealership are typically a larger source of revenues

than are after-sales revenue items such as servicing and repairs.

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The levels approach introduced in Chapter 15 shows how the variances we now discuss are

linked to each other:

Level 1

Static-budget variance

Level 2

Flexible-budget variance

Sales-volume variance

Level 3

Sales-mix variance

Sales-quantity variance

Level 4

Market-size variance

Market-share variance

We discuss how each variance can be calculated for the revenues of Global Air, which has mul-

tiple classes of air service on its flights. The variances in this section could be calculated for any

line item in the income statement. For exposition purposes, we calculate variances for the revenue

line item of Global Air. Airlines face many challenges in increasing their revenues, such as the level

of price discounting and the special airline club promotions to use. The variances discussed in

the next section help managers to evaluate how well budgeted revenue targets are met. A second

reason for Global Air's emphasis on revenues (as opposed to, say, contribution margin per pas-

senger) is that variable costs per passenger are minimal. A third reason is that many marketing or

sales divisions are run as revenue centres.

Variance analysis for multiple products

Global Air operates flights between New York and London. It has three classes of service: first

class, business class and economy class. It is currently examining results for August 2022. Unit

volume is measured in terms of a round-trip ticket (one-way tickets are converted into equivalent

round-trip tickets). Budgeted and actual results for August 2022 are as follows:

Budget for August 2022

Actual for August 2022

Selling

Selling

price

Unit

Sales

price

Unit

Sales

per unit

volume

mix

Revenue

per unit volume

mix

Revenue

First class

€3200

1 000

5%

€3 200 000

€2600

2 400

10%

€6 240 000

Business class

2400

3 000

15%

7 200 000

1600

6 000

25%

9 600 000

Economy class

900

16 000

80%

14 400 000

700

15 600

65%

10 920 000

Total

20 000

100%

€24 800 000

24 000

100%

€26 760 000

In July 2022, Pan Air, a major competitor of Global, went bankrupt. It was acquired by Easy

Travel, a low-cost economy travel operator. Pan Air had a sizeable presence in the first- and

business-class markets. Easy Travel immediately offered deep price discounts for all classes of

travel. Its reputation among first-class and business-class travellers, however, was poor. Global

Air dropped all its fares in late July (after its budget was prepared) to meet the new competition.

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Static-budget variance

The *static-budget variance* for revenues is the difference between the actual revenues and the

budgeted revenues from the static budget.

Static-budget variance

Actual

Static-budget

=

–

of revenues

results

amount

First class

= €6 240 000 − €3 200 000

= €3 040 000 F

Business class

= €9 600 000 − €7 200 000

= €2 400 000 F

Economy class

= €10 920 000 − €14 400 000

= €3 480 000 U

Total

€1 960 000 F

Global Air has favourable variances for first class and business class and an unfavourable variance

for economy class. More information about the €1 960 000 favourable total variance can be gained

by examining the flexible-budget variance and the sales-volume variance.

Flexible-budget and sales-volume variances

The *flexible-budget variance* for revenues is the difference between the actual revenues and the

flexible-budget amount for the actual unit volume of sales.

Flexible-budget variance

Actual

Flexible-budget

=

–

of revenues

results

amount

First class

= €6 240 000

–

(€3200 × 2400)

= €6 240 000

–

€7 680 000

= €1 440 000 U

Business class

= €9 600 000

–

(€2400 × 6000)

= €9 600 000

–

€14 400 000

= €4 800 000 U

Economy class

= €10 920 000

–

(€900 × 15 600)

= €10 920 000

–

€14 040 000

= €3 120 000 U

Total

€9 360 000 U

The €9 360 000 unfavourable total variance arises because Global Air sizably reduced the price

for each class of travel relative to the budgeted price.

The *sales-volume variance* shows the effect of the difference between the actual and budgeted

quantity of the variable used to ‘flex’ the flexible budget. For the revenues of Global Air, this var-

iable is units sold. This variance can be calculated for each class of service of Global Air:

Sales-volume

□□ Actual sales Budgeted sales □□

Budgeted

□

□□

variance of = □□ quantity

–

quantity

□□× selling price

□□

□□

revenues

□□

□

□

in units

in units

□□

per unit

□

□

First class

= (2400 − 1000)

× €3200

=

€4 480 000 F

Business class

= (6000 − 3000)

× €2400

=

€7 200 000 F

Economy class

= (15 600 − 16 000)

× €900

=

€360 000 U

Total

€11 320 000 F

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While the total sales-volume variance for revenues is €11 320 000 favourable, there is a combi-

nation of favourable variances for first class and business class and an unfavourable variance for

economy class. Managers can gain additional insight into sales-volume changes by separating the

sales-volume variance into a sales-quantity variance and a sales-mix variance.

Sales-quantity variance

The sales-quantity variance is the difference between two amounts: (1) the budgeted amount based on

actual quantities sold of all products and the budgeted mix, and (2) the amount in the static budget

(which is based on the budgeted quantities to be sold of all products and the budgeted mix). The for-

mula for computing the sales-quantity variance in terms of revenues and the amounts for Global Air is:

Sales-quantity

□□ Actual units

Budgeted units □□

Budgeted

Budgeted

□

□□

variance of

= □□ of all products − of all products □□ × sales-mix × selling price

□

□

revenues

□□

□

□

sold

sold

□□ percentage

□

per unit

□

First class

=

(24 000 − 20 000)

× 0.05 × €3200

=

€640 000 F

Business class

=

(24 000 − 20 000)

× 0.15 × €2400

=

€1 440 000 F

Economy class

=

(24 000 − 20 000)

× 0.80 × €900

=

€2 880 000 F

Total

€4 960 000 F

This variance is favourable when the actual units of product sold exceed the budgeted units of

product sold. Global Air sold 4000 more round-trip tickets than was budgeted. Hence, its sales-

quantity variance for revenues is favourable.

Sales-mix variance

The sales-mix variance is the difference between two amounts: (1) the budgeted amount for the

actual sales mix, and (2) the budgeted amount if the budgeted sales mix had been unchanged.

The formula for computing the sales-mix variance in terms of revenue and the amounts for

Global Air is:

Sales-mix

Actual units

□□ Actual

Budgeted □□

Budgeted

□

□□

variance of =

of all

× □□ sales-mix − sales-mix □□ × selling price

□

□

revenues

products sold

□□

□

□ percentage

percentage □□□

per unit

□

First class

= 24 000 × (0.10 − 0.05) × €3200

=

€3 840 000 F

Business class

= 24 000 × (0.25 − 0.15) × €2400

=

€5 760 000 F

Economy class

= 24 000 × (0.65 − 0.80) × €900

=

€3 240 000 U

Total

€6 360 000 F

A favourable sales-mix variance arises at the individual product level when the actual sales-mix

percentage exceeds the budgeted sales-mix percentage. This situation applies to both first class

(10% actual versus 5% budgeted) and business class (25% actual versus 15% budgeted). In con-

trast, economy class has an unfavourable variance because the actual sales-mix percentage (65%)

is less than the budgeted sales-mix percentage (80%).

The concept behind the sales-mix variance for revenues of €6 360 000 F is best explained in

terms of the budgeted selling prices per composite unit of the sales mix. A composite product

unit is a hypothetical unit with weights related to the individual products of the company. The

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weights for the revenue-based variances are calculated as follows in column 3 for the actual mix

and column 5 for the budgeted mix:

Budgeted

Budgeted

Budgeted

selling price

selling price

selling

Actual

per composite unit

Budgeted

per composite

price

sales-mix

for

sales-mix

unit for

per unit

percentage

actual mix

percentage

budgeted mix

(1)

(2)

(3) = (1) × (2)

(4)

(5) = (1) × (4)

First class

€3200

0.10

€320

0.05

€160

Business class

2400

0.25

600

0.15

360

Economy class

900

0.65

585

0.80

720

Total

€1505

€1240

The actual sales mix has a budgeted selling price per composite unit of €1505 (where the com-

posite unit comprises 0.10 of first class, 0.25 of business class and 0.65 of economy class). The

budgeted sales mix had a budgeted selling price per composite unit of €1240 (where the compos-

ite unit comprises 0.05 of first, 0.15 of business and 0.80 of economy). Thus, the effect of the

2022 sales-mix shift for Global Air is to increase the budgeted selling price per composite unit by

€265(€1505 − €1240). For the 24 000 units actually sold, this increase translates to a favourable

sales-mix variance of €6 million.

Exhibit 17.5 shows how both the sales-mix and sales-quantity variances can be calculated using

the columnar approach introduced in Chapter 15. Exhibit 17.5 highlights the revenue effect of

the shift towards a mix with higher revenue generating units (first class and business class) and

the revenue effect of the 20% increase in total units sold (actual of 24 000 round-trips versus

20 000 budgeted).

Market-size and market-share variances

Sales depend on overall market demand as well as the company's ability to maintain its share of

the market. Assume that the budgeted unit sales of 20 000 units (round-trip tickets) came from a

management estimate of a 50% market share on the New York to London route in August 2022

and an industry sales forecast by the Travel Information Group (TIG) of 40 000 round-trip tickets

for the route. In September, TIG reported the following:

Budgeted

Actual

industry volume

industry volume

for August 2022

for August 2022

First class

1 500

3 000

Business class

6 000

9 000

Economy class

32 500

38 000

Total

40 000

50 000

Global Air’s actual market share was 48% of unit volume (24 000 ÷ 50 000) in contrast to its

budgeted share of 50%. TIG noted that Easy Travel was highly successful in generating economy

travel but had been unsuccessful in attracting first- and business-class travellers. In contrast, it

noted Global Air’s great success in expanding its first- and business-class presence.

Global Air can use this industry information from TIG to get further insight into the

sales-quantity variance by dividing it into a market-size variance and a market-share variance.

The market-size variance is the difference between two amounts: (1) the budgeted amount based

Variance analysis for multiple products

537

2022

August

€3 200 000

€7 200 000

€14 400 000

€24 800 000

for

Budgeted ×

=

=

=

route

Budgeted selling

€3200)

€2400)

€900)

×

×

×

×

ariance

oducts sold

price per unit)

0.05

0.15

0.80

London

×

×

×

to

Static budget (Budgeted units

sales mix

of all pr

€4 960 000 F

(20 000

(20 000

(20 000

York

otal sales-quantity v

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N

ariance

on

Air

€3 840 000

€8 640 000

volume v

€17 280 000

€29 760 000

=

=

€11 320 000 F

=

Global

Budgeted sales ×

of

per unit

Total sales-

€3200)

€2400)

€900)

Actual units of

×

×

×

Budgeted selling price

ariance

×

0.05

0.15

0.80

revenues

oducts sold

mix

×

×

×

for

all pr

€6 360 000 F*

(24 000

(24 000

(24 000

Total sales-mix v

analysis

variance

€7 680 000 €14 400 000 €14 040 000 €36 120 000

Actual sales

=

=

=

Actual units of

×

€3200

€2400

€900

Budgeted selling

×

×

×

sales-quantity

×

price per unit)

oducts sold

mix

0.10

0.25

0.65

×

×

×

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24 000

24 000

24 000

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Sales-mix

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Exhibit 17.5

First class

Business class

Econom

* Ff

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+ =

on the *actual market size in units* and the budgeted market share, and (2) the static-budget amount

based on the *budgeted market size in units* and the budgeted market share. The formula and the

2022 amount for Global Air for revenues are:

Market-size

□□ Actual

Budgeted □□

Budgeted

Budgeted average

□

□□

variance of = □□ market size − market size □□ × market ×

selling price

□

□

revenues

□□

□

□ in units

in units □□

share

□

per unit

□

= (50 000 − 40 000) × 0.50 × €1240

= €6 200 000 F

The budgeted average selling price per (composite) unit is calculated by dividing the total budg-

eted revenues of €24 800 000 by the total budgeted units of 20 000. The €6 200 000 market-size

variance for revenues is favourable because it is the additional revenue expected as a result of the

25% increase in market size (50 000 ÷ 40 000 = 125%), provided Global Air maintains both

its budgeted market share of 50% and its budgeted average selling price of €1240.

The market-share variance is the difference between two amounts: (1) the budgeted amount at

budgeted mix based on the actual market size in units and the actual market share, and (2) the

budgeted amount at budgeted mix based on actual market size in units and the *budgeted market*

share. The formula and the 2022 amounts for Global Air for revenues are:

Market-share

Actual

□□ Actual

Budgeted □□ Budgeted average

□

□□

variance for = market size × □□ market − market □□ ×

selling price

□

□

revenues

in units

□□

□

□ share

share □

□

□□

per unit

= 50 000 × (0.48 − 0.50) × €1240

= €1 240 000 U

Global Air lost total market share from that budgeted – from the 50% budgeted to the

actual of 48%. The €1 240 000 unfavourable variance highlights the revenue impact of this 2

percentage-point decline in market share.

Exhibit 17.6 shows both the market-share and market-size variances using the columnar

approach introduced in Chapter 15. Exhibit 17.7 presents an overview of the Level 1 to Level

4 variances calculated for Global Air. Note how offsetting variances occur in both Levels 2

and 4. In some cases, these offsetting variances may be causally related. The €9 360 000 unfa-

vourable flexible-budget variance arises because of the decline in actual ticket prices from that

budgeted. The €11 320 000 favourable sales-volume variance reflects the unit-volume increase

stimulated by this decrease in selling prices.

The phrase ‘drilling down’ or ‘peeling the onion’ is sometimes used to describe starting at the

most aggregate level (Level 1) and then progressively seeking more detail on the factors underlying

specific variance amounts. Managers are increasingly able to access software programs that start

at Level 1 and then proceed to Levels 2, 3 and 4.

Is dividing the sales-quantity variance into the market-size and market-share variances useful

for evaluating the marketing manager's performance? Suppose market size and the demand for

an industry's products are largely influenced by factors such as growth and interest rates in the

economy. Then the market-size variance does not tell us much about the marketing manager's

performance because it is largely determined by factors outside the manager's control. Senior

management may therefore put greater weight on the market-share variance in their evaluation

of the marketing manager.

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Exhibit 17.6

Market-share and market-size variance analysis for revenues of

Global Air on New York to London route for August 2022

Static budget

Actual market size

Actual market size

(Budgeted market size

× Actual market share

×Budgeted market share

× Budgeted market share

× Budgeted average

× Budgeted average

× Budgeted average

selling price per unit

selling price per unit

selling price per unit)

50 000

0.48*

€1240†

×

×

50 000

0.50‡

€1240†

×

×

40 000

0.50

€1240†

×

×

€29 760 000

€31 000 000

€24 800 000

€1 240 000 U§ €6 200 000 F

Market-share variance Market-size variance

€4 960 000 F

Total sales-quantity variance

* Actual market share: 24 000 ÷ 50 000 = 0.48.

† Budgeted average selling price per unit = €24 800 000 ÷ 20 000 units = €1240.

‡ Budgeted market share: 20 000 ÷ 40 000 = 0.50.

§ F = favourable effect on revenue; U = unfavourable effect on revenue.

Exhibit 17.7

Overview of revenue variances for Global Air on New York to London route

for August 2022

Level 1

Static-budget variance

€1 960 000 F

Sales-volume variance

Level 2

Flexible-budget variance

€9 360 000 U

€11 320 000 F

Sales-quantity variance

Level 3

Sales-mix variance

€6 360 000 F

€4 960 000 F

Market-size variance

Level 4

Market-share variance

€1 240 000 U

€6 200 000 F

F = favourable effect on revenue; U = unfavourable effect on revenue.

F = favourable effect on revenue; U = unfavourable effect on revenue.

A caution when computing market-size and market-share variances is appropriate. Reliable

information on market size and market share is available for some, but not all, industries.

For example, the soft-drinks and television industries are ones where market size and share

statistics are widely available. In other industries such as management consulting, informa-

tion about market size and market share is far less reliable and is usually not published on a

regular basis.

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Summary

The following points are linked to the chapter's learning objectives.

1 When inputs, such as three direct materials, are not substitutes, price and efficiency variances individually calcu-

lated for each material typically provide the information necessary for decisions. In the case of substitutable inputs,

however, various combinations of inputs can be used to produce the same output. Further splitting the efficiency

variance into yield and mix variances provides additional information.

2 Many products use multiple direct materials that can be substituted for one another. In these cases, direct mate-

rials efficiency can come from two sources: (1) using fewer inputs of one or more of the materials, and (2) using

a cheaper mix of materials to produce output. The total direct materials yield and mix variances divide the total

direct materials efficiency variance into two components, with the yield variance focusing on the total inputs used

and the mix variance evaluating how the inputs are combined.

3 Multiple direct-labour inputs that are substitutes for one another are often used to manufacture a product or

provide a service. The total direct manufacturing labour yield and mix variances indicate the sources of direct

manufacturing labour efficiency. A favourable total direct manufacturing labour yield variance results when fewer

total direct manufacturing labour-hours are used to produce a given quantity of product. A favourable total direct

manufacturing labour mix variance results when a cheaper mix of direct manufacturing labour inputs is used to

produce the actual quantity of product.

4 A sales-volume variance can occur because of (a) a change in the actual unit sales from the budgeted unit sales (a

sales-quantity variance), and (b) a change in the actual sales mix from the budgeted sales mix (a sales-mix variance).

Sales-quantity and sales-mix variances can be calculated for companies selling multiple products or services or the

same product or service in multiple markets.

5 The sales-quantity variance can occur because of (a) a change in the actual market size in units from that budgeted

(the market-size variance), and (b) a change in the actual share of the market compared to its budgeted share (the

market-share variance).

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CHAPTER 17

Assessment material

Review questions

17.1 Distinguish between total direct materials yield and mix variances.

17.2 'Direct materials yield and mix variances are particularly useful when materials are sub**st**itutable.'

Do you agree? Explain.

17.3 Name three sources of the standards used in the total direct materials yield and mix variances.

17.4 'Changes in the mix of direct materials used from the budgeted mix always hurt yield.' Do you

agree? Explain.

17.5 How might managers use information about direct-labour yield and mix variances in **i**mproving

the performance of a business?

17.6 Give an example of an input other than direct materials and direct labour where calculating yield

and mix variances might be useful. Explain your reasoning briefly.

17.7 The manager of a highly automated plant that assembles desktop computers comment**e**d, 'Yield

and mix variance information is irrelevant to my cost management decisions.' Give two possible

reasons for the manager's statement.

17.8 Explain why a favourable sales-quantity variance occurs.

17.9 Distinguish between a market-size variance and a market-share variance.

17.10 Why might some companies not calculate market-size and market-share variances?

Exercises

Intermediate level

***17.11 Direct materials efficiency, yield and mix variance**s (CMA, adapted) (20–25 minutes)

Paix-Trolls SARL produces a petrol additive, Elysium, which increases engine efficiency and

reduces petrol consumption. The actual and budgeted quantities (in litres) of materials required

to produce Elysium and the budgeted prices of materials in August 2022 are as follows:

Chemical

Actual quantity

Budgeted quantity

Budgeted price

Echol

24 080

25 200

€0.20

Protex

15 480

16 800

0.45

Benz

36 120

33 600

0.15

CT-40

10 320

8 400

0.30

Required

1 Calculate the total direct materials efficiency variance for August 2022.

2 Calculate the total direct materials yield and mix variances for August 2022.

3 What conclusions would you draw from the variance analysis?

17.12 Direct nursing labour efficiency, yield and mix variances (25 minutes)

Les Cliniques du Parc reports the following information for July 2022 regarding its nursing staff

consisting of nurses, nursing assistants and orderlies.

Actual hours

Budgeted hours

Budgeted rate per hour

Nurses

8750

8100

SFr 25

Nursing assistants

4900

5400

17

Orderlies

3850

4500

12

Required

1 Calculate the total direct nursing labour efficiency variance for July 2022.

2 Calculate the total direct nursing labour yield and mix variances for July 2022.

3 Briefly describe the conclusions you would draw from the variance analysis.

17.13 Variance analysis of revenues, multiple products (30–40 minutes)

The Antwerp Lions play in the Flemish Football League. The Lions play in the Antwerp Stadium

(owned and managed by the City of Antwerp), which has a capacity of 30 000 seats (10 000

lower- tier seats and 20 000 upper-tier seats). The Antwerp Stadium charges the Lions a per-ticket

charge for use of their facility. All tickets are sold by the Reservation Network, which charges the

Lions a reservation fee per ticket. The Lions budgeted net revenue for each type of ticket in 2022

is calculated as follows:

Lower-tier tickets

Upper-tier tickets

Selling price

€35

€14

Antwerp Stadium fee

10

6

Reservation Network fee

5

3

Net revenue per ticket

20

5

The budgeted and actual average attendance figures per game in the 2022 season are:

Budgeted seats sold

Actual seats sold

Lower tier

8 000

6 600

Upper tier

12 000

15 400

Total

20 000

22 000

There was no difference between the budgeted and actual net revenue for lower-tier or upper-tier seats.

The manager of the Lions was delighted that actual attendance was 10% above budgeted attend-

ance per game, especially given the depressed state of the local economy in the past six months.

Required

1 Calculate the sales-volume variance for individual ‘product’ net revenues and total net revenues

for the Antwerp Lions in 2022.

2 Calculate the sales-quantity and sales-mix variances for individual ‘product’ net revenues and

total net revenues in 2022.

3 Present a summary of the variances in requirements 1 and 2. Comment on the results.

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17.14 Standard costing (From ACCA Financial Information for Management, Part 1, June 2006)

(40 minutes)

Deadeye Ltd operates a standard costing system in which all stocks are valued at standard cost.

The standard direct material cost of one unit of product MS is £36, made up of 4.8 kg of mate-

rial H at £7.50 per kg. Material H is used only in the manufacture of product MS. The following

information relates to last month:

Material H:

Purchased 40 000 kg for

£294 000

Issued into production

36 500 kg

Finished output of MS

7200 units

Required

1 Calculate the direct material price and usage variances for last month.

2 Prepare a statement that reconciles the actual cost of material H purchased with the standard

material cost of actual production of MS for last month. The statement should incorporate

the variances calculated in 1.

3 a Suggest ONE possible cause for EACH of the variances calculated in 1.

b Who should the direct material price variance be reported to, and why?

17.15 Variance calculations (From CIMA Management Accounting Pillar Managerial Level Paper,

November 2006) (40 minutes)

X Ltd uses an automated manufacturing process to produce an industrial chemical, Product P. X

Ltd operates a standard marginal costing system. The standard cost data for Product P is as follows:

Standard cost per unit of Product P

Materials

A 10 kg @ £15 per kilo

£150

B 8 kg @ £8 per kilo

£64

C 5 kg @ £4 per kilo

£20

23 kg

Total standard marginal cost

£234

Budgeted fixed production overheads

£350 000

In order to arrive at the budgeted selling price for Product P the company adds 80% mark-up to

the standard marginal cost. The company budgeted to produce and sell 5000 units of Product P

in the period. There were no budgeted inventories of Product P. The actual results for the period

were as follows:

Actual production and sales

5450 units

Actual sales price

£445 per unit

Material usage and cost

A 43 000 kg

£688 000

B 37 000 kg

£277 500

C 23 500 kg

£99 875

103 500 kg

Fixed production overheads

£385 000

Required

1 Prepare an operating statement which reconciles the budgeted profit to the actual profit for the

period. The statement should include the material mix and material yield variances.

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2 The Production Manager of X Ltd is new to the job and has very little experience of

management information. Write a brief report to the Production Manager of X Ltd that:

a interprets the material price, mix and yield variances;

b discusses the merits, or otherwise, of calculating the materials mix and yield variances for

X Ltd.

Advanced level

***17.16 Direct materials price, efficiency, yield and mix variances** (35 minutes)

Granoline SA manufactures cereal products such as multi-grain porridge and breakfastcereals.

It makes multi-grain porridge by blending barley, wheat and rye. Budgeted costs to produce 100

000 kg of multi-grain porridge in November 2022 are as follows:

45 000 kg of barley at €0.30 per kg

€13 500

180 000 kg of wheat at €0.26 per kg

46 800

75 000 kg of rye at €0.22 per kg

16 500

Actual costs in November 2022 are:

62 000 kg of barley at €0.28 per kg

€17 360

155 000 kg of wheat at €0.26 per kg

40 300

93 000 kg of rye at €0.20 per kg

18 600

Required

1 Calculate the total direct materials price and efficiency variances for November 2022.

2 Calculate the total direct materials mix and yield variances for November 2022.

3 Comment on your results in requirements 1 and 2.

17.17 Direct materials price and efficiency variances, direct materials yield and mix variances,

perfume manufacturing (SMA, adapted) (40 minutes)

Markku Antero Oy produces perfume. To make this perfume, Markku Antero uses three different

types of fluid. Tartarus, Erebus and Uranus are used in standard proportions of 4/10, 3/10 and

3/10 , and their standard costs are €6.00, €3.50 and €2.50 per litre, respectively. The chief engineer

reported that in the past few months the standard yield has been at 80% on 100 litres of mix. The

company maintains a policy of not carrying any direct materials, as stock storage space is costly.

Last week, the company produced 75 000 litres of perfume at a total direct materials cost of €449

500. The actual number of litres used and costs per litre for the three fluids are as follows:

Direct materials

Actual litres

Costs per litre

Tartarus

45 000

€5.50

Erebus

35 000

4.20

Uranus

20 000

2.75

Required

1 Calculate the total direct materials price and efficiency variances for perfume made in the last

week.

2 Calculate the total direct materials yield and mix variances for the last week.

3 Explain the significance of the price, yield and mix variances from management's perspective.

17.18 Direct materials price and efficiency variances, direct materials yield and mix variances,

food processing (50 minutes)

Tropica AB processes tropical fruit into fruit salad mix, which it sells to a food-service company.

Tropica has in its budget the following standards for the direct materials inputs to produce 80 kg

of tropical fruit salad:

50 kg of pineapple at SFr 1.00 per kg

SFr 50

30 kg of watermelon at SFr 0.50 per kg

15

20 kg of mango at SFr 0.75 per kg

15

100

SFr 80

Note that 100 kg of input quantities are required to produce 80 kg of fruit salad. No stocks of

direct materials are kept. Purchases are made as needed, so all price variances are related to direct

materials used. The actual direct materials inputs used to produce 54 000 kg of tropical fruit

salad for the month of October were:

36 400 kg of pineapple at SFr 0.90 per kg

SFr 32 760

18 200 kg of watermelon at SFr 0.60 per kg

10 920

15 400 kg of mango at SFr 0.70 per kg

10 780

70 000

SFr 54 460

Required

1 Calculate the total direct materials price and efficiency variances in October.

2 Calculate the total direct materials yield and mix variances for October.

3 Comment on your results in requirements 1 and 2.

4 How might the management of Tropica use information about the direct materials yield and

mix variances?

17.19 Direct materials efficiency variance, mix and yield variances; working backwards

(30–40 minutes)

Calypso SA manufactures and sells fertilisers. Calypso uses the following standard direct materials

costs to produce 1 tonne of fertiliser:

75% of the input materials is Alpha at €400 per tonne

€360

25% of the input materials is Gamma at €200 per tonne

60

Total standard cost of 1.2 tonnes of inputs

€420

Note that 1.2 tonnes of input quantities are required to produce 1 tonne of fertiliser. No stocks

of direct materials are kept. Purchases are made as needed, so all price variances are related to

direct materials used. Calypso produced 2000 tonnes of fertiliser in a particular period. The total

direct materials yield variance for the period was €35 000 U. The actual input mix for the period

was 50% of Alpha and 50% of Gamma.

Required

1 Calculate the individual direct materials yield variances for the period.

2 Calculate the individual and total direct materials mix variances for the period.

3 Calculate the individual and total direct materials efficiency variances for the period.

4 Briefly describe the conclusions you would draw from the variance analyses.

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17.20 Direct service labour price, efficiency, yield and mix variances (40 minutes)

O'Connell & Associates, a firm of architects, has three levels of professional staff: principals

(managers), who manage all aspects of the architectural job; senior architects, who are responsible

for the main designs; and junior architects, who provide technical support. Budgeted costs for five

architectural jobs done over a recent period are as follows:

600 principal-hours at €105 per hour

€63 000

1800 senior-hours at €75 per hour

135 000

3600 junior-hours at €25 per hour

90 000

Actual hours worked and the actual rates per hour to complete the five jobs are:

295 principal-hours at €108 per hour

€31 860

2360 senior-hours at €70 per hour

165 200

3245 junior-hours at €30 per hour

97 350

Required

1 Calculate the total direct labour price and efficiency variances for the five jobs.

2 Calculate the total direct labour mix and yield variances for the five jobs.

3 Comment on your results in requirements 1 and 2.

4 How might managers use information about the direct labour yield and mix variances?

***17.21 Variance analysis of contribution margin, multiple products; working backwards**

(30 minutes)

Rusti-Verres SNC sells two brands of wine glasses – Choc and Chic. Rusti-Verres provides the

following information for sales in the month of June 2022:

Static-budget total contribution margin

SFr 5600

Budgeted units to be sold of all glasses in June 2022

2000 units

Budgeted contribution margin per unit of Choc

SFr 2 per unit

Budgeted contribution margin per unit of Chic

SFr 6 per unit

Total sales-quantity variance

SFr 1400 U

Actual sales-mix percentage of Choc

60%

All variances are to be calculated in contribution-margin terms.

Required

1 Calculate the sales-quantity variances for each product for June 2022.

2 Calculate the individual product and total sales-mix variances for June 2022. Calculate the

individual product and total sales-volume variances for June 2022.

3 Briefly describe the conclusions you would draw from the variances.

17.22 From ACCA Performance Management, section B, December 2014 (45 minutes)

The Safe Soap Co. makes environmentally-friendly soap using three basic ingredients. The stand-

ard cost card for one batch of soap for the month of September was as follows:

Material

Kilograms

Price per kilogram (£)

Lye

0.25

10

Coconut oil

0.6

4

Shea butter

0.5

3

547

The budget for production and sales in September was 120 000 batches. Actual production and

sales were 136 000 batches. The actual ingredients used were as follows:

Material

Kilograms

Lye

34 080

Coconut oil

83 232

Shea butter

64 200

Required

1 Calculate the total material mix variance and the total material yield variance for September.

2 In October the materials mix and yield variances were as follows:

Mix: £6 000 unfavourable

Yield: £10 000 favourable

The production manager is pleased with the results overall, stating: ‘At the beginning of

September I made some changes to the mix of ingredients used for the soaps. As I expected, the

mix variance is unfavourable in both months because we haven't yet updated our standard cost

card but, in both months, the favourable yield variance more than makes up for this. Overall, I

think we can be satisfied that the changes made to the product mix are producing good results

and now we are able to produce more batches and meet the growing demand for our product.'

The sales manager, however, holds a different view and says:

'I'm not happy with this change in the ingredients mix. I've had to explain to the board why

the sales-volume variance for October was £22 000 unfavourable. I've tried to explain that the

quality of the soap has declined slightly and some of my customers have realised this and sim-

ply aren't happy but no one seems to be listening. Some customers are even demanding that the

price of the soap be reduced and threatening to go elsewhere if the problem isn't sorted out.'

a Briefly explain what the unfavourable materials mix and favourable materials yield

variances indicate about production at Safe Soap Co. in October.

Note: You are NOT required to discuss revision of standards or operational and planning

variances.

b Discuss whether the sales manager could be justified in claiming that the change in the

materials mix has caused an unfavourable sales-volume variance in October.

17.23 From CIMA Performance Management, section A, November 2014 (20 minutes)

A company sells three products: D, E and F. The market for the products dictates that the numbers

of products sold are always in the ratio of 3D:4E:5F.

Budgeted sales volumes and prices, and cost details for the previous period were as follows:

D

E

F

Sales units

300

400

500

Selling price per unit

£80

£55

£70

Contribution to

70%

65%

50%

sales ratio

The budgeted total fixed costs for that period were £31 200.

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The budget for the previous period was based on the company having a 20% share of the total

market of 6000 units.

It has now been realised that the size of the market had been underestimated. The actual total

market size for that period was 7500 units.

During that period the company actually sold 1740 units for a total of £109 500. Unit variable

costs were as expected but total fixed costs were 10% higher than budgeted.

The company reports variances using a standard marginal costing system.

Required

Calculate for the company for the previous period:

a the market-size variance.

b the market-share variance.

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PART III

Case study problems

Case 301

Zeros plc

Falconer Mitchel , University of Edinburgh

This case is concerned with the use of ROI to measure divisional performance. It also addresses

the use of an integrated standard costing system to produce meaningful profit statements where

standard setting is problematic.

The board of Zeros plc assesses divisional performance within the company primarily on the

basis of a return-on-investment ratio. This is computed as follows:

Operating Profit

× 100 = ROI

Book value of total assets

The figure of operating profit is obtained from a standard-costing-based profit statement (see

Exhibit 301.1 for the two most recent such statements).

The Blank Division

In terms of turnover the Blank Division is the second largest division within the company. The

divisional manager is Joseph Olsen who has worked in the division for over 30 years, initially as

a management accountant and then as manager over the past decade. He is 63 years old and will

retire in 18 months' time. In accordance with a board policy introduced to improve motivation at

divisional level, his current remuneration contains a substantial bonus element based on divisional

operating profit. In addition, his retirement pension will be based upon his average total earnings

in his last three working years.

The Blank Division was resituated in a town-centre freehold site which was purchased 20 years

ago. A custom-built factory was erected on the site with considerable financial aid from the gov-

ernment, and was equipped with what were, at the time, the most modern machines available. It

is a matter of considerable pride to Joseph that much of this equipment has been conscientiously

maintained and is still in use today. In the accounting records the freehold site and factory building

are still valued at historic cost.

Source: Mitchell, F. (1988) ‘Zeros plc’, in D. Otley, D. Brown and C. Wilkinson (eds) *Case Studies in Management Accounting* (Hemel Hempstead, UK: Philip Allan Publishers). Reproduced with permission.

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Exhibit 301.1

Annual profit statement

2022

2023

(£000)

(£000)

Budgeted sale

8000

10 940

Selling price variance

–

–

Sales-volume variance

(1600) U

(2 735) U

Actual sales

6400

8 205

Standard cost of sales

4800

6 150

Standard operating profit

1600

2 055

Cost variances

Direct material price

(100) U

(80) U

Direct material usage

(220) U

(280) U

Labour rate

(150) U

(130) U

Labour efficiency

(200) U

(300) U

Variable overhead spending

(180) U

(300) U

Variable overhead efficiency

(250) U

(275) U

Fixed overhead spending

(120) U

(150) U

Fixed overhead volume

–

–

Operating profit

380

Exhibit 301.2

Unit standard costs and selling price

2022

2023

Unit standard cost

Direct material

0.50

0.60

Direct labour

0.75

0.90

Variable overheads

0.50

0.60

Fixed overheads

1.25

2.00

3.00

4.10

Actual unit selling prices

4.00

5.47

The Blank Division produces a wide range of sizes of surgical needles, although all are sold at

a standard price (see Exhibit 301.2). Although the market is growing the competition is intense,

being based on both price and, particularly, product quality.

Standard costs are revised at the start of each financial year (see Exhibit 301.2) and are based

on the middle-range size of surgical needle produced in the division.

It is frequently pointed out at board meetings by Joseph Olsen that the Blank Division can

still achieve a 33% mark-up on its standard unit cost, and that no competing firm can approach

this level of margin.

In recent years the Blank Division has produced highly satisfactory return-on-investment

figures and a reasonable profit growth. The board has, however, been concerned by the large

unfavourable variances which have been consistently reported. The normal retort of the Blank

Division manager to queries on the size of variances has been to state unequivocally that ‘it

is the bottom line that matters; if that's OK you can forget the rest'. He has also consistently

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Exhibit 301.3

Records of production and sales

2022

2023

('000 units)

('000 units)

Opening stock

200

600

Production

2000

2000

Sales

(1600)

(1500)

Closing stock

600

1100

promoted the performance of his division during 2022 and 2023 to the board as ‘excellent’ and

rebuffed any judgements to the contrary. Results for the last two years are given in Exhibits

301.1 and 301.3.

Questions

1 What criticism would you make of the approach to divisional-performance assessment

s

employed by the board of Zeros plc?

2 Would you agree with Jospeh Olsen’s assessment that his division’s performance was

‘excellent’ during 2022 and 2023?

roblem

3 What suggestions would you make for improving the divisional-performance measurement

in Zeros plc?

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II Case s

RT I

Case 302

PA

Instrumental Ltd

Vijay Govindarajan and John Shank

This case requires the analysis of budgeted versus actual performance for different organisational

functions and considers strategic versus operational issues.

David Jones, president and principal shareholder of Instrumental Ltd, sat at his desk reflecting on

the 2022 results (Exhibit 302.1). For the second year in succession the company had exceeded its

profit target. David was obviously happy with the year's results. All the same, he wanted to get a

better feel for the relative contributions of the R&D, manufacturing and marketing departments

in this overall success. With this in mind, he called his colleague, Jennifer Lee, a recent MBA

graduate of the London Business School, into his office.

'Jennifer,' he started, 'as you can see from our recent financial results, we have exceeded our

profit target by £622 000. Could you please prepare an analysis showing how much R&D, man-

ufacturing and marketing contributed to this?'

Source: Adapted from a case written by Govindarajan, V. and Shank, J. (1989) 'Profit variance analysis: a strategic focus', *Issues in Accounting Education,* Fall, pp. 396–410. Reproduced with permission from the American Accounting Association.

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Exhibit 302.1

Profit and loss account for year ending 2022

	Budget	Actual
	(£000)	(£000)
Sales	16 872	17 061
Cost of goods sold	9 668	9 865
Gross margin		

7 204

7 196

Less:

Operating expenses

Marketing

1856

1440

R&D

1480

932

Administration

1340

4 676

1674

4 046

Profit before taxes

2 528

3 150

Jennifer, elated with all the fervour and enthusiasm of a total convert to professional man-

agement, got down to work immediately. She collected all the data in Exhibit 302.2 and then

wondered somewhat disconsolately what her next step should be.

Exhibit 302.2

Instrumental Ltd: additional information

Electric motors

Electronic instruments

(EM)

(EI)

Selling prices per unit

Average standard price

£40.00

£180.00

Average actual prices, 2022

30.00

206.00

Variable product costs per unit

Average standard manufacturing cost

20.00

50.00

Average actual manufacturing cost

21.00

54.00

Volume information

Units produced and sold – actual

141 770

62 172

Units produced and sold – planned

124 800

66 000

Total industry sales, 2022 – actual

£44 million

£76 million

Total industry variable product costs,

2022 – actual

£16 million

£32 million

Instrumental’s share of the market

(% of physical units)

Planned

10%

15%

Actual

16%

9%

Planned

Actual

Firm-wide fixed expenses (£000)

Fixed manufacturing expenses

£3872

3530

Fixed marketing expenses

1856

1440

Fixed administrative expenses

1340

1674

Fixed R&D expenses

(exclusively for EI)

1480

932

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Instrumental's products can be grouped into two main lines of business: electric motors (EM)

and electronic instruments (EI). Both EM and EI are industrial measuring instruments and per-

form almost identical functions. However, EM is based on mechanical and electrical technology,

whereas EI is based on the microchip.

Instrumental Ltd uses a variable costing system for internal reporting purposes.

Question

You are required to put yourself in Jennifer Lee's position and state what you would do in your

analysis of Instrumental's performance across its different departments and what you would

recommend to the president.

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PART IV

Management control systems

and performance issues

Part III emphasised planning and control considerations in management and cost

accounting. Part IV builds on costing system design and implementation issues we

have discussed by looking at other ways in which managerial action is influenced

by internal accounting information. In particular, we consider how the structure of

organisations influences accounting practices and performance assessment in this

chapter and the next.

Chapter 18

Control systems and transfer pricing

Chapter 19

Control systems and performance measurement

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Part IV

Case study problems

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CHAPTER 18

Control systems and transfer pricing

Aside from studying the technical aspects of management control systems, it is essential to consider how the system will influence

Learning objectives

the behaviour of the people who use it. What role can accounting information play in management control activities? We could for

After studying this chapter, you

example, ask how does cost and budget information help in planning

should be able to:

and coordinating the actions of multiple divisions within companies

●

Describe a management control

such as Philips and Ericsson? This chapter explores some links between system

strategy, organisation structure, management control systems and accounting information. It examines the benefits and costs of centralised

- Understand important elements

and decentralised organisational structures and looks at the pricing of effective management control

of products or services transferred between subunits of the same systems

organisation. Over half of international transactions are intercompany

- Describe the benefits and costs of

transactions. With exponential advances in technology, transportation decentralisation

and communication that are part of the modern global economy, many

- Identify three general methods for

multinational companies have opted for location choices based on after-

determining transfer prices

profit returns and conducted their activities judiciously. They do this as

- Illustrate how market-based

when firms engage in cross-border intercompany transactions, a variety

transfer prices promote goal

of direct and indirect implications, including an impact on shareholder

congruence in perfectly

wealth, tax liabilities and corporate after-tax cash flow ensue. The

competitive markets

mechanisms used to establish the pricing of intercompany transactions

(transfer prices) can be complex. Relevant transfer-pricing issues are

- Recognise when a transfer price

considered in this chapter.

may lead to suboptimal decisions

- Understand the range over which

two divisions generally negotiate

the transfer price when there is

unused capacity

- Present a general guideline for determining a minimum transfer price in transfer-pricing situations
- Be aware of income tax considerations in multinational transfer pricing

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Management control systems

A management control system is a means of gathering and using information to aid and coordinate the process of making planning and control decisions throughout the organisation and to guide employee behaviour. The goal of the system is to improve the collective decisions within an organisation.

Consider part of the management control system at Siemens, the German electrical and elec-

tronics company. Information for management control is gathered and reported at various levels:

1 *Total-organisation level* – for example, stock price, net income, return on investment, cash flow

from operations, total employment, pollution control, and contributions to the community.

2 *Customer/market level* – for example, customer satisfaction, time taken to respond to customer

requests for products, and cost of competitors' products.

3 *Individual-facility level* – for example, materials costs, labour costs, absenteeism and accidents

in various divisions or business functions (such as R&D, manufacturing and distribution).

4 *Individual-activity level* – for example, the time taken and costs incurred for receiving, storing,

assembling and dispatching goods in a warehouse; scrap rates, defects and units reworked on a

manufacturing line; the number of sales transactions and sales euros per salesperson; and the

number of shipments per employee at distribution centres.

As the preceding examples indicate, formal elements of management control systems collect

both financial data (for example, net income, materials costs and storage costs) and non-financial

data (for example, the time taken to respond to customer requests for products, absenteeism and

accidents). Some of the information is obtained from within the company (such as net profit and

number of shipments per employee); other information is obtained from outside the company

(such as stock price and cost of competitors' products). Some companies present financial and

non-financial information in a single report called the balanced scorecard (see Chapter 22).

The levels indicate the different kinds of information that are needed by managers performing

different tasks. For example, stock price information is important at the total-organisation level

but not at the individual-activity level in the warehouse, where information about the time taken

for receiving and storing is more relevant. At the individual-activity level, management control

reports focus on internal financial and non-financial data. At higher levels, management control

reports also emphasise external financial and non-financial data.

Management control systems have both formal and informal components. The formal man-

agement control system of an organisation includes those explicit rules, procedures, performance

measures and incentive plans that guide the behaviour of its managers and employees. The formal

control system itself consists of several systems. The management accounting system is a formal

accounting system that provides information on costs, revenues and income. Examples of other

formal control systems are human resource systems (providing information on recruiting, train-

ing, absenteeism and accidents) and quality systems (providing information on scrap, defects,

rework and late deliveries to customers).

The informal part of the management control system includes such aspects as shared values,

loyalties and mutual commitments among members of the organisation and the unwritten norms

about acceptable behaviour for promotion that also influence employee behaviour.

Evaluating management control systems

To be effective, management control systems should be closely aligned to an organisation's strategies

and goals. Examples of strategies are doubling net profit in four years, increasing market share by

50% in two years, or maximising short-run profit. Suppose management decides, wisely or unwisely,

to emphasise maximising short-run profit as a strategy. Then the management control system must

attempt to reinforce this strategy. It should aim to provide managers with information that will

help them make short-run decisions – for example, contribution margins on individual products. It

should tie managers' incentives to short-run net profit figures in contexts where such remuneration

is desirable.

A second important feature of formal management control systems is that they should be

designed to fit the organisation's structure and the decision-making responsibility of individual

managers. For example, management control should align with accountability and decision- making

authority. Consider Uniliver's move away from its current matrix structure and reorganisation

around five distinct Business Groups: Beauty & Wellbeing, Personal Care, Home Care, Nutri-

tion, and Ice Cream. Unilever wants each Business Group to be fully responsible and accountable

for their strategy, growth, and profit delivery globally. Alan Jope, CEO Unilever, explains, ‘Our

new organisational model has been developed over the last year and is designed to continue the

step-up we are seeing in the performance of our business. Moving to five category-focused Business

Groups will enable us to be more responsive to consumer and channel trends, with crystal-clear

accountability for delivery. Growth remains our top priority and these changes will underpin our

pursuit of this’ (Unilever, 2022).

The way in which an enterprise is organised needs to be considered in light of the management

control priorities pursued and changes must be made which correspond with altering conditions

and strategies.

Finally, effective management control systems motivate managers and employees. Motivation is

the desire to attain a selected goal (the goal-congruence aspect) combined with the resulting drive

towards that goal (the effort aspect). Goal congruence exists when individuals and groups work

towards the organisational goals that top management desires – that is, managers working in their

own best interest take actions that further the overall goals of top management. Goal-congruence

issues have arisen in earlier chapters. For example, in capital-budgeting decisions, making deci-

sions by discounting long-run cash flows at the required rate of return best achieves organisational

goals. But if the management control system evaluates managers on the basis of short-run accrual

accounting income, managers will be tempted to make decisions to maximise accrual accounting

income that may not be in the best interests of the organisation.

Effort is defined as exertion towards a goal. Effort goes beyond physical exertion, such as a

worker producing at a faster rate, to include all conscientious actions (physical and mental).

Management control systems usually aim to motivate employees to exert effort towards attaining

organisational goals through a variety of incentives tied to the achievement of those goals. These

incentives can be monetary (cash, stock, use of a company car and membership of a club) or

non-monetary (power, self-esteem, and pride in working for a successful company).

One criterion for evaluating the effectiveness of a management control system is to see how far

the attainment of top management’s goals are promoted in a cost-effective way.

Organisational structure and decentralisation

Given that organisations are in a constant state of flux in terms of their markets, customers, work-

ers, technology, and so on, it is in practice difficult ever to attain a ‘fit’ which might be deemed

desirable between, for instance, strategy, structure and motivation of individuals. What is clear

is that any such attempts need to be continuous since organisational processes are never static.

Top management makes decisions about decentralisation that affect day-to-day operations at

all levels of the organisation. The essence of decentralisation is the freedom for managers at lower

levels of the organisation to make decisions.

As we discuss the issues of decentralisation, we use the term *subunit* to refer to any part of

an organisation. In practice, a subunit may be a large division (the Premier Banking subunit of

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Barclays plc – a UK-based financial services group) or a small group (the two-person advertising

department of a local clothing boutique).

Total decentralisation means *minimum constraints and maximum freedom* for managers at

the lowest levels of an organisation to make decisions. Total centralisation means *maximum*

constraints and minimum freedom for managers at the lowest levels. Most companies' structures

fall somewhere between these two extremes.

Benefits of decentralisation

How should top managers decide how far to decentralise? Conceptually, they might try to choose the

degree of decentralisation that maximises the excess of benefits over costs, bearing in mind organi-

sational context factors. From a practical standpoint, top managers can seldom quantify either the

benefits or the costs. But thought can be given to the advantages and drawbacks of decentralisation.

Advocates of decentralising decision making and granting responsibilities to managers of sub-

units claim the following benefits:

1 *Creates greater responsiveness to local needs.* Information is the key to intelligent decisions.

Compared with top managers, subunit managers are better informed about their customers,

competitors, suppliers and employees, as well as about factors that affect the performance of

their jobs such as ways to decrease costs and improve quality.

2 *Leads to quicker decision making.* An organisation that gives lower-level managers the respon-

sibility for making decisions can make decisions quickly, creating a competitive advantage over

organisations that are slower because they send the decision-making responsibility upwards

through layer after layer of management.

3 *Increases motivation.* Subunit managers are usually more highly motivated when they can

exercise greater individual initiative.

4 *Aids management development and learning.* Giving managers more responsibility promotes

the development of an experienced pool of management talent – a pool that the organisation

can draw from to fill higher-level management positions. The organisation also learns which

people are not management material. Consider Jeffrey Immelt who served as General Electric's

CEO for 16 years from 2001.The company became the world's most valuable company when

he took over from the prior celebrated CEO Jack Welch. General Electric (GE) was revered for

its scientific approaches to efficient manufacturing, developing managers and producing highly

reliable profits. By 2017, Immelt had been forced to break the group up, cut its dividend and axe

thousands of jobs. GE also paid $200 million to resolve claims from the Securities and Exchange

Commission that it misled investors while he was in charge. In relation to succession, the per-

ceived failure at GE was explained by Immelt that this had been due to too few executives being

given the profit and loss responsibility that could shape them to be CEOs (Edgecliffe-Johnson

and Indap, 2021). Decentralisation if done right can shape the next generation of executives.

5 *Sharpens the focus of managers.* In a decentralised setting, the manager of a small subunit

has a concentrated focus. A small subunit is more flexible and nimbler than a larger subunit

and better able to adapt itself quickly to a fast-developing market opportunity. Also, top man-

agement, relieved of the burden of day-to-day operating decisions, can spend more time and

energy on strategic planning for the entire organisation.

Costs of decentralisation

Advocates of more centralised decision making point out the following costs of decentralising

decision making:

1 *Leads* to suboptimal decision making (also called incongruent decision making), which arises

when a decision's benefit to one subunit is more than offset by the costs or loss of benefits

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to the organisation as a whole. This cost arises because top management has given up some

control over decision making. Suboptimal decision making may occur (1) when there is a lack

of harmony or congruence among the overall organisational goals, the subunit goals and the

individual goals of decision makers, or (2) when no guidance is given to subunit managers con-

cerning the effects of their decisions on other parts of the organisation. Suboptimal decision

making is most likely to occur when the subunits in the organisation are highly interdependent,

such as when the end-product of one subunit is the direct material of another subunit.

2 *Results in duplication of activities.* Several individual subunits of the organisation may under-

take the same activity separately. For example, there may be a duplication of staff functions

(accounting, employee relations and legal) if an organisation is highly decentralised. Centralis-

ing these functions helps to consolidate, streamline and downsize these activities. Consider, for

instance, the Coke Group which initiated in 2021 the global restructuring of its organisation.

The two previous regions of Western and Central and Eastern Europe merged to create a new

business unit Europe. The new unit covers more than 40 countries, from the United Kingdom

to Russia. This re-structure is accompanied by numerous changes in management to 'emerge

stronger from the pandemic' whereby the structure becomes streamlined. The change was

regarded as a reaction to the revenues of the company falling 11% to $33 billion, yielding

earnings of $7.7 billion – a fall of 13% from the previous year (Chwallek and Hebben, 2021).

3 *Focuses managers' attention on the subunit rather than the organisation as a whole.* Individual

subunit managers may regard the managers of other subunits in the same organisation as

external parties or competitors. Consequently, managers may be unwilling to share signifi-

cant information or to assist when another subunit faces an emergency. They may also use

information they have about local conditions to further their own self-interest rather than

the organisation's goals. For instance, they may ask for more resources than they need from

the organisation in order to reduce the effort they need to exert. If subunits provide similar

products or services, their internal competition could lead to failure in the external markets.

The reason is that divisions may find it easier to steal market share from one another, by

mimicking each other's successful products, rather than those of competing firms. Eventually,

this leads to confusion in the minds of customers and the loss of each division's distinctive

strengths.

4 *Increases costs of gathering information.* Managers may spend too much time negotiating the

prices for internal products or services transferred among subunits.

To choose an appropriate organisation structure, top managers need to consider the benefits and

costs of decentralisation, often on a function-by-function basis. For example, the chief account-

ant's function may be highly decentralised for many attention-directing and problem-solving

purposes (such as preparing operating budgets and performance reports) but highly centralised

for other purposes (such as processing creditors and developing income tax strategies). Decen-

tralising budgeting and cost reporting enables the marketing manager of a subunit, for example,

to influence the design of product-line profitability reports for the subunit. Tailoring the report

to the specific information that the manager may need helps the manager make more informed

decisions. Centralising income tax strategies, on the other hand, allows the organisation to

trade-off profits in some subunit with losses in others to evaluate the impact on the organisation

as a whole.

Multinational corporations are often decentralised. Language, customs, cultures, business

practices, rules, laws and regulations vary significantly across countries. Decentralisation enables

country managers to make decisions that exploit their knowledge of local business and political

conditions and to deal with uncertainties in their individual environments. Philips, the Dutch elec-

tronics conglomerate, delegates marketing and pricing decisions for its television business in the

Indian and Singaporean markets to its respective country managers. Multinational corporations

often rotate managers between foreign locations and the home office. Job rotation combined with

decentralisation helps develop managers' abilities to operate in global environments.

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Choices about responsibility centres

To measure the performance of subunits in centralised or decentralised organisations, the man-

agement control system uses one or a mix of the four types of responsibility centre presented in

Chapter 14:

- *Cost centre* – manager accountable for costs only.
- *Revenue centre* – manager accountable for revenues only.
- *Profit centre* – manager accountable for revenues and costs.
- *Investment centre* – manager accountable for investments, revenues and costs.

Centralisation or decentralisation is not mentioned in these descriptions. This is because each of

these responsibility units can be found in either of the extremes of centralised and decentralised

organisations.

A common misconception is that the term *profit centre* (and, in some cases, *investment cen-*

tre) is a synonym for a decentralised subunit, and that *cost centre* is a synonym for a centralised

subunit. But profit centres can also be coupled with a highly centralised organisation, and cost

centres can exist within a highly decentralised organisation. For example, managers in a division

organised as a profit centre may have little leeway in making decisions. They may need to obtain

approval from corporate headquarters for every expenditure over, say, €10 000 and may be forced

to accept central-staff 'advice'. In another company, divisions may be organised as cost centres,

but their managers may have great latitude on capital expenditures and on where to purchase

materials and services. In short, the labels 'profit centre' and 'cost centre' are independent of the

degree of decentralisation in an organisation.

Transfer pricing

In decentralised organisations, individual subunits of an organisation act as separate units. In

these settings, the management control system often uses transfer prices to coordinate actions

and to evaluate performance of the subunits.

An intermediate product is a product transferred from one subunit to another subunit of the

same organisation. This product may be processed further and sold to an external customer. A

transfer price is the price one subunit (segment, department, division, and so on) of an organisa-

tion charges for a product or service supplied to another subunit of the same organisation. The

transfer price creates revenue for the selling subunit and a purchase cost for the buying subunit,

affecting operating profit for both subunits. The operating profits can be used to evaluate the

performance of each subunit and to motivate managers.

Alternative transfer-pricing methods

There are three general methods for determining transfer prices:

1 *Market-based transfer prices.* Upper management may choose to use the price of a similar

product or service publicly listed in, say, a trade association website. Also, upper management

may select, for the internal price, the external price that a subunit charges to outside customers.

2 *Cost-based transfer prices.* Upper management may choose a transfer price based on the costs of

producing the product in question. Examples include variable manufacturing costs, manufactur-

ing (absorption) costs and full product costs. ‘Full product costs’ include all production costs as

well as costs from other business functions (R&D, design, marketing, distribution and customer

service). The costs used in cost-based transfer prices can be actual costs or budgeted costs.

3 *Negotiated transfer prices.* In some cases, the subunits of a company are free to negotiate

the transfer price between themselves and then to decide whether to buy and sell internally

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or deal with outside parties. Subunits may use information about costs and market prices in

these negotiations, but there is no requirement that the chosen transfer price bear any specific

relationship to either cost or market-price data. Negotiated transfer prices are often employed

when market prices are volatile and change occurs constantly. The negotiated transfer price is

the outcome of a bargaining process between the selling and the buying subunits.

Ideally, the chosen transfer-pricing method should lead each subunit manager to make optimal

decisions for the organisation as a whole. As in all management control systems, transfer pricing

should help achieve an organisation's strategies and goals, and fit its structure. In particular, it

should promote *goal congruence* and a sustained high level of *management effort.* Sellers should

be motivated to hold down costs of supplying a product or service, and buyers should be moti-

vated to acquire and use inputs efficiently. If top management favours a high degree of decentrali-

sation, transfer pricing should also promote a high level of *subunit autonomy* in decision making.

Autonomy is the degree of freedom to make decisions.

In effect, to help a company achieve its goals, transfer prices should meet four key criteria:

1 Promote goal congruence, so that division managers acting in their own interest will take

actions that are aligned with the objectives of top management.

2 Induce managers to exert a high level of effort. Subunits selling a product or service should be

motivated to hold down their costs; subunits buying the product or service should be motivated

to acquire and use inputs efficiently.

3 Help top managers evaluate the performance of individual subunits.

4 Preserve autonomy of subunits if top managers favour a high degree of decentralisation.

A subunit manager seeking to maximise the operating income of the subunit should have the

freedom to transact with other subunits of the company (on the basis of transfer prices) or to

transact with external parties.

An illustration of transfer pricing

Stavanger-Oil AS has three divisions. Each operates as a profit centre. The Production Division

manages the production of crude oil from a petroleum field near Heimberg. The Transportation

Division manages the operation of a pipeline that transports crude oil from the Heimberg area

to Nordstad. The Refining Division manages a refinery at Nordstad that processes crude oil into

petrol. (For simplicity, assume that petrol is the only saleable product the refinery makes and that

it takes two barrels of crude oil to yield one barrel of petrol.)

Variable costs in each division are assumed to be variable with respect to a single cost driver in

each division: barrels of crude oil produced by the Production Division, barrels of crude oil trans-

ported by the Transportation Division, and barrels of petrol produced by the Refining Division.

The fixed costs per unit are based on the budgeted annual output of crude oil to be produced and

transported and the amount of petrol to be produced. Stavanger-Oil reports all costs and revenues

of its non-European operations in euros using the prevailing exchange rate.

●

The Production Division can sell crude oil to outside parties in the Heimberg area at €13 per barrel.

● The Transportation Division 'buys' crude oil from the Production Division, transports it to

Nordstad, and then 'sells' it to the Refining Division. The pipeline from Heimberg to Nordstad

has the capacity to carry 40 000 barrels of crude oil per day.

● The Refining Division has been operating at capacity, 30 000 barrels of crude oil a day, using oil

from Stavanger-Oil's Production Division (an average of 10 000 barrels per day) and oil bought

from other producers and delivered to the Nordstad Refinery (an average of 20 000 barrels per

day, at €18 per barrel).

● The Refining Division sells the petrol it produces at €52 per barrel.

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Exhibit 18.1

Operating data for Stavanger-Oil

PRODUCTION DIVISION

External market:

Variable costs per barrel of crude oil =

€2

Market price to outside

Fixed costs per barrel of crude oil

=

6

parties = €13 per

Full costs per barrel of crude oil

=

€8

barrel of crude oil.

TRANSPORTATION DIVISION

Variable costs per barrel of crude oil =

€1

Fixed costs per barrel of crude oil

=

3

Full costs per barrel of crude oil

=

€4

External market:

Market price of

REFINING DIVISION

External market:

outside suppliers

Market price to outside

to Nordstad

Variable costs per barrel of petrol

=

€8

parties = €52 per

refinery = €18

Fixed costs per barrel of petrol

=

6

barrel of petrol.

per barrel of

Full costs per barrel of petrol

=

€14

crude oil.

Exhibit 18.1 summarises Stavanger-Oil's variable and fixed costs per unit of the cost driver in

each division, the external market prices of buying and selling crude oil, and the external market

prices of selling petrol. Consider the divisional operating profits resulting from three transfer-pric-

ing methods applied to a series of transactions involving 100 barrels of crude oil produced by

Stavanger-Oil's Production Division.

● Method A: Market-based transfer prices.

● Method B: Cost-based transfer prices at 110% of full costs, where full costs are the cost of the

transferred-in product plus the division's own variable and fixed costs.

● Method C: Negotiated transfer prices.

The transfer prices per barrel of crude oil under each method are as follows. The transferred-in

cost component in method B is denoted by an asterisk (*).

● *Method A*: *Market-based transfer prices:*

From Production Division to Transportation Division = €13

From Transportation Division to Refining Division = €18

● *Method B*: *Cost-based transfer prices at 110% of full costs:*

From Production Division to Transportation Division = 1.10 × (€2 + €6) = €8.80

From Transportation Division to Refining Division = 1.10 × (€8.80* + €1 + €3) = €14.08

● *Method C*: *Transfer prices negotiated by divisions to be between market-based and cost-based*

transfer prices:

From Production Division to Transportation Division = €10

From Transportation Division to Refining Division = €16.75

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Exhibit 18.2 presents divisional operating profits per 100 barrels of crude oil reported under each

transfer-pricing method. Transfer prices create income for the 'selling' division and corresponding

costs for the 'buying' division that cancel out when divisional results are consolidated. The exhibit

assumes that the different transfer-pricing methods have no effect on the decisions and actions

taken by the Production, Transportation and Refining Division managers. Stavanger-Oil's total

operating profit from producing, transporting and refining the 100 barrels of crude oil is therefore

the same, €700 (revenues of €2600 minus costs of €800 in production, €400 in transportation and

€700 in refining), regardless of internal transfer prices used. Keeping total operating profit the same

focuses attention on the effects of different transfer-pricing methods on divisional operating profits.

These profits differ under the three methods. The operating profit amounts span a €420 range (€80

to €500) in the Production Division, a €175 range (€100 to €275) in the Transportation Division,

and a €392 range (€100 to €492) in the Refining Division. Note that each division would choose a

different transfer-pricing method if its sole criterion were to maximise its own divisional operating

profit: the Production Division would choose market prices, the Transportation Division would

favour negotiated prices, and the Refining Division would choose 110% of full costs. Little wonder

that divisional managers take considerable interest in the setting of transfer prices, especially those

managers whose compensation or promotion directly depends on their division's operating profit.

Exhibit 18.2

Divisional operating profit of Stavanger-Oil for 100 barrels of crude oil under

alternative transfer-pricing methods

Method A:

Method B:

Method C:

Internal

Internal

Internal

transfers

transfers

transfers at

at market

at 110% of

negotiated

prices

full costs

prices

1 Production Division

Revenues:

€13, €8.80, €10, × 100 barrels crude oil

€1300

€880

€1000

Less:

Division variable costs, €2 × 100 barrels crude oil

200

200

200

Division fixed costs, €6 × 100 barrels crude oil

600

600

600

Division operating profit

€500

€80

€200

2 Transportation Division

Revenues:

€18, €14.08, €16.75, × 100 barrels crude oil

€1800

€1408

€1675

Less:

Transferred-in costs, €13, €8.80, €10, ×

1300

880

1000

100 barrels crude oil

Division variable costs, €1× 100 barrels crude oil

100

100

100

Division fixed costs, €3 × 100 barrels crude oil

300

300

300

Division operating profit

€100

€128

€275

3 Refining Division

Revenues:

€52 × 50 barrels petrol

€2600

€2600

€2600

Less:

Transferred-in costs, €18, €14.08, €16.75, ×

1800

1408

1675

100 barrels crude oil

Division variable costs, €8 × 50 barrels petrol

400

400

400

Division fixed costs, €6 × 50 barrels petrol

300

300

300

Division operating profit

€100

€492

€225

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Exhibit 18.2 maintains company-wide operating profit at €700 and illustrates how the choice of

a transfer-pricing method divides the company-wide operating profit pie among individual divi-

sions. Subsequent sections of this chapter illustrate that the choice of a transfer-pricing method

can also affect the decisions that individual division managers make and hence the size of the

operating profit pie itself. We consider this effect as we expand our discussion of market-based,

cost-based and negotiated transfer prices.

Market-based transfer prices

Perfectly competitive market case

Transferring products or services at market prices generally leads to optimal decisions when three

conditions are satisfied: (1) the intermediate market is perfectly competitive, (2) interdependencies

of subunits are minimal, and (3) there are no additional costs or benefits to the corporation as a

whole in using the market instead of transacting internally. A perfectly competitive market exists

when there is a homogeneous product with equivalent buying and selling prices and no individual

buyers or sellers can affect those prices by their own actions. By using market-based transfer prices

in perfectly competitive markets, a company can meet the criteria of goal congruence, manage-

ment effort and (if desired) subunit autonomy.

Reconsider the Stavanger-Oil example, assuming that there is a perfectly competitive market

for crude oil in the Heimberg area. As a result, the Production Division can sell and the Transpor-

tation Division can buy as much crude oil as each wants at €13 per barrel. Stavanger-Oil would

like its managers to buy or sell crude oil internally. Think about the decisions that Stavanger-Oil's

division managers would make if each had the option to sell or buy crude oil externally. If the

transfer price between Stavanger-Oil's Production Division and Transportation Division is set

below €13, the manager of the Production Division will be motivated to sell all production to

outside buyers at €13 per barrel. If the transfer price is set above €13, the manager of the Trans-

portation Division will be motivated to purchase all its crude oil requirements from outside

suppliers. A transfer price of €13 will motivate the Production Division and the Transportation

Division to buy and sell internally.

Suppose each division manager is motivated to maximise his or her own divisional operating

profit. The Production Division will sell (either internally or externally) as much crude oil as it

can profitably sell, and the Transportation Division will buy (either internally or externally) as

much crude oil as it can profitably transport. At a transfer price of €13, the actions that maximise

divisional operating profit are also the actions that maximise operating profit of Stavanger-Oil

as a whole. Market prices also serve to evaluate the economic performance and profitability of

each division individually.

Distress prices

When supply outstrips demand, market prices may drop well below their historical average. If the

drop in prices is expected to be temporary, these low market prices are sometimes called ‘distress

prices’. Deciding whether a current market price is a distress price is often difficult. The market

prices of several agricultural commodities, such as wheat and oats, have stayed for many years at

what observers initially believed were temporary distress levels.

Which transfer-pricing method should be used for judging performance if distress prices pre-

vail? Some companies use the distress prices themselves, but others use long-run average prices,

or ‘normal’ market prices. In the short run, the manager of the supplier division should meet the

distress price as long as it exceeds the incremental costs of supplying the product or service; if not,

the supplying division should stop producing and the buying division should buy the product or

service from an outside supplier. These actions would increase overall company-wide operating

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income. If the long-run average market price is used, forcing the manager to buy internally at a

price above the current market price will hurt the buying division's short-run performance and

understate its profitability. If, however, prices remain low in the long run, the manager of the

supplying division must decide whether to dispose of some manufacturing facilities or shut down

and get the buying division to purchase the product from outside.

Cost-based transfer prices

Cost-based transfer prices are helpful when market prices are unavailable, inappropriate, or too

costly to obtain. For example, the product may be specialised or unique, price lists may not be

widely available, or the internal product may be different from the products available externally

in terms of quality and service.

Full-cost bases

In practice, many companies use transfer prices based on full costs. These prices, however, can

lead to suboptimal decisions. Assume that Stavanger-Oil makes internal transfers at 110% of full

cost. The Nordstad Refining Division purchases, on average, 20 000 barrels of crude oil per day

from a local Nordstad supplier, who delivers the crude oil to the refinery. Purchase and delivery

cost €18 per barrel. To reduce crude oil costs, the Refining Division has located an independent

producer in Heimberg who is willing to sell 20 000 barrels of crude oil per day at €13 per barrel,

delivered to Stavanger-Oil's pipeline in Heimberg. Given Stavanger-Oil's organisation structure,

the Transportation Division would purchase the 20 000 barrels of crude oil in Heimberg, trans-

port it to Nordstad and then sell it to the Refining Division. The pipeline has excess capacity and

can ship the 20 000 barrels at its variable costs of €1 per barrel without affecting the shipment

of crude oil from Stavanger-Oil's own Production Division. Will Stavanger-Oil incur lower costs

by purchasing crude oil from the independent producer in Heimberg or by purchasing crude oil

from the Nordstad supplier? Will the Refining Division show lower crude oil purchasing costs by

using oil from the Heimberg producer or by using its current Nordstad supplier?

The following analysis shows that operating profit of Stavanger-Oil as a whole would be max-

imised by purchasing oil from the independent Heimberg producer. The analysis compares the

incremental costs in all divisions under the two alternatives.

● *Alternative 1*

Buy 20 000 barrels from Nordstad supplier at €18 per barrel.

Total costs to Stavanger-Oil = 20 000 × €18 = €360 000

● *Alternative 2*

Buy 20 000 barrels in Heimberg at €13 per barrel and transport it to

Nordstad at €1 per barrel variable costs.

Total costs to Stavanger-Oil = 20 000 × (€13 + €1) = €280 000

There is a reduction in total costs to Stavanger-Oil of €80 000 by using the independent producer

in Heimberg.

In turn, suppose the Transportation Division's transfer price to the Refining Division is 110%

of full cost. The Refining Division will see its reported division costs increase if the crude oil is

purchased from the independent producer in Heimberg:

□□ Purchase price

Unit variable cost

Unit fixed cost □□

Transfer

□

□□

= 1.10 × □□ from Heimberg = of Transportation + of Transportation □□

price

□□

□

□

□

□

producer

Division

Division

□

□

□□

= 1.10 × (€13 + €1 + €3) = 1.10 × €17 = €18.70

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● *Alternative 1* Buy 20 000 barrels from Nordstad supplier at €18 per barrel.

Total costs to Refining Division = 20 000 × €18 = €360 000

●

Alternative 2

Buy 20 000 barrels from the Transportation Division of Stavanger-Oil that are

purchased from the independent producer in Heimberg.

Total costs to Refining Division = 20 000 × €18.70 = €374 000

As a profit centre, the Refining Division can maximise its short-run divisional operating profit by

purchasing from the Nordstad supplier (€360 000 versus €374 000).

The transfer-pricing method has led the Refining Division to regard the fixed cost (and the

10% mark-up) of the Transportation Division as a variable cost. Why? Because the Refining

Division looks at each barrel that it obtains from the Transportation Division as a variable cost

of €18.70 – if 10 barrels are transferred, it costs the Refining Division €187; if 100 barrels are

transferred, it costs €1870. From the point of view of Stavanger-Oil as a whole, its variable costs

per barrel are €14 (€13 to purchase the oil from the independent producer and €1 to transport it

to Nordstad). The remaining €4.70 (€18.70 − €14) per barrel are fixed costs and mark-ups of the

Transportation Division. Buying crude oil in Nordstad costs Stavanger-Oil an additional €18 per

barrel. For the company, it is cheaper to buy from Heimberg. But the Refining Division sees the

problem differently. From its standpoint, it prefers buying from the Nordstad supplier at a cost

of €360 000 (20 000 barrels × €18 per barrel) because buying from Heimberg costs the division

€374 000 (20 000 barrels × €18.70). Goal incongruence is induced by the transfer price based on

full cost plus a mark-up.

What transfer price will promote goal congruence for both the Transportation Division and

the Refining Division? The minimum transfer price is €14 per barrel; a transfer price below €14

does not provide the Transportation Division with an incentive to purchase crude oil from the

independent producer in Heimberg, while a transfer price above €14 generates contribution mar-

gin to cover fixed costs. The maximum transfer price is €18 per barrel; a transfer price above €18

will cause the Refining Division to purchase crude oil from the external market rather than from

the Transportation Division. A transfer price between the minimum and maximum transfer prices

of €14 and €18, respectively, will promote goal congruence – both divisions will increase their

own reported divisional operating profit by purchasing crude oil from the independent producer

in Heimberg. In particular, a transfer price based on the full costs of €17 without a mark-up will

achieve goal congruence. The Transportation Division will show no operating profit and will be

evaluated as a cost centre. Surveys indicate that managers prefer to use full-cost transfer pricing

because it yields relevant costs for long-run decisions and because it facilitates pricing on the basis

of full product costs.

Using full-cost transfer prices that include an allocation of fixed overhead costs raises other

issues. How are indirect costs allocated to products? Have the correct activities, cost pools and

cost drivers been identified? Are the chosen overhead rates actual or budgeted rates? The issues

here are similar to the issues that arise in allocating fixed costs (Chapter 5). Full-cost-based trans-

fer prices calculated using activity-based cost drivers can provide more refined allocation bases for

allocating costs to products. Using budgeted costs and budgeted rates lets both divisions know the

transfer price in advance. Also variations in the quantity of units produced by the selling division

do not affect the transfer price.

Prorating the difference between minimum and maximum

transfer prices

An alternative cost-based approach is for Stavanger-Oil to choose a transfer price that splits the

€4 difference between the maximum transfer price the Refining Division is willing to pay and

the minimum transfer price the Transportation Division wants on some equitable basis. Suppose

Stavanger-Oil allocates the €4 difference on the basis of the budgeted variable costs incurred by

the Transportation Division and the Refining Division for a given quantity of crude oil. Using the

data in Exhibit 18.2, the variable costs are as follows:

Transportation Division to transport 100 barrels of crude oil

€100

Refining Division to refine 100 barrels of crude oil

400

€500

The Transportation Division gets to keep (€100/€500) × €4.00 = €0.80, and the Refining Divi-

sion gets to keep (€400/€500) × €4.00 = €3.20 of the €4 difference. That is, the transfer price

between the Transportation Division and the Refining Division would be €14.80 per barrel of

crude oil (€13 purchase cost + €1 variable costs + €0.80 that the Transportation Division gets

to keep). In essence, this approach is a budgeted variable cost plus transfer price; the ‘plus’ indi-

cates the setting of a transfer price above variable costs.

To decide on the €0.80 and €3.20 allocation of the €4.00 contribution to total corporate

operating profit per barrel, the divisions must share information about their variable costs. In

effect, each division does not operate (at least for this transaction) in a totally decentralised

manner. Because most organisations are hybrids of centralisation and decentralisation anyway,

this approach deserves serious consideration when transfers are significant. Note, however, that

each division has an incentive to overstate its variable costs in order to receive a more favourable

transfer price.

Dual pricing

There is seldom a *single* transfer price that simultaneously meets the criteria of goal congru-

ence, management effort and subunit autonomy. Some companies turn to dual pricing, using two

separate transfer-pricing methods to price each interdivisional transaction. An example of dual

pricing arises when the selling division receives a full cost plus mark-up-based price and the buying

division pays the market price for the internally transferred products. Assume that Stavanger-Oil

purchases crude oil from the independent producer in Heimberg at €13 per barrel. One way of

recording the journal entry for the transfer between the Transportation Division and the Refining

Division is as follows:

1 Credit the Transportation Division (the selling division) with the 110%-of-full-cost transfer

price of €18.70 per barrel of crude oil.

2 Debit the Refining Division (the buying division) with the market-based transfer price of €18

per barrel of crude oil.

3 Debit a corporate cost account for the €0.70 (€18.70 − €18.00) difference between the

two transfer prices for the cost of crude oil borne by corporate rather than the Refining

Division.

The dual-price method promotes goal congruence because it makes the Refining Division no

worse off if it purchases the crude oil from the Transportation Division rather than from the

outside supplier. In either case, the Refining Division's cost is €18 per barrel of crude oil. This

dual-price system in essence gives the Transportation Division a corporate subsidy. The results

of dual pricing? The operating profit for Stavanger-Oil as a whole is less than the sum of the

operating profit of the divisions.

Dual pricing is not widely used in practice even though it reduces the goal-congruence problems

associated with a pure cost-plus-based transfer-pricing method. One concern of top management

is that the manager of the supplying division does not have sufficient incentive to control costs

with a dual-price system. A second concern is that the dual-price system confuses division man-

agers about the level of decentralisation top management seeks. Above all, dual pricing tends

to insulate managers from the frictions of the marketplace. Managers should know as much as

possible about their subunit's buying and selling markets, and dual pricing reduces the incentive

to gain this knowledge.

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A general guideline for transfer-pricing situations

Negotiated transfer prices

Negotiated transfer prices arise as the outcome of a bargaining process between selling and

buying divisions. Consider again the choice of a transfer price between the Transportation and

Refining Divisions of Stavanger-Oil. The Transportation Division has excess capacity that it

can use to transport oil from Heimberg to Nordstad. The Transportation Division will only be

willing to ‘sell’ oil to the Refining Division if the transfer price equals or exceeds €14 per barrel

of crude oil (its variable costs). The Refining Division will only be willing to ‘buy’ crude oil from

the Transportation Division if the cost equals or is below €18 per barrel (the price at which the

Refining Division can buy crude oil in Nordstad).

From the viewpoint of Stavanger-Oil as a whole, operating profit would be maximised if the

Refining Division purchased from the Transportation Division rather than from the Nordstad

market (incremental costs of €14 per barrel versus incremental costs of €18 per barrel). Both

divisions would be interested in transacting with each other if the transfer price is set between

€14 and €18. For example, a transfer price of €16.75 per barrel will increase the Transportation

Division’s operating profit by €16.75 − €14 = €2.75 per barrel. It will increase the Refining

Division’s operating profit by €18 − €16.75 = €1.25 per barrel because Refining can now ‘buy’

the oil for €16.75 inside rather than for €18 outside.

The key question is where between the €14 and €18 will the transfer price be? The answer

depends on the bargaining strengths of the two divisions. Negotiations become particularly sen-

sitive if Stavanger-Oil evaluates each division's performance on the basis of divisional operating

profit. The price negotiated by the two divisions will, in general, have no specific relationship to

either costs or market price. But cost and price information are often useful starting points in the

negotiation process.

A general guideline for transfer-pricing situations

Is there an all-pervasive rule for transfer pricing that leads towards optimal decisions for the

organisation as a whole? No. Why? Because the three criteria of goal congruence, management

effort and subunit autonomy must all be considered simultaneously. The following general guide-

line, however, has proved to be a helpful first step in setting a minimum transfer price in many

specific situations:

Minimum

Additional *incremental* or *outlay* costs per

Opportunity costs per unit

=

+

transfer price

unit incurred up to the point of transfer

to the supplying division

The term *incremental* or *outlay costs* in this context represents the additional costs that are

directly associated with the production and transfer of the products or services. *Opportunity costs*

are defined here as the maximum contribution forgone by the supplying division if the products or

services are transferred internally. For example, if the supplying division is operating at capacity,

the opportunity cost of transferring a unit internally rather than selling it externally is equal to

the market price minus variable costs. We distinguish incremental costs from opportunity costs

because the accounting system typically records incremental costs but not opportunity costs. We

illustrate the general guideline in some specific situations using data from the Production and

Transportation Divisions of Stavanger-Oil.

1 A perfectly competitive market for the intermediate product exists, and the supplying division

has no idle capacity. If the market for crude oil is perfectly competitive, the Production Divi-

sion can sell all the crude oil it produces to the external market at €13 per barrel, and it will

have no idle capacity. The Production Division's incremental costs (see Exhibit 18.1) are €2 per

barrel of crude oil. The Production Division's opportunity cost per barrel of transferring the

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oil internally is the contribution margin per barrel of €11 (market price, €13 – variable cost,

€2) forgone by not selling the crude oil in the external market. In this case,

Minimum transfer

Incremental

Opportunity

=

+

price per barrel

costs per barrel

costs per barrel

= €2 + €11

= €13 = Market price per barrel

Market-based transfer prices are ideal in perfectly competitive markets when there is no idle

capacity.

2 An intermediate market exists that is not perfectly competitive, and the supplying division has

idle capacity. In markets that are not perfectly competitive, capacity utilisation can be increased

only by cutting prices. Idle capacity exists because cutting prices is often not worthwhile – it

decreases operating profit.

If the Production Division has idle capacity, its opportunity cost of transferring the oil

internally is zero because the division does not forgo any external sales and hence does not

forgo any contribution margin from internal transfers. In this case,

Minimum transfer price per barrel = Incremental costs per barrel = €2 per barrel

Note that any transfer price between €2 and €13 (the price at which the Transportation Divi-

sion can buy crude oil in Heimberg) motivates the Production Division to produce and sell

crude oil to the Transportation Division and the Transportation Division to buy crude oil from

the Production Division. In this situation, the company could either use a cost-based transfer

price or allow the two divisions to negotiate a transfer price between themselves.

In general, though, in markets that are not perfectly competitive, the potential to influence

demand and operating profit through prices makes measuring opportunity costs more compli-

cated. The transfer price depends on constantly changing levels of supply and demand. There

is not just one transfer price; rather, a transfer-pricing schedule yields the transfer price for

various quantities supplied and demanded, depending on the incremental costs and opportu-

nity costs of the units transferred.

3 No market exists for the intermediate product. This would occur, for example, in the Stavanger-Oil

case if oil from the production well flows directly into the pipeline and cannot be sold to outside

parties. Here, the opportunity cost of supplying crude oil internally is zero because the inability

to sell crude oil externally means no contribution margin is forgone. At the Production Division

of Stavanger-Oil, the minimum transfer price under the general guideline would be the incre-

mental costs per barrel of €2. As in the previous case, any transfer price between €2 and €13

will achieve goal congruence. If the transfer price is set at €2, of course, the Production Division

would never record positive operating profit and would show poor performance. One approach

to overcoming this problem is to oblige the Transportation Division to make a lump-sum pay-

ment to cover fixed costs and generate some operating profit for the Production Division while

the Production Division continues to make transfers at incremental costs of €2 per barrel.

Transfer pricing and tax considerations

Transfer prices often have tax implications. Tax factors include not only income taxes, but also

payroll taxes, customs duties, tariffs, sales taxes, value added taxes, environment-related taxes

and other government levies on organisations. Full consideration of tax aspects of transfer -pricing

decisions is beyond the scope of this book. Our aim here is to highlight tax factors and, in particu-

lar, income taxes as an important consideration in transfer-pricing decisions. Multinational firms

often consider ways of charging artificially low or high prices for sales between related parties

in high-tax and low-tax jurisdictions, in order to shift income and reduce overall tax incursion.

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Consider the Stavanger-Oil data in Exhibit 18.2. Assume that the Production Division based

in the Heimberg area pays income taxes at 30% of operating profit and that both the Transpor-

tation and Refining Divisions based in Nordstad pay profit taxes at 20% of operating profit.

Stavanger-Oil would minimise its total profit tax payments with the 110%-of-full-costs trans-

fer-pricing method, as shown in the following table:

Operating profit for

Income tax on

100 barrels of crude oil

100 barrels of crude oil

Transportation

Transportation

Production and Refining

Production

and Refining

Transfer-pricing

Division

Divisions

Total

Division

Divisions

Total

method

(1)

(2)

(3) = (1) + (2) (4) = 0.30 × (1) (5) = 0.20 × (2) (6) = (4) + (5)

A Market price

€500

€200

€700

€150

€40

€190

B 110% of full costs

80

620

700

24

124

148

C Negotiated price

200

500

700

60

100

160

What needs to be borne in mind is that tax considerations raise issues that may conflict with

other objectives of transfer pricing. Suppose that the market for crude oil in Heimberg is perfectly

competitive. In this case, the market-based transfer price achieves goal congruence and provides

effort incentives. It also helps Stavanger-Oil to evaluate the economic profitability of the Produc-

tion Division. But it is costly from an income tax standpoint.

Stavanger-Oil would favour using 110% of full costs for tax reporting. Tax laws in the Nordstad

area and the Heimberg area constrain this option. In particular, the Heimberg tax authorities

are fully aware of Stavanger-Oil's incentives to minimise income taxes by reducing the profits

reported in Heimberg. They would challenge any attempts to shift profits to the Transportation

and Refining Divisions through a low transfer price.

The perfectly competitive market for crude oil in Heimberg would probably force Stavanger-Oil

to use the market price for transfers from the Production Division to the Transportation Division.

Stavanger-Oil might successfully argue that the transfer price should be set below the market price

because the Production Division incurs no marketing and distribution costs when 'selling' crude

oil to the Transportation Division.

To meet multiple transfer-pricing objectives, a company may choose to keep one set of account-

ing records for tax reporting and a second set for internal management reporting. The difficulty

here is that tax authorities may interpret two sets of books as suggestive of the company manip-

ulating its reported taxable profits to avoid tax payments.

Additional factors that arise in multinational transfer pricing include tariffs and customs duties

levied on imports of products into a country. The issues here are similar to the income tax con-

siderations discussed earlier – companies will have incentives to lower transfer prices for products

imported into a country to reduce the tariffs and customs duties that those products will attract.

In addition to the various motivations for choosing transfer prices described so far, multina-

tional transfer prices are sometimes influenced by restrictions that some countries place on the

payment of income or dividends to parties outside their national borders. By increasing the prices

of goods or services transferred into divisions in these countries, companies can increase the funds

paid out of these countries without appearing to violate income or dividend restrictions. Such

practices have become widespread and this leads to differences between the profitability of firms

with only domestic operations versus others which have activities across multiple countries. For

instance, it has been reported that German affiliates of multinational firms save on average more

than a quarter in taxes relative to comparable domestic German firms. In the UK, taxable income

as a proportion of total assets reported by subsidiaries of foreign multinationals are more than 12

percent lower than those of comparable domestic standalone companies (De Mooj and Liu, 2020).

Transfer pricing has long been an important issue for tax directors and some government

authorities. It is now firmly on the agenda of world leaders. The number of countries that have

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Concepts in action

The European Commission thinks Apple's transfer price arrangements

are unfair

The Irish government put together a low tax model during the 1980s to attract foreign direct investment. The country

welcomed companies such as Apple and Google to operate some activities on its shores. But there has been pressure

for the low-tax jurisdiction to dismantle the 'double Irish structure'. In the case of Apple, the European Commission

(EC) indicated in 2016 that Apple had been granted illegal state aid in Ireland and owed €13 billion in taxes. But in

2020, the General Court ruled against the EC finding that Apple's transfer pricing arrangements in Ireland were not

illegal state aid. The EC has appealed the decision claiming that the General Court relied on 'inadmissible evidence'.

If the Court of Justice of the European Union (CJEU) ends up seeing the General Court's judgment was made in 'error',

then Apple will have to pay the taxes owed.

The contentious 'Double Irish' is viewed as a base erosion and profit-shifting corporate tax tool, used in the past

mostly by many US multinationals to avoid corporate taxation on most non-US profits. For instance, suppose $3 000 000

was sent by Meta from Spain to Ireland, and then subsequently sent on to a 'tax haven' such as Bermuda. Irish taxation

would therefore be by-passed. Google has made very extensive use of the double Irish loophole to funnel billions in

global profits through Ireland and on to Bermuda, effectively putting them beyond the reach of US tax authorities.

Google shifted more than $75.4 billion (€63 billion) in profits out of the Republic using the controversial double-Irish

tax arrangement in 2019, which was the last year in which it used the loophole.

The Organisation for Economic Co-operation and Development (OECD) has run a project on base erosion and

profit shifting, which produced a 15-point action plan. In the United States, the Internal Revenue Service (IRS) has

made a substantial investment in transfer-pricing resources. As a consequence, the IRS has delivered a 'notice of

deficiency' to Facebook for $3 billion to $5 billion, plus interest and penalties, following an audit of the value at

which Facebook transferred its intellectual property to its Irish entity. Another transfer-pricing dispute occurred with

GlaxoSmithKline, a UK-based pharmaceutical and health care company, which then had to pay $3.4 billion to cover

back taxes and interest.

Sources: Taylor, C. (2021) 'Google used "double-Irish" to shift $75.4bn in profits out of Ireland', *The Irish Times,* 17 April (https://www.irishtimes.com/

business/technology/google-used-double-irish-to-shift-75-4bn-in-profits-out-of-ireland-1.4540519); De Mooj, R. and Liu, L (2018) 'At a cost: the real effects of transfer pricing regulations' (www.ntanet.org/wp-content/uploads/proceedings/2017/NTA2017-132.pdf).

imposed transfer-pricing regulations has grown rapidly in the past decade. Countries such as

Canada, Greece, India and Turkey have focused on intellectual-property values, the costs of

back-office functions, and losses of any type. Countries rich in minerals and natural resources,

including Australia, Chile and Indonesia, have introduced new tax policies and transfer-pricing

guidelines aimed at increasing the local tax base, especially in the area of outbound commodities.

There is much coordinated action by governments.

Summary

The following points are linked to the chapter's learning objectives.

1 A management control system is a means of gathering and using information to aid and coordinate the process

of making planning and control decisions throughout the organisation, and to guide employee behaviour.

2 Effective management control systems are closely aligned to the organisation's strategy, fit the organisation's struc-

ture, and motivate managers and employees to give effort to achieve the organisation's goals.

3 The benefits of decentralisation include (a) greater responsiveness to local needs, (b) gains from quicker decision mak-

ing, (c) increased motivation of subunit managers, (d) greater management development and learning, and (e) sharper

management focus. The costs of decentralisation include (a) dysfunctional decision making (control loss), (b) duplication

of activities, (c) decreased loyalty towards the organisation, and (d) increased costs of information gathering.

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References and further reading

4 Transfer prices can be (a) market-based, (b) cost-based, or (c) negotiated. Different transfer-pricing methods pro-

duce different revenues and costs for individual subunits, and hence different operating profits for them.

5 In perfectly competitive markets, there is no idle capacity, and division managers can buy and sell as much as

they want at the market price. Setting the transfer price at the market price motivates division managers to deal

internally and to take exactly the same actions as they would if they were dealing in the external market.

6 A transfer price based on full cost plus a mark-up may lead to suboptimal decisions because it leads the 'buying'

division to regard the fixed costs and the mark-up of the selling division as variable costs.

7 When there is excess capacity, the transfer price range for negotiations generally lies between the minimum price

at which the selling division is willing to sell (its variable costs) and the maximum price the buying division is willing

to pay (the price at which the product is available from outside suppliers).

8 The general guideline for transfer pricing states that the minimum transfer price equals the incremental costs per

unit incurred up to the point of transfer plus the opportunity costs per unit to the supplying division resulting from

transferring products or services internally.

9 Transfer prices can reduce income tax payments by recognising higher profits in low-tax-rate countries and lower

profits in high-tax-rate countries.

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press-releases/2022/unilever-simplifies-organisation/)

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CHAPTER 18

Assessment material

Review questions

18.1 What is a management control system?

18.2 Describe three criteria you would use to evaluate whether a management control system is

effective.

18.3 What is the relationship among motivation, goal congruence and effort?

18.4 Name three benefits and two costs of decentralisation.

18.5 'Organisations typically adopt a consistent decentralisation or centralisation philosophy across

all their business functions.' Do you agree? Explain.

18.6 'Transfer pricing is confined to profit centres.' Do you agree? Why?

18.7 Under what conditions is a market-based transfer price optimal?

18.8 Give two reasons why a dual-price approach to transfer pricing is not widely used.

18.9 'Under the general transfer-pricing guideline, the minimum transfer price will vary depending on

whether the supplying division has idle capacity or not.' Do you agree? Explain.

18.10 Why should managers consider income tax issues when choosing a transfer-pricing method?

Exercises

Basic level

18.11 Goals of public accounting firms (10 minutes)

All personnel, including partners, of public accounting firms must usually turn in biweekly time

reports, showing how many hours were devoted to their various duties. These firms have tradi-

tionally looked unfavourably on idle or unassigned staff time. They have looked favourably on

heavy percentages of chargeable time because this maximises revenue.

Required

What effect is such a policy likely to have on the behaviour of the firm's personnel? Can you relate

this practice to the problem of goal congruence that was discussed in this chapter? How?

18.12 Decentralisation, goal congruence, responsibility centres (15 minutes)

Montaigne-Chimie SA consists of seven operating divisions, each of which operates independently.

The operating divisions are supported by a number of support divisions such as R&D, labour

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relations and environmental management. The environmental management group consists of 20

environmental engineers. These engineers must seek out business from the operating divisions –

that is, the projects they work on must be mutually agreed to and paid for by one of the operating

divisions. Under Montaigne-Chimie's rules, the environmental group is required to charge the

operating divisions for environmental services at cost.

Required

1 Is the environmental management organisation centralised or decentralised?

2 What type of responsibility centre is the environmental management group?

3 What benefits and problems do you see in structuring the environmental management group

the way Montaigne-Chimie has? Does it lead to goal congruence and motivation?

18.13 Transfer-pricing dispute (20 minutes)

Gustavsson AB, manufacturer of tractors and other heavy farm equipment, is organised along

decentralised lines, with each manufacturing division operating as a separate profit centre. Each

divisional manager has been delegated full authority on all decisions involving the sale of that

division's output both to outsiders and to other divisions of Gustavsson. Division C has in the

past always purchased its requirement of a particular tractor-engine component from Division

A. However, when informed that Division A is increasing its selling price to €150, Division C's

manager decides to purchase the engine component from outside suppliers.

Division C can purchase the component for €135 on the open market. Division A insists that,

because of the recent installation of some highly specialised equipment and the resulting high

depreciation charges, it will not be able to earn an adequate return on its investment unless it

raises its price. Division A's manager appeals to top management of Gustavsson for support in

the dispute with Division C and supplies the following operating data:

C's annual purchases of tractor-engine component

1000 units

A's variable costs per unit of tractor-engine component

€120

A's fixed costs per unit of tractor-engine component

€20

Required

1 Assume that there are no alternative uses for internal facilities. Determine whether the com-

pany as a whole will benefit if Division C purchases the component from outside suppliers for

€135 per unit.

2 Assume that internal facilities of Division A would not otherwise be idle. By not producing the

1000 units for Division C, Division A's equipment and other facilities would be used for other

production operations that would result in annual cash-operating savings of €18 000. Should

Division C purchase from outside suppliers?

3 Assume that there are no alternative uses for Division A's internal facilities and that the price

from outsiders drops €20. Should Division C purchase from outside suppliers?

18.14 Transfer-pricing problem (continuation of Exercise 18.13) (5 minutes)

Refer to Exercise 18.13. Assume that Division A can sell the 1000 units to other customers at €155

per unit with variable marketing costs of €5 per unit.

Required

Determine whether Gustavsson will benefit if Division C purchases the 1000 components from

outside suppliers at €135 per unit.

***18.15 Ethics, transfer pricing** (20 minutes)

The Leipzig Division of Bohemia Industries makes two component parts, X23 and Y99. It supplies

X23 to the Hanover Division to be used in the manufacture of car engines and supplies Y99 to the

Bremen Division to be used in the manufacture of car gearboxes. The Leipzig Division is the only

supplier of these specialised components. When transfers are made in-house, Bohemia Industries

transfers products at full cost (calculated using an activity-based cost system) plus 10%. The unit

cost information for X23 and Y99 is as follows:

	X23	**Y99**
Variable costs per unit	€11	€8
Allocated fixed costs per unit	€14	

€7

The Hanover Division feels that the price for X23 is too high and has told Leipzig that it is trying

to locate an outside vendor to supply the part at a lower price. Wilhelm von Kalkstein, Leipzig

Division's management accountant, calls Eberhard Dunkelmann, his assistant, into his office. 'We

can't afford to lose the Hanover Division business. Our fixed costs won't go away even if we stop

supplying Hanover, and this means that the costs of supplying Y99 to Bremen will increase. Then

they'll start wanting to buy from outside. We're seriously looking at possibly shutting down the

entire division if we lose the Hanover business. See if you can find a different method of allocating

fixed costs that will decrease X23's transfer price to €23.65. I think Bremen will be willing to pay

a somewhat higher price for Y99.'

Eberhard is uncomfortable making any changes because he knows that any other allocation

method would violate corporate guidelines on overhead cost allocation. Still, he believes that

changing the fixed-cost allocations is in the best interest of Bohemia Industries. Eberhard is con-

fused about what he should do.

Required

1 Calculate the transfer prices for X23 and Y99.

2 Calculate the fixed cost per unit that Eberhard would have to allocate to X23 to enable Leipzig

to transfer X23 at €23.65 per unit.

3 Evaluate whether Wilhelm von Kalkstein's suggestion to Eberhard to change the fixed-cost

allocations is ethical. Would it be ethical for Eberhard to revise the fixed-cost allocations at

his boss's urging? What steps should he take to resolve this situation?

Intermediate level

18.16 Transfer-pricing methods, goal congruence (30 minutes)

Ilmajoki-Lumber Oy has a Raw Lumber Division and Finished Lumber Division. The variable

costs are:

● Raw Lumber Division: €100 per 100 board-metres of raw lumber.

● Finished Lumber Division: €125 per 100 board-metres of finished lumber.

Assume that there is no waste incurred in processing raw lumber into finished lumber. Raw

lumber can be sold at €200 per 100 board-metres. Finished lumber can be sold at €275 per 100

board-metres.

Required

1 Should Ilmajoki-Lumber process raw lumber into its finished form?

2 Assume that internal transfers are made at 110% of variable costs. Will each division maximise

its contribution to divisional operating profit by adopting the action that is in the best interests

of Ilmajoki-Lumber?

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3 Assume that internal transfers are made at market prices. Will each division maximise its

contribution to divisional operating profit by adopting the action that is in the best interests

of Ilmajoki-Lumber?

18.17 Effect of alternative transfer-pricing methods on divisional operating profit (CMA,

adapted) (30 minutes)

Escuelas SA has two divisions. The Mining Division makes toldine, which is then transferred

to the Metals Division. The toldine is further processed by the Metals Division and is sold to

customers at a price of €150 per unit. The Mining Division is currently required by Escuelas to

transfer its total yearly output of 400 000 units of toldine to the Metals Division at 110% of full

manufacturing cost. Unlimited quantities of toldine can be purchased and sold on the outside

market at €90 per unit. To sell the toldine it produces at €90 per unit on the outside market, the

Mining Division would have to incur variable marketing and distribution costs of €5 per unit.

Similarly, if the Metals Division purchased toldine from the outside market, it would have to incur

variable purchasing costs of €3 per unit.

The following table gives the manufacturing costs per unit in the Mining and Metals Divisions

for the year:

Mining Division

Metals Division

Direct materials

€12

€6

Direct manufacturing labour costs

16

20

Manufacturing overhead costs

32*

25†

Manufacturing costs per unit

€60

€51

* Manufacturing overhead costs in the Mining Division are 25% fixed and 75% variable.

† Manufacturing overhead costs in the Metals Division are 60% fixed and 40% variable.

Required

1 Calculate the operating profits for the Mining and Metals Divisions for the 400 000 units of

toldine transferred under each of the following transfer-pricing methods: (a) market price, and

(b) 110% of full manufacturing costs.

2 Suppose Escuelas rewards each division manager with a bonus, calculated as 1% of divisional

operating profit (if positive). What is the amount of bonus that will be paid to each division

manager under each of the transfer-pricing methods in requirement 1? Which transfer-pricing

method will each division manager prefer to use?

3 What arguments would Arturo Tuzón, manager of the Mining Division, make to support the

transfer-pricing method that he prefers?

18.18 Goal congruence, negotiated transfer prices (continuation of Exercise 18.17) (20 minutes)

Refer to the information in Exercise 18.17. Suppose that the Mining Division is not required to

transfer its yearly output of 400 000 units of toldine to the Metals Division.

Required

1 From the standpoint of Escuelas, SA, as a whole, what quantity of toldine should the Mining

Division transfer to the Metals Division?

2 Now suppose each division manager acts autonomously to maximise the division's operating

profit. What range of transfer prices will result in managers of the Metals and Mining Divi-

sions achieving the actions determined to be optimal in requirement 1? Explain your answer.

3 Would you recommend that Escuelas allow the divisions to buy and sell toldine in the open

market, and to negotiate the transfer price between themselves? Explain your answer.

***18.19 Pertinent transfer price** (20–30 minutes)

Liberaki SA has two divisions, A and B, which manufacture bicycles. Division A produces the

bicycle frame, and Division B assembles the bicycle components onto the frame. There is a mar-

ket for both the subassembly and the final product. Each division has been designated as a profit

centre. The transfer price for the subassembly has been set at the long-run average market price.

The following data are available to each division:

Estimated selling price for final product

€300

Long-run average selling price for intermediate product

200

Incremental costs for completion in Division B

150

Incremental costs in Division A

120

The manager of Division B has made the following calculation:

Selling price for final product

€300

Transferred-in costs (market)

€200

Incremental costs for completion

150

350

Contribution (loss) on product

€(50)

Required

1 Should transfers be made to Division B if there is no excess capacity in Division A? Is the mar-

ket price the correct transfer price?

2 Assume that Division A's maximum capacity for this product is 1000 units per month and sales

to the intermediate market are now 800 units. Should 200 units be transferred to Division B? At

what transfer price? Assume that for a variety of reasons, A will maintain the €200 selling price

indefinitely; that is, A is not considering lowering the price to outsiders even if idle capacity

exists.

3 Suppose Division A quoted a transfer price of €150 for up to 200 units. What would be the

contribution to the company as a whole if the transfer were made? As manager of Division B,

would you be inclined to buy at €150?

18.20 Transfer-pricing issues (From CIMA Management Accounting Pillar Managerial Level Paper,

November 2006) (25 minutes)

ZP Plc operates two subsidiaries, X and Y. X is a component manufacturing subsidiary and

Y is an assembly and final product subsidiary. Both subsidiaries produce one type of output

only. Subsidiary Y needs one component from Subsidiary X for every unit of Product W pro-

duced. Subsidiary X transfers to Subsidiary Y all of the components needed to produce Product

W. Subsidiary X also sells components on the external market. The following budgeted informa-

tion is available for each subsidiary:

X Y

Market price per component

$800

Market price per unit of W

$1 200

Production costs per component

$600

Assembly costs per unit of W

$400

Non-production fixed costs

$1.5m

$1.3m

External demand

10 000 units

12 000 units

Capacity

22 000 units

Taxation rates

25%

30%

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The production cost per component is 60% variable. The fixed production costs are absorbed

based on budgeted output. X sets a transfer price at marginal cost plus 70%.

Required

Calculate the post-tax profit generated by each subsidiary.

18.21 Transfer-pricing issues (From CIMA Management Accounting Pillar Managerial Level Paper)

(40 minutes)

The ZZ Group has two divisions, X and Y. Each division produces only one type of product: X pro-

duces a component, C and Y produces a finished product, FP. Each FP needs one C. It is the current

policy of the group for C to be transferred to Division Y at the marginal cost of £ 10 per component

and that Y must buy all the components it needs from X. The markets for the component and the

finished product are competitive and price sensitive. Component C is produced by many other

companies but it is thought that the external demand for the next year could increase to 1000 units

more than the sales volume shown in the current budget for Division X. Budgeted data, taken from

the ZZ Group internal information system, for the divisions for the next year is as follows:

Division X

Income statement

Sales

£70 000

Cost of sales

Variable costs

£50 000

Contribution

£20 000

Fixed costs (controllable)

£15 000

Profit

£5 000

Production/Sales (units)

5000 (3000 of which are transferred to Division Y)

External demand (units)

3000 (Only 2000 of which can be currently satisfied)

Capacity (units)

5000

External market price per unit

£20

Balance sheet extract

Capital employed

£60 000

Other information

Cost of capital charge

10%

Division Y

Income statement

Sales

£270 000

Cost of sales

Variable costs

£114 000

Contribution

£156 000

Fixed costs (controllable)

£100 000

Profit

£56 000

Production/Sales (units)

3000

Capacity (units)

7000

Market price per unit

£90

Balance sheet extract

Capital employed

£110 000

Other information

Cost of capital charge

10%

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Four measures are used to evaluate the performance of the divisional managers. Based on the data

above, the budgeted performance measures for the two divisions are as follows:

Division X

Division Y

Residual income

(£1 000)

£45 000

Return on capital employed

8.33%

50.91%

Operating profit margin

7.14%

20.74%

Asset turnover

1.17

2.46

Proposed policy

ZZ Group is thinking of giving the divisional managers the freedom to set their own transfer

price and to buy the components from external suppliers but there are concerns about problems

that could arise by granting such autonomy.

Required

1 If the transfer price of the component is set by the manager of Division X at the current market

price (£20 per component), recalculate the budgeted performance measures for each division.

2 Discuss the changes to the performance measures of the divisions that would arise as a result

of altering the transfer price to £20 per component.

3 a Explain the problems that could arise for each of the divisional managers and for ZZ Group

as a whole as a result of giving full autonomy to the divisional managers.

b Discuss how the problems you have explained could be resolved without resorting to a

policy of imposed transfer prices.

Advanced level

***18.22 Pricing in imperfect markets** (continuation of Exercise 18.19) (30–40 minutes)

Refer to Exercise 18.19.

Required

1 Suppose the manager of Division A has the option of (a) cutting the external price to €195

with the certainty that sales will rise to 1000 units, or (b) maintaining the outside price of

€200 for the 800 units and transferring the 200 units to Division B at some price that would

produce the same operating profit for Division A. What transfer price would produce the

same operating profit for Division A? Does that price coincide with that produced by the

general guideline in the chapter so that the desirable decision for the company as a whole

would result?

2 Suppose that if the selling price for the intermediate product is dropped to €195, outside sales

can be increased to 900 units. Division B wants to acquire as many as 200 units if the transfer

price is acceptable. For simplicity, assume that there is no outside market for the final 100 units

of Division A's capacity.

a Using the general guideline, what is (are) the minimum transfer price(s) that should lead to

the correct economic decision? Ignore performance-evaluation considerations.

b Compare the total contributions under the alternatives to show why the transfer price(s)

recommended lead(s) to the optimal economic decision.

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18.23 From the Chartered Institute of Management Accountants, Intermediate Level,

Management Accounting – Decision Making, November 2003 (45 minutes)

P Ltd has two divisions, Q and R that operate as profit centres. Division Q has recently been set

up to provide a component (Comp1) which division R uses to produce its product (ProdX). Prior

to division Q being established, division R purchased the component on the external market at a

price of £160 per unit. Division Q has an external market for Comp1 and also transfers to division

R. Division R uses one unit of Comp1 to produce ProdX which is sold externally. There are no

other products produced and sold by the divisions.

Costs associated with the production of Comp1 and ProdX are as follows:

Comp1

ProdX

Fixed costs

£50 000 per annum

£100 000 per annum

Variable costs

£250 per unit*

Direct labour

£15 per hour

Materials

£25 per unit

Variable overheads

£3 per labour-hour

* The variable cost for ProdX excludes the cost of the component.

The first unit of Comp1 will take 20 labour-hours to produce. However, it is known that the work

of direct labour is subject to a 90% learning curve.

The forecast external annual sales and capacity levels for the divisions are as follows:

External sales

Division Q

Comp1

5000 units at a price of £150 per unit

Division R

ProdX

10 000 units at a price of £500 per unit

Production capacity

Division Q

Comp1

13 000 units

Division R

ProdX

15 000 units

Required

1 State, with reasons, the volume of Comp1 which division Q would choose to produce in the

first year and calculate the marginal cost per unit of Comp1 at this volume.

2 a Explain the criteria an effective system of transfer pricing should satisfy.

b Discuss one context in which a transfer price based on marginal cost would be appropriate

and describe any issues that may arise from such a transfer-pricing policy.

c Identify the minimum transfer price that division Q would wish to charge and the maximum

transfer price which division R would want to pay for the Comp1. Discuss the implications

for the divisions and for the group as a whole of the transfer prices that you have identified.

18.24 From the Chartered Institute of Management Accountants Performance Operations,

section B, November 2014 (15 minutes)

A company, which operates from a number of different locations, uses a system of centralised

purchasing. The directors of the company are considering whether to change to a system of

decentralised purchasing.

Required

Explain the benefits that may result from the company using a decentralised purchasing system.

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18.25 From the Chartered Institute of Management Accountants Performance Management,

Section B, November 2014 (50 minutes)

AA and BB are two divisions of the ZZ Group. The AA division manufactures electrical compo-

nents, which it sells to other divisions and external customers.

The BB division has designed a new product, Product B, and has asked AA to supply the electrical

component, Component A, that is needed in the new product. This will be a completely new style

of component. Each unit of Product B will require one Component A. This component will not

be sold by AA to external customers. AA has quoted a transfer price to BB of £45 for each unit

of Component A.

It is the policy of the ZZ Group to reward managers based on their individual division's return

on capital employed.

Details of the monthly production for each division are as follows:

AA division

Output

Component A will be produced in batches of 1000 units.

The maximum capacity is 6000 components per month.

Variable cost

£15 per component

Fixed costs

£50 000 (these are incurred specifically to produce Component A)

BB division

Output

Product B will be produced in batches of 1000 units. The maximum

customer demand is 6000 units of Product B per month.

Variable cost

£9 per unit plus the cost of Component A

Fixed costs

£75 000 (these are incurred specifically to produce Product B)

The relationship between monthly customer demand and the selling price of Product B is shown

below:

Demand

Selling price per unit

1000 units

£120

2000 units

£110

3000 units

£100

4000 units

£90

5000 units

£80

6000 units

£67

Required

1 Calculate, based on a transfer price of £45 per Component A, the monthly profit that would

be earned as a result of selling Product B by:

a BB division

b AA division

c ZZ Group.

2 Calculate the maximum monthly profit from the sale of Product B for the ZZ Group.

3 Calculate, using the marginal cost of Component A as the transfer price, the monthly profit

that would be earned as a result of selling Product B by:

a BB division

b AA division

c ZZ Group.

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4 Discuss, using the above scenario, the problems of setting a transfer price and suggest a trans-

fer-pricing policy that would help the ZZ Group to overcome the transfer-pricing problems

that it faces.

18.26 From the Chartered Institute of Management Accountants Performance Management,

Section B, March 2014 (50 minutes)

SBA is a company that produces televisions and components for televisions. The company has

two divisions, Division S and Division B.

Division S manufactures components for televisions. Division S sells components to division B

and to external customers. Division B uses five of the components in each of the televisions that

it manufactures, and sells televisions directly to external customers.

Division S

Budgeted variable manufacturing cost per component:

£

Direct material

14

Direct labour

18

Variable overhead

12

The following information relating to next year is also available:

Fixed costs

£560 000

Production capacity

175 000 components

External demand

150 000 components

Potential demand from Division B

80 000 components

Division B

£

Sales price

450

Budgeted variable manufacturing cost per television

Direct material

40

Direct labour

62

Variable overhead

16

In addition to the variable costs above, each television produced needs five components

Fixed costs are budgeted to be £1 460 000 for next year. Annual sales of televisions are expected

to be 16 000 units.

Transfer pricing policy

Transfer prices are set at opportunity cost.

Division S must satisfy the demand of Division B before selling components externally.

Division B is allowed to purchase components from Division S or from external suppliers.

Required

1 Assuming that Division B buys all the components it requires from Division S.

Produce a profit statement for each division detailing sales and costs, showing external sales

and internal company transfers separately where appropriate.

2 A specialist external supplier has approached Division B and offered to supply 80 000 compo-

nents at a price of £42 each. The components fulfil the same function as those manufactured

by Division S. The manager of Division B has accepted the offer and has agreed to buy all the

components it requires from this supplier.

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a Produce a revised profit statement for each division **and** for the total SBA Company.

Division S has just received an enquiry from a new customer for the production of 25 000

components. The manager of Division S requires a total profit for the year for the division

of £450 000.

b Calculate the minimum price per component to sell the 25 000 components to the new

customer that would enable the manager of Division S to meet the profit target.

Note: this order will have no effect on the divisional fixed costs and no impact on the 150 000

components Division S sells to its existing external customers at £50 per component. Division B

will continue to purchase the 80 000 components it requires from the specialist external supplier.

3 Discuss the potential implications for SBA of outsourcing the production of one type of com-

ponent that it manufactures.

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Control systems and performance

measurement

We have discussed performance measurement in many of the earlier chapters, each time within a specific accounting context. We have,

Learning objectives

for example, described situations where the correct decision based on a relevant-cost analysis (buying new equipment, say) may not be

After studying this chapter, you

implemented because the performance-measurement system induced should be able to:

the manager to act differently. This chapter discusses the design,

-

Provide examples of financial

implementation and uses of performance measures more generally.

and non-financial measures of

Performance measures are a central component of a management-

performance

control system. Planning and control decisions requires information about how different subunits of the organisation have performed. To be

-

Understand the return on

effective, management-control systems must also motivate managers

investment (ROI) method of

and employees to strive to achieve organisation goals. Performance

profitability analysis

evaluation and rewards are key elements for motivating employees.

●

Describe the residual-income (RI)

Performance measurement of an organisation's subunits should be

measure

a prerequisite for allocating resources within that organisation. When a

●

Understand the economic value

subunit undertakes new activities, it forecasts revenues, costs and invest-

added (EVA®) method

ments. Periodic comparisons of the actual revenues, costs and invest-

●

Distinguish between current-

ments with the budgeted amounts can help guide top management's

cost and historical-cost asset

decisions about future allocations.

measurement methods

Performance measurement of managers is used in decisions about

their salaries, bonuses, future assignments and career advancement.

●

Recognise the role of salaries

Moreover, the very act of measuring their performance can motivate

and incentives in compensation

managers to strive for the goals used in their evaluation. But lack of clarity

arrangements

between pay and performance can prove problematic for investors. For

●

Be aware of the management

instance, Norway's sovereign wealth fund – the world's biggest – which

accountant's role in designing

exceeds $1.4 trillion in value, desires companies it invests in to curb exces-

incentive systems

sive and opaque top-management pay. The wealth fund owns about 1.5%

●

Describe the incentive problems

of all listed stocks in the world and invests in over 9000 companies. The

arising when employees perform

fund seeks to focus on companies where a ‘substantial proportion’ of

multiple tasks

annual pay be provided as shares that are locked in for at least five years,

●

Understand the four levers of

though preferably ten. Pay practices are also to be kept simple with total

control and their effects

remuneration being transparent (Holter, 2017). In 2022, the sovereign wealth fund opposed Apple’s executive compensation plan whereby CEO Tim Cook’s pay package was $99 million (Treloar, 2022). The fund adopts a highly responsible investment strategy, not just in terms of seeking moderation in top management pay packets but also pursues an ‘overall long-term goal of net zero emissions from the companies in which the fund is invested’ (Eccles, 2022). Rebellions by shareholders over excessive executive pay are common. The boss of JD Sports, Peter Cowgill, was

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paid almost £6 million in bonuses despite the firm accepting £100 million in COVID support in 2021 which caused

a revolt. Consider also, General Electric (GE) which was once the most valuable company in the United States. After

famed CEO Jack Welch retired in 2001, the company began a long, steep decline resulting in a smaller company today

worth around one-tenth what it was back in 2000. While GE's performance significantly declined over the years, com-

pensation for then CEOs Jeff Immelt and John Flannery did not. During his 16-year run as CEO, Immelt earned nearly

$211 million in salary and incentive compensation. When Immelt retired under shareholder pressure in 2017, he left

with at least another $112 million. His replacement, John Flannery, earned $5.8 million during his 14-month tenure as

CEO. During his short time at the helm, GE's stock price fell nearly 50%. There is usually an expectation that rewards

should be connected to sustained performance, and managers should not increase their compensation without sup-

porting the company's objectives. But the outcomes do not always match desires!

This chapter examines issues in designing performance measures for different levels of an organisation and for man-

agers at these different levels. We discuss both financial and non-financial performance measures.

Financial and non-financial performance measures

Chapter 18 noted how the information used in a management-control system can be financial

or non-financial. Many common performance measures such as operating profit rely on internal

financial and accounting information. Increasingly, companies are supplementing internal

financial measures with measures based on external financial information (for example, stock

prices), internal non-financial information (such as manufacturing lead time) and external non-

financial information (such as customer satisfaction). In addition, companies are benchmarking

their financial and non-financial measures against other companies that are regarded as the ‘best

performers’. To compete effectively in the global market, companies need to perform at or near

the ‘best of the breed’.

Some companies present financial and non-financial performance measures for various organ-

isation subunits in a single report called the *balanced scorecard* (see Chapter 22). Different com-

panies stress various elements in their scorecards, but most scorecards include (1) profitability

measures; (2) customer-satisfaction measures; (3) internal measures of efficiency, quality and time;

and (4) innovation measures (see Kaplan and Norton, 2001; 2004).

The balanced scorecard highlights trade-offs that the manager may have made. For example,

it indicates whether improvements in financial performance resulted from sacrificing investments

in new products or from on-time delivery. The specific non-financial measures chosen signal to

employees the areas that top management views as critical to the company's success.

Some performance measures, such as the number of new patents developed, have a long-run

time horizon. Other measures, such as direct materials efficiency variances, overhead spending

variances and yield, have a short-run time horizon. We focus on the most widely used performance

measures covering an intermediate to long-run time horizon. These are internal financial measures

based on accounting numbers routinely maintained by organisations.

Non-financial performance measures offer some distinct benefits. Ittner and Larcker (2000)

suggest that they:

● provide a closer link to long-term organisational strategies

● provide indirect quantitative information on a company's intangible assets

● can be good indicators of future financial performance

● can improve managers' performance by providing more transparent evaluation of their actions.

However, these researchers also note that non-financial performance measures:

● can be time consuming and costly to implement

● do not have a common denominator and entail different denominators such as time,

percentages, quantities, etc.

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● sometimes lack verifying links to accounting profits or stock prices and may have weak statis-

tical reliability

● may be too numerous to translate into main drivers of success.

Different performance measures

Enterprises try to align reporting structures to performance-measurement systems to obtain

the best information for monitoring activities. This section elaborates on step 1 noted above by

describing four measures commonly used to evaluate the economic performance of organisation

subunits. Good performance measures promote goal congruence with the organisation’s objec-

tives and facilitate comparisons across different subunits. We illustrate these measures using the

example of Hôtels Desfleurs.

Hôtels Desfleurs owns and operates three hotels, located in Vaison-la-Romaine, Perpignan and

La Rochelle. Exhibit 19.1 summarises data for each of the three hotels for the most recent year

(2022). At present, Hôtels Desfleurs does not allocate to the three separate hotels the total long-

term debt of the company. Exhibit 19.1 indicates that the La Rochelle hotel generates the highest

operating profit, €510 000. The Perpignan hotel generates €300 000; the Vaison hotel, €240 000. But

is this comparison appropriate? Is the La Rochelle hotel the most 'successful'? Actually, the compar-

ison of operating profit ignores potential differences in the *size* of the investments in the different

hotels. Investment refers to the resources or assets used to generate profits. The question then is not

how large operating profit is *per se,* but how large it is given the resources that were used to earn it.

Three approaches include investment in performance measures: return on investment (ROI),

residual income (RI) and economic value added (EVA®). A fourth approach measures return on

sales (ROS).

Exhibit 19.1

Annual financial data for Hôtels Desfleurs for 2022

Vaison

Perpignan

La Rochelle

hotel

hotel

hotel

Total

(1)

(2)

(3)

(4) = (1) + (2) + (3)

Hotel revenues (sales)

€1 200 000

€1 400 000

€3 185 000

€5 785 000

Hotel variable costs

310 000

375 000

995 000

1 680 000

Hotel fixed costs

650 000

725 000

1 680 000

3 055 000

Hotel operating profit

€240 000

€300 000

€510 000

1 050 000

Interest costs on long-term

–

–

–

450 000

debt at 10%

Profit before income taxes

–

–

–

600 000

Income taxes at 30%

–

–

–

180 000

Net profit

–

–

–

€420 000

Average book values for 2022

Current assets

€400 000

€500 000

€600 000

€1 500 000

Long-term assets

600 000

1 500 000

2 400 000

4 500 000

Total assets

€1 000 000

€2 000 000

€3 000 000

€6 000 000

Current liabilities

€50 000

€150 000

€300 000

€500 000

Long-term debt

–

–

–

4 500 000

Stockholders’ equity

–

–

–

1 000 000

Total liabilities and

€6 000 000

shareholders’ equity

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Return on investment

Return on investment (ROI) is an accounting measure of income divided by an accounting measure

of investment.

Return on investment (ROI

Income

) = Investment

ROI is the most popular approach to incorporating the investment base into a performance

measure. ROI appeals conceptually because it blends all the major ingredients of profitability

(revenues, costs and investment) into a single number. ROI can be compared with the rate of

return on opportunities elsewhere, inside or outside the company. Like any single performance

measure, however, ROI should be used cautiously and in conjunction with other performance

measures.

ROI is also called the accounting rate of return. Managers usually use the term ROI in the

context of evaluating the performance of a division or subunit and accrual accounting rate of

return when evaluating a project. Companies vary in the way they define both the numerator and

the denominator of the ROI. For example, some firms use operating profit for the numerator.

Other firms use net profit. Some firms use total assets in the denominator. Others use total assets

minus current liabilities.

Hôtels Desfleurs can increase ROI by increasing revenues or decreasing costs (both these

actions increase the numerator), or by decreasing investments (decreases the denominator).

ROI can often provide more insight into performance when it is divided into the following

components:

Revenues × Income = Income

Investment

Revenues

Investment

This approach is widely known as the *DuPont method of profitability analysis.* The DuPont

approach recognises that there are two basic ingredients in profit making: using assets to generate

more revenue, and increasing income per euro of revenue. An improvement in either ingredient

without changing the other increases return on investment.

Consider the ROI of each of the three Hôtels Desfleurs in Exhibit 19.1. For our calculations,

we are using the operating profit of each hotel for the numerator and total assets of each hotel

for the denominator.

Hotel

Operating profit

÷

Total assets

=

ROI

Vaison

€240 000

÷

€1 000 000

=

24%

Perpignan

€300 000

÷

€2 000 000

=

15%

La Rochelle

€510 000

÷

€3 000 000

=

17%

Using these ROI figures, the Vaison hotel appears to make the best use of its total assets.

Assume that the top management at Hôtels Desfleurs adopts a 30% target ROI for the Vaison

hotel. How can this return be attained? The DuPont method (Exhibit 19.2) illustrates the present

situation and three alternatives. Other alternatives such as increasing the selling price per room

could increase both the revenue per euro of total assets and the operating profit per euro of

revenue.

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Exhibit 19.2

The DuPont method applied to the present situation and three alternatives for

Hôtels Desfleurs

Revenues × Operatingprofit

Operating profit

Revenues

Totalasses

Totalasses

Present situation

€1200 000

€240 000

×

= 1.20 × 0.20 =

0.24 or 24%

€1000 000

€1200 000

Alternatives

A. Decrease assets (for example, debtors) €1200 000

€240 000

×

= 1.50 × 0.20 =

0.30 or 30%

keeping revenues and operating profit

€800 000

€1200 000

per euro of revenue constant

B. Increase revenues (by selling more

€1500 000

€300 000

×

= 1.50 × 0.20 =

0.30 or 30%

rooms) keeping assets and operating

€1000 000

€1500 000

profit per euro of revenue constant

C. Decrease costs (for example, via efficient €1200 000

€300 000

×

= 1.50 × 0.25 =

0.30 or 30%

maintenance) to increase operating

€1000 000

€1200 000

profit per euro of revenue, keeping rev-

enues and assets constant

ROI highlights the benefits that managers can obtain by reducing their investments in current

or fixed assets. Some managers are conscious of the need to boost revenues or to control costs

but pay less attention to reducing their investment base. Reducing investments means decreasing

idle cash, managing credit judiciously, determining proper stock levels and spending carefully on

fixed assets.

Residual income

Residual income is income minus a required euro return on the investment:

Residual income = Income − (Required rate of return × Investment)

The required rate of return multiplied by investment is also called the imputed cost of the

investment. Imputed costs are costs recognised in particular situations that are not regularly

recognised by accrual accounting procedures. An imputed cost is not recognised in accounting

records because it is not an incremental cost but instead represents the return forgone by Hôtels

Desfleurs as a result of tying up cash in various investments of similar risk. Assume that each

hotel faces similar risks. Hôtels Desfleurs defines residual income for each hotel as hotel operating

profit minus a required rate of return of 12% of the total assets of the hotel:

Hotel

Operating profit − Required rate of return × Investment = Income

Vaison

€240 000

–

€120 000 (12% × €1 000 000)

= €120 000

Perpignan

€300 000

–

€240 000 (12% × €2 000 000)

=

€60 000

La Rochelle €510 000

–

€360 000 (12% × €3 000 000)

= €150 000

Given the 12% required rate of return, the La Rochelle hotel is performing best in terms of

residual income.

Some firms favour the residual-income approach because managers will concentrate on max-

imising an absolute amount (euros of residual income) rather than a percentage (return on invest-

ment). The objective of maximising residual income assumes that as long as a division earns a

rate in excess of the required return for investments, that division should expand.

The objective of maximising ROI may induce managers of highly profitable divisions to reject

projects that, from the viewpoint of the organisation as a whole, should be accepted. To illustrate,

assume that Hôtels Desfleurs' required rate of return on investment is 12%. Assume also that an

expansion of the Vaison hotel will increase its operating profit by €160 000 and increase its total

assets by €800 000. The ROI for the expansion is 20% (€160 000 ÷ €800 000), which makes it

attractive to Hôtels Desfleurs as a whole. By making this expansion, however, the Vaison manager

will see the hotel's ROI decrease:

€240 000

Pre-expansion ROI =

= 24%

1000 000

€240 000 + €160 000

€400 000

Pre-expansion ROI =

=

= 22.2%

1000 000 + €1800 000

€1800 000

The annual bonus paid to the Vaison manager may decrease if ROI is a key component in the

bonus calculation and the expansion option is selected. In contrast, if the annual bonus is a func-

tion of residual income, the Vaison manager will view the expansion favourably:

Pre-expansion residual income = €240 000 – (12% × €1000 000) = €120 000

Pre-expansion residual income = €400 000 – (12% × €1800 000) = €184 000

Goal congruence is more likely to be promoted by using residual income rather than ROI as a

measure of the division manager’s performance.

Both ROI and residual income represent the results for a single time period (such as a year).

Managers could take actions that cause short-run increases in ROI or residual income but are

in conflict with the long-run interests of the organisation. For example, managers may curtail

R&D and plant maintenance in the last three months of a fiscal year to achieve a target level of

annual operating profit. For this reason, some companies evaluate subunits on the basis of ROI

and residual income over multiple years.

Economic value added (EVA®)

Economic value added (EVA®) is a specific type of residual-income calculation that has attracted

considerable attention for the past two decades (Bouwens and Speklé, 2007; Stewart, 1994; Young

and O'Byrne, 2001). Joel Stern, a partner at consultants Stern Stewart, which developed and

markets EVA®, argues that EVA® is a superior measure for certain management decisions and

performance tracking. Many companies have adopted this measure, including Boots, Burton

Group, Coca-Cola, Siemens, Pirelli, Lucas, Nestlé and Telecom Italia Group. Economic value

added equals after-tax operating profit *minus* the (after-tax) weighted-average cost of capital

multiplied by total assets minus current liabilities.

□

□

□ □

Economic value

After-tax

□ Weighted-average

Total

Current □ □

=

− □

× □□

–

®

□

□□□ □

added (EVA)

operating profit

□

cost of capital

□□ assets

liabilities □□ □

□□

□□

EVA® substitutes the following numbers in the residual-income calculations: (1) income equal to

after-tax operating profit, (2) a required rate of return equal to the weighted-average cost of cap-

ital and (3) investment equal to total assets minus current liabilities. We use the Hôtels Desfleurs

data in Exhibit 19.1 to illustrate EVA®.

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The key calculation is the weighted-average cost of capital (WACC), which equals after-tax

average cost of all the long-term funds used by Hôtels Desfleurs. The company has two sources

of long-term funds: long-term debt with a market and book value of €4.5 million issued at an

interest rate of 10% and equity capital that has a market value of €3 million (and a book value

of €1 million). (The market value of Hôtels Desfleurs' equity exceeds book value because book

values, based on historical costs, do not reflect the current values of the company's assets and

because various intangible assets, such as the company's brand name, are not shown at current

value on the balance sheet.) Since interest costs are tax deductible, the after-tax cost of debt

financing equals 0.10 × (1 − tax rate) = 0.10 × (1 − 0.30) = 0.10 × 0.70 = 0.07, or 7%. The

cost of equity capital is the opportunity cost to investors of not investing their capital in another

investment that is similar in risk to Hôtels Desfleurs. Suppose that Hôtels Desfleurs' cost of

equity capital is 15%. The WACC computation, which uses market values of debt and equity, is

as follows:

(0.07 × €4 500 000)(0.15 × €3 000 000)

WACC =

€4 500 00 + €3 000 000

€315 000 + €450 000

€765 000

=

=

€7 500 000

€7 500 000

= 0.102 or 10.2%

The company applies the same WACC to all its hotels since each hotel faces similar risks.

Long-term assets minus current liabilities (see Exhibit 19.1) can also be calculated as:

Total assets − Current liabilities = Long-term assets + Current assets − Current liabilities

= Long-term assets + Working capital

where working capital = current assets − current liabilities. After-tax hotel operating profit is:

Hotel operating profit × (1 – Tax rate) = Hotel operating profit × (1 – 0.30)

= Hotel operating profit × 0.70

EVA® calculations for Hôtels Desfleurs are as follows:

After-tax

□

□

□ **W**

Weeiigghhtteedd-aavveerraaggee

□□

□

T

Toottaall

C

Cuurrrreenntt □□ □

Economic

operating

– □

× □□

–

□ □

□

ccoosstt ooff ccaappiittaall

□

□

value added

□ aasssseettss

□ =

□

□

lliiaabbiilliittiieess □□

Hotel

profit

□

□

□

□□

(EVA®)

Vaison

€240 000 × 0.7 − [10.2%

× (€1 000 000 − €50 000)]

= €168 000 − €96 900

=

€71 100

Perpignan

€300 000 × 0.7 − [10.2%

× (€2 000 000 − €150 000)]

−

= €210 000 − €188 700

=

€21 300

La Rochelle €510 000 × 0.7 − [10.2%

× (€3 000 000 − €300 000)]

= €357 000 − €275 400

=

€81 600

The La Rochelle hotel has the highest EVA®. EVA®, like residual income, charges managers

for the cost of their investments in long-term assets and working capital. Value is created only

if after-tax operating profit exceeds the cost of investing the capital. To improve EVA®, manag-

ers must earn more operating profit with the same capital, use less capital, or invest capital in

high-return projects.

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Return on sales

The income-to-revenue (sales) ratio, often called *return on sales* (ROS), is a frequently used finan-

cial performance measure. ROS is one component of ROI in the DuPont method of profitability

analysis. To calculate the ROS of each of the Desfleurs hotels, we use operating profit divided by

revenues. The ROS for each hotel is:

Operating

Revenues

Hotel

profit

÷

(sales)

=

ROS

Vaison

€240 000

÷

€1 200 000

= 20.0%

Perpignan

€300 000

÷

€1 400 000

= 21.4%

La Rochelle

€510 000

÷

€3 185 000

= 16.0%

The following table summarises the performance and ranking of each hotel under each of the

four performance measures:

Residual

Hotel

ROI (rank)

income (rank)

EVA® (rank)

ROS (rank)

Vaison

24% (1)

€120 000 (2)

€71 100 (2)

20.0% (2)

Perpignan

15% (3)

€60 000 (3)

€21 300 (3)

21.4% (1)

La Rochelle

17% (2)

€150 000 (1)

€81 600 (1)

16.0% (3)

The residual-income and EVA® rankings differ from the ROI and ROS rankings. Consider the

ROI and residual-income rankings for the Vaison and Perpignan hotels. The La Rochelle hotel has

a smaller ROI. Although its operating profit is only slightly more than twice that of the Vaison

hotel (€510 000 versus €240 000), its total assets are three times as large (€3 million versus €1 mil-

lion). The return on assets invested in the La Rochelle hotel is not as high as the return on assets

invested in the Vaison hotel. The La Rochelle hotel has a higher residual income because it earns

a higher operating income after covering the 12% required return on investment. The Perpignan

hotel has the highest ROS but the lowest ROI. Why? Because although it earns very high profit per

euro of revenue, it generates very low revenues per euro of assets invested. Is any method superior

to the others? No, because each evaluates a slightly different aspect of performance. For example,

in markets where revenue growth is limited, return on sales is the most meaningful indicator of a

subunit's performance. To evaluate overall aggregate performance, ROI or residual-income-based

measures are more appropriate since they consider both income earned and investments made.

Residual-income and EVA® measures overcome some of the goal-congruence problems that ROI

measures might introduce. Some managers favour EVA® because it explicitly considers tax effects

while pre-tax residual-income measures do not. Other managers favour pre-tax residual-income

because it is easier to calculate and because it often leads to the same conclusions as EVA®.

Exhibit 19.3 presents the key financial performance measures used by seven companies. Note

the diversity in the use of income-based measures, ROS, ROI and EVA®.

Exhibit 19.3

Company examples of key financial performance measures

Company

Country

Product/

Key financial

name

headquarters

business

performance measures

Quaker Oats

USA

Food products

EVA®

Guinness

Ireland

Consumer products

Profit and ROS

Krones

Germany

Machinery/equipment

Sales and income

Mayne Nickless

Australia

Security/transportation

ROI and ROS

Mitsui

Japan

Trading

Sales and income

Pirelli

Italy

Tires/manufacturing

Income and cash flow

Swedish Match

Sweden

Consumer products

ROI

Source: Business International (1989, 1992); Stewart (1994).



Concepts in action

Running pharmas can prove challenging and CEO compensation can fall!

CEOs are evaluated on a number of dimensions mirroring their firms' priorities. Good financial performance is often not enough. Bristol Myers Squibb (BMS) awarded its CEO Giovanni Caforio $19.78 million in 2021 pay, down from $20.15 million the prior year, BMS met or exceeded several targets that it has set to evaluate its executives' pay. The company's revenues came above the company's billion

target and its pipeline development also exceeded expecta-

tions. The board of directors also thought that he ‘exceeded

all customer service metrics and supply chain reliability

targets’. But aside from the business metrics, the compa-

ny’s performance fell short in the ‘human capital’ category,

leading to a 73% payout against that goal. This dimension

focuses on employee engagement and retention by taking account of quarterly employee surveys and voluntary

attrition rate.

Consider another pharmaceutical company Sanofi. Its CEO Paul Hudson saw his pay dropping 3.7% to €10.98

million in 2021. As Liu (2022b) explains, of the many targets that Sanofi had set for Mr Hudson, only ‘growth in key

assets’ as part of the financial objectives was marked as below target because of vaccines. In that dimension, the

company witnessed underperformance of the U.S. influenza vaccine and the vaccine business in China.

Source: Liu, A. (2022a) ‘Bristol Myers CEO Giovanni Caforio takes pay cut as 'human capital' metric drags down bonus’, 1 April (https://www.

fiercepharma.com/pharma/bristol-myers-ceo-caforio-takes-pay-cut-employee-metric-drags-down-bonus); Liu, A. (2022b) ‘Sanofi CEO Paul Hudson's 2021 pay dips no thanks to lagging vaccine sales in US, China’m 30 March (https://www.fiercepharma.com/pharma/sanofi-ceo-paul-hudsons-

2021-pay-dips-amid-lagging-vaccine-efforts).

Alternative definitions of investment

We use the different definitions of investment that companies use to illustrate step 2 when design-

ing accounting-based performance measures. Definitions include the following:

1 *Total assets available* – includes all business assets, regardless of their particular purpose.

2 *Total assets employed* – defined as total assets available minus idle assets and minus assets pur-

chased for future expansion. For example, if the La Rochelle hotel in Exhibit 19.1 has unused

land set aside for potential expansion, the total assets employed by the hotel would exclude

the cost of that land.

3 *Working capital (current assets minus current liabilities) plus long-term assets* – this definition

excludes that portion of current assets financed by short-term creditors.

4 *Shareholders' equity* – use of this definition for each individual hotel in Exhibit 19.1 requires

allocation of the long-term liabilities of Hôtels Desfleurs to the three hotels, which would then

be deducted from the total assets of each hotel.

Most companies that employ ROI, residual income or EVA® for performance measurement use

either total assets available or working capital plus long-term assets as the definition of invest-

ment. However, when top management directs a division manager to carry extra assets, total

assets employed can be more informative than total assets available. The most common rationale

for using working capital plus long-term assets is that the division manager often influences deci-

sions on the short-term debt of the division.

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Alternative performance measures

To illustrate step 3 in the design of accounting-based performance measures, consider different

ways to measure assets included in the investment calculations. Should they be measured at his-

torical cost or at current cost? Should gross book value or net book value be used for depreciable

assets? We now examine these issues.

Current cost

Current cost is the cost of purchasing an asset today identical to the one currently held. It is the

cost of purchasing the services provided by that asset if an identical asset cannot currently be

purchased. Of course, measuring assets at current costs will result in different ROIs compared

with the ROIs calculated based on historical costs.

We illustrate the current-cost ROI calculations using the Hôtels Desfleurs example (see

Exhibit 19.1) and then compare ROIs based on current and historical costs. Assume the following

information about the long-term assets of each hotel:

Vaison

Perpignan

La Rochelle

Age of facility (at end of 2023)

8 years

4 years

2 years

Gross book value

€1 400 000

€2 100 000

€2 800 000

Total depreciation

€800 000

€600 000

€400 000

Net book value (at end of 2023)

€600 000

€1 500 000

€2 400 000

Depreciation for 2023

€100 000

€150 000

€200 000

Hôtels Desfleurs assumes a 14-year estimated useful life, assumes no terminal disposal price

for the physical facilities and calculates depreciation on a straight-line basis.

An index of construction costs for the eight-year period that Hôtels Desfleurs has been oper-

ating is as follows:

Year

2016

2017

2018

2019

2020

2021

2022

2023

Construction

110

122

136

144

152

160

174

180

cost index

Earlier in this chapter, we calculated an ROI of 24% for Vaison, 15% for Perpignan and 17% for

La Rochelle. One possible explanation of the high ROI for Vaison is that this hotel's long-term

assets are expressed in terms of 2014 construction price levels, and that the long-term assets for the

Perpignan and La Rochelle hotels are expressed in terms of the higher, more recent construction

price levels, which depress ROIs for these hotels.

Exhibit 19.4 illustrates a step-by-step approach for incorporating current-cost estimates for

long-term assets and depreciation into the ROI calculation. The aim is to approximate what it

would cost today to obtain assets that would produce the same expected operating profit that the

subunits currently earn. (Similar adjustments to represent current costs of capital employed and

depreciation can also be made in the residual income and EVA® calculations.) The current-cost

adjustment dramatically reduces the ROI of the Vaison hotel.

Historical-cost ROI

Current-cost ROI

Vaison

24%

10.81%

Perpignan

15%

11.05%

La Rochelle

17%

14.70%

Adjusting for current costs negates differences in the investment base caused solely by differences

in construction price levels. Consequently, compared to historical-cost ROI, current-cost ROI is

a better measure of the current economic returns from the investment. For example, current-cost

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ROI indicates that taking into account current construction price levels, investing in a new hotel

in Vaison will result in an ROI closer to 10.81% than to 24%. If Hôtels Desfleurs were to invest

in a new hotel today, investing in one like the La Rochelle hotel offers the best ROI.

A drawback of the current-cost method is that obtaining current-cost estimates for some assets

can be difficult. Why? Because the estimate requires a company to consider technological advances

when determining the current cost of assets needed to earn today's operating profit. (When a

specific cost index, such as the construction-cost index, is not available, companies use a general

index, such as the consumer price index, to approximate current costs.)

Exhibit 19.4

ROI for Hôtels Desfleurs computed using current-cost estimates as of the end

of 2023 for depreciation and long-term assets

Step 1: Restate long-term assets from gross book value at historical cost to gross book value at current cost as of the end of 2023.

Construction cost

Gross book value of long-term assets

Gross book value of long-term

index in 2023

=

×

at current cost at the end of 2023

assets at historical cost

Construction cost index

in year of construction

Vaison

€1400 000 × (180 ÷ 100) = €2 520 000

Perpignan

€2 100 000 × (180 ÷ 144) = €2 625 000

La Rochelle

€2 800 000 × (180 ÷ 160) = €3 150 000

Step 2: Derive the net book value of long-term assets at current cost as of the end of 2023. (The estimated useful

life of each hotel is 14 years.)

Gross book value of

Net book value of long-term assets at

Estimated useful life remaining

= long-term assets at current ×

current cost at the end of 2023

Estimated total useful life

cost at the end of 2023

Vaison

€2 520 000 × (6 ÷ 14) = €1080 000

Perpignan

€2 625 000 × (10 ÷ 14) = €1875 000

La Rochelle

€3 150 000 × (12 ÷ 14) = €2 700 000

Step 3: Compute the current cost of total assets at the end of 2023. (Assume that the current assets of each hotel

are expressed in 2023 euros.)

Net book value of long-term

Current cost of total assets

Current assets at the end of

=

+ assets at current cost at the

at the end of 2023

2023 (from Exhibit 19.1)

end of 2023 (from step 2)

Vaison

€400 000 + €1 080 000 = €1 480 000

Perpignan

€500 000 + €1 875 000 = €2 375 000

La Rochelle

€600 000 + €2 700 000 = €3 300 000

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Exhibit 19.4

continued

Step 4: Compute the current-cost depreciation expense in 2023 euros.

Gross book value of long-term assets

Current-cost depreciation = at current cost at theendof 2023 ×

1

expense in 2023 euros

Estimated total useful life

(from step 1)

Vaison

€2 520 000 × (1 ÷ 14) = €180 000

Perpignan

€2 625 000 × (1 ÷ 14) = €187 500

La Rochelle

€3 150 000 × (1 ÷ 14) = €225 000

Step 5: Compute 2023 operating profit using 2023 current-cost depreciation.

□□

□

□

Current-cost

□

□

□□

□

□

Operating profit for 2023 using

Historical-cost

□

□

depreciation expense

Historical-cost □

=

× □□

–

□

□

□

2023 current-cost depreciation

operating profit

□

□

in 2023 euros

depreciation □

□

□

□

□

□

□□

□□

(from step 4)

□□□

Vaison

€240 000 − (€180 000 − €100 000) = €160 000

Perpignan

€300 000 − (€187 500 − €150 000) = €262 500

La Rochelle

€510 000 − (€225 000 − €200 000) = €485 000

Step 6: Compute the ROI using current-cost estimates for long-term assets and depreciation.

ROI using current-

Operating profit for 2023 using 2023 current cost depreciation (from step 5)

=

cost estimates

Current cost of total assets at the end of 2023 (from step 3)

Vaison

€160 000 ÷ €1 480 000 = 10.81%

Perpignan

€262 500 ÷ €2 375 000 = 11.05%

La Rochelle

€485 000 ÷ €3 300 000 = 14.70%

Long-term assets: gross or net book value?

Because historical-cost investment measures are used often in practice, there has been much dis-

cussion about the relative merits of using gross book value (original cost) or net book value (orig-

inal cost minus depreciation). Using the data in Exhibit 19.1 and the accompanying text, the ROI

calculations using net book values and gross book values of plant and equipment are as follows:

Vaison

Perpignan

La Rochelle

ROI for 2023 using net book value

€240 000 = 24%

€300 000 = 15%

€510 000 = 17%

of total assets given in Exhibit 19.1 €1 000 000

€2 000 000

€3 000 000

and calculated earlier

ROI for 2023 using gross book value

€240 000 = 13.33% €300 000 = 11.54% €510 000 = 15%

of total assets obtained by adding €1 800 000

€2 600 000

€3 400 000

depreciation under ‘Current cost’

above to net book value of total

assets in Exhibit 19.1

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Using the gross book value, the ROI of the older Vaison hotel (13.33%) is lower than that of

the newer La Rochelle hotel (15%). Those who favour using gross book value claim that it enables

more accurate comparisons across subunits. For example, using gross book value calculations,

the return on the original plant and equipment investment is higher for the newer La Rochelle

hotel than for the older Vaison hotel. This probably reflects the decline in earning power of the

Vaison hotel. In contrast, using the net book value masks this decline in earning power because the

constantly decreasing base results in a higher ROI (24%); this higher rate may mislead decision

makers into thinking that the earning power of the Vaison hotel has not decreased.

The proponents of using net book value as a base maintain that it is less confusing because

(1) it is consistent with the total assets shown on the conventional balance sheet, and (2) it is

consistent with net profit computations that include deductions for depreciation. Surveys of

company practice report net book value to be the dominant asset measure used by companies in

their internal performance evaluations.

Choosing targeted levels of performance and timing of feedback

Choosing targets to compare performance

We next consider step 4 and the setting of targets to compare actual performance against. Recall

that historical-cost-based accounting measures are often inadequate for evaluating economic

returns on new investments and sometimes create disincentives for new expansion. Despite these

problems, historical-cost ROIs can be used to evaluate current performance by adjusting target

ROIs. Consider our Hôtels Desfleurs example. The key is to recognise that the hotels were built

at different times, which in turn means they were built at different levels of the construction-cost

index. Top management could adjust the target historical cost ROIs accordingly, perhaps setting

Vaison's ROI at 26%, Perpignan's at 18% and La Rochelle's at 19%.

Nevertheless, the alternative of comparing actual with target performance is frequently over-

looked in the literature. Critics of historical cost have indicated how high rates of return on old

assets may erroneously induce a manager not to replace assets. Regardless, the manager's mandate

is often 'Go forth and attain the budgeted results'. The budget, then, should be carefully nego-

tiated with full knowledge of historical-cost accounting pitfalls. *The desirability of tailoring a*

budget to a particular subunit and a particular accounting system cannot be overemphasised. For

example, many problems of asset valuation and profit measurement (whether based on historical

cost or current cost) can be satisfactorily solved if top management gets everybody to focus on

what is attainable in the forthcoming budget period – regardless of whether the financial measures

are based on historical costs or some other measure, such as current costs.

Top management often sets continuous improvement targets. Consider companies implement-

ing EVA®. These companies have generally found it cost-effective to use historical-cost net assets

rather than estimates of market or replacement values. Why? Because top management evaluates

operations on year-to-year changes in EVA®, not on absolute measures of EVA®. Evaluating per-

formance on the basis of *improvements* in EVA® makes the initial method of calculating EVA®

less important.

Timing of feedback

The fifth and final step in designing accounting-based performance measures is the timing of

feedback. Timing of feedback depends largely on how critical the information is for the success of

the organisation, the specific level of management that is receiving the feedback, and the sophisti-

cation of the organisation's information technology. For example, hotel managers responsible for

room sales will want information on the number of rooms sold each day on a daily or, at most,

weekly basis. Why? Because a large percentage of hotel costs are fixed costs, so that achieving high

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room sales and taking quick action to reverse any declining sales trends are critical to the financial

success of each hotel. Supplying managers with daily information about room sales would be

much easier if Hôtels Desfleurs had a computerised room reservation and check-in system. Senior

management, on the other hand, in their overseeing role may look at information about daily

room sales only on a monthly basis. In some instances, for example, because of concern about

the low sales to total assets ratio of the Perpignan hotel, they may want the information weekly.

Distinction between managers and organisational units1

As noted before in this and several earlier chapters, the performance evaluation of a manager

should be distinguished from the performance evaluation of an organisation subunit, such as a

division of a company. For example, historical-cost-based ROIs for a particular division can be

used to evaluate a manager's performance relative to a budget or over time, even though historical-

cost ROIs may be unsatisfactory for evaluating economic returns earned by the subunit. But

using historical-cost ROIs to compare the performance of managers of different subunits can

be misleading. Why? Because among other factors, one subunit's ROI may have been adversely

affected relative to another's because of legal, political and government regulations as well as

economic conditions over which certain subunit managers have no control.

Likewise, companies often put the most skilful division manager in charge of the weakest divi-

sion in an attempt to change its fortunes. Such an effort may take years to bear fruit. Furthermore,

the manager's efforts may result merely in bringing the division up to a minimum acceptable ROI.

The division may continue to be a poor profit performer in comparison with other divisions, but

it would be a mistake to conclude from the poor performance of the division that the manager is

necessarily performing poorly.

This section focuses on developing basic principles for evaluating the performance of a division

manager of an individual subunit. The concepts we discuss apply, however, to all organisation levels.

Later sections consider specific examples at the individual-activity level and the total-organisation

level. For specificity, we use the residual-income (RI) performance measure throughout.

The basic trade-off: creating incentives versus imposing risk

The performance evaluation of managers and employees often affects their compensation. Com-

pensation arrangements run the range from a flat salary with no direct performance-based bonus

(as in the case of some government officials) to rewards based only on performance (as in the case

of door-to-door salespeople). Most often, however, a manager's total compensation includes some

combination of salary and a performance-based bonus. An important consideration in designing

compensation arrangements is the trade-off between creating incentives and imposing risk. We

illustrate this trade-off in the context of our Hôtels Desfleurs example.

Antoinette Kessel owns the Hôtels Desfleurs chain of hotels. Joseph Saint-Exupéry manages the

Hôtels Desfleurs Vaison (HDV) hotel. Assume that Antoinette uses RI to measure performance.

To achieve good results as measured by RI, Antoinette would like Joseph to control costs,

provide prompt and courteous service and reduce receivables. But even if he did all those things,

good results are by no means guaranteed. HDV's RI is affected by many factors outside their

control, such as a recession in the Vaison economy, or recent floods that might negatively affect

HDV. Alternatively, non-controllable factors might have a positive influence on HDV's RI. Non-

controllable factors make HDV's profitability uncertain and risky.

Antoinette is an entrepreneur and does not mind bearing risk, but Joseph does not like being

subject to risk. One way of insuring Joseph against risk is to pay him a flat salary, regardless of

the actual amount of residual income attained. All the risk would then be borne by Antoinette.

1The presentations here draw (in part) from teaching notes prepared by S. Huddart, N. Melumad and S. Reichelstein.

Distinction between managers and organisational units

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There is a problem here, however, because the effort that Joseph puts in is difficult to monitor

and the absence of performance-based compensation will provide him with no incentive to work

harder or undertake extra physical and mental effort beyond what is necessary to retain his job

or to uphold his own personal values.

Moral hazard describes contexts in which an employee prefers to exert less effort (or report dis-

torted information) than the effort (or information) desired by the owner because the employee's

effort (or information) cannot be accurately monitored and enforced. In some repetitive jobs – for

example, in electronic assembly – a supervisor can monitor the workers' actions and the moral

hazard problem may not arise. However, the manager's job is often to gather information and

exercise judgement on the basis of the information obtained and monitoring a manager's effort

is thus considerably more difficult.

The term *moral hazard* originated in insurance contracts to represent situations where insur-

ance coverage caused insured parties to take less care of their properties than they might other-

wise. One response to moral hazard in insurance contracts is the system of deductibles (that is,

the insured pays for damages below a specified amount). For a fuller discussion of principal–agent

contract issues, see Baiman (2006).

Paying no salary and rewarding Joseph *only* on the basis of some performance measure – RI,

in our example – raises different concerns. He would now be motivated to strive to increase RI

because his rewards would increase with increases in RI. But compensating Joseph on RI also

subjects him to risk. Why? Because HDV's RI depends not only on Joseph's effort, but also on

random factors such as the local economy over which he has no control.

To compensate Joseph (who does not like being subject to risk) for taking on uncontrollable

risk, Antoinette must pay him some extra compensation within the structure of the RI-based

arrangement. Thus, using performance-based incentives will cost Antoinette more money, *on*

average, than paying Joseph a flat salary. Why 'on average'? Because her compensation payment

to Joseph will vary with RI outcomes. When averaged over these outcomes, the RI-based

compensation will cost Antoinette more than would paying Joseph a flat salary. The motivation

for having some salary and some performance-based bonus in compensation arrangements is

to balance the benefits of incentives against the extra costs of imposing uncontrollable risk on

the manager.

Intensity of incentives and financial and non-financial measurements

What dictates the intensity of the incentives? That is, how large should the incentive component

be relative to salary? A key question is: How well does the performance measure capture the

manager's ability to influence the desired results?

Measures of performance that are preferred change significantly with the manager's perfor-

mance and not very much with changes in factors that are beyond the manager's control. Conse-

quently, superior performance measures motivate the manager but limit the manager's exposure

to uncontrollable risk and hence reduce the cost of providing incentives to get the manager to

accept the incentive programme. On the other hand, measures of performance are inferior if they

fail to capture the manager's performance and fail to induce managers to improve. When owners

have superior performance measures available to them, they place greater reliance on incentive

compensation.

Suppose Joseph has no authority to determine investments. Further suppose revenue is

determined largely by external factors such as the local economy. His actions influence only

costs. Using RI as a performance measure in these circumstances subjects Joseph's bonus to

excessive risk because two components of the performance measure (investments and revenues)

are unrelated to his actions. The management accountant might suggest that, to create stronger

incentives, Antoinette should consider using a different performance measure for Joseph –

perhaps HDV's costs – that more closely captures his effort. Note that, in this case, RI may

be a perfectly good measure of the economic viability of HDV, but it is not a good measure of

Joseph's performance.

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The benefits of tying performance measures more closely to a manager's efforts encourage

the use of non-financial measures. Consider two possible measures for evaluating the manager

of the Housekeeping Department at one of Desfleurs' hotels – the costs of the Housekeeping

Department and the average time taken by the housekeeping staff to clean a room. Suppose house-

keeping costs are affected by factors such as wage rates, which the housekeeping manager does

not determine. In this case, the average time taken to clean a room may more precisely capture

the manager's performance.

The salary component of compensation dominates in the absence of good measures of per-

formance (as in the case of some corporate staff and government officials). This is not to say,

however, that incentives are completely absent; promotions and salary increases do depend on

some overall measure of performance, but the incentives are less direct. Employers give stronger

incentives when superior measures of performance are available to them and when monitoring

the employee's effort is very difficult (estate agencies, for example, reward employees mainly on

commissions on houses sold).

Benchmarks and relative performance evaluation

Owners can use *benchmarks* to evaluate performance. Benchmarks representing best practice may

be available inside or outside the overall organisation. In our Hôtels Desfleurs example, bench-

marks could be other similar hotels, either within or outside the Hôtels Desfleurs chain. Suppose

Joseph has authority over revenues, costs and investments. In evaluating his performance, Antoi-

nette would want to use, as a benchmark, a hotel of a similar size that is influenced by the same

uncontrollable factors – for example, location, demographic trends and economic conditions –

that affect HDV. *Differences* in performances of the two hotels occur only because of differences in

the two managers' performances, not because of random factors. Thus, benchmarking, also called

relative performance evaluation, 'filters out' the effects of the common non-controllable factors.

Concepts in action

Performance measurement at Unilever

Managers and boards of directors are often pushed to focus intently on a single measure of success, such as share-

holder value or profit, and then do everything they can to maximise it. As a result, they can overlook other important

measures, which can do long-term damage to a company. Unilever, the Anglo-Dutch manufacturer of Axe body

spray and Lipton tea, has taken a different approach under chief executive officer Paul Polman. On Polman's first day

as CEO, Unilever did away with earnings guidance and quarterly reporting in order to refocus the company's metrics

on the long-term needs of a full range of stakeholders. And in 2012, Unilever launched an ambitious plan to double

revenue by 2020 while halving the company's environmental impact. Dubbed the Unilever Sustainable Living Plan,

the company is working to decouple financial growth from its impact on the environment and global health. Unilever's

ambitious goals include improving financial performance while slashing its environmental footprint by 50%, sourcing

100% of its raw materials sustainably, and helping more than a billion people improve their health and well-being.

Assessing the impact of its commitment means Unilever not only measures success based on its financial performance

– including annual revenue, year-over-year revenue growth, and operating margin – but also how many calories it

cuts from its ice cream products and how much of its energy use is derived from renewable sources. Initially, investors

took a dim view of Unilever's shift in perspective, punishing the stock price. But it quickly rebounded, after analysts

and shareholders accepted Polman's wider lens. When Polman retired at the end of 2018, the company had more

than 160,000 employees worldwide, had annual revenue of €51 billion, and delivered a total shareholder return of

290% during his tenure.

Source: Kenny, G (2015) 'The false promise of the single metric', *Harvard Business Review*, 26 August, (https://hbr.org/2015/08/the-false-promise-of-the-

single-metric); Ignatius, A. (2012) 'Captain Planet', *Harvard Business Review*, June (https://hbr.org/2012/06/captain-planet); Ruddick, G. (2016) 'Unilever

CEO Paul Polman – the optimistic pessimist,' *The Guardian,* 25 January (https://www.theguardian.com/business/2016/jan/25/unilever-ceo-paul-polman-

the-optimistic-pessimist); Boynton A. and Barchan, M. (2015) 'Unilever's Paul Polman: CEOs can't be 'slaves' to shareholders', Forbes, 20 July (https://www.

forbes.com/sites/andyboynton/2015/07/20/unilevers-paul-polman-ceos-cant-be-slaves-to-shareholders/#33e41372561e); Unilever PLC press release (2018) 'Unilever CEO Announcement: Paul Polman to Retire; Alan Jope Appointed as Successor', London, United Kingdom/Rotterdam, Netherlands, 29

November (https://www.unilever.com/news/press-releases/2018/unilever-ceo-announcement.html).

Benchmarking is important in this light, but the element of surprise has recently been found to

motivate people at work. Consider the experiment run by Professor Hayagreeva Rao at Stanford

University. In one study he provides three groups of people with puzzles to solve. The first group

received $1 immediately after solving a puzzle. The second knew they would get $1 for solving

each puzzle but did not know when. The third group knew only that its members would be ran-

domly rewarded – they completed most of the puzzles. Rao reports: ‘It’s the element of surprise,

not the size of the award that really moves people.’

Can the performance of two managers responsible for running similar operations within a

company be benchmarked against one another? Yes, but one problem is that the use of these

benchmarks may reduce incentives for these managers to help one another. That is, a manager’s

performance evaluation measure improves either by doing a better job or by making the other

manager look bad. Not working together as a team is not in the best interests of the organi-

sation as a whole. In this case, using benchmarks for performance evaluation can lead to *goal*

incongruence.

Performance measures at the individual activity level

This section focuses on incentive issues that arise in the context of individual activities. The principles described here, however, can be applied at all levels of the organisation.

Performing multiple tasks

Most employees perform more than one task as part of their job. Marketing representatives sell products, provide customer support and gather market information. Other jobs have multiple aspects to them. Manufacturing workers, for example, are responsible for both the quantity and quality of their products. Employers want employees to allocate their time and effort intelligently among various tasks or aspects of their jobs.

Consider, for example, garage mechanics. Their jobs have at least two distinct and important aspects. The first aspect is the repair work. Performing more repair work would generate more revenues for the workshop. The second aspect is customer satisfaction. The higher the quality of the job, the more likely the customer will be pleased. If the employer wants an employee to focus on both these aspects, then the employer must measure and compensate performance on both.

Suppose the employer can easily measure the quantity of repairs but not their quality. If the

employer rewards workers on a piece-rate system – which pays workers only on the basis of the

number of repairs performed – mechanics will probably increase the number of repairs they make

at the expense of quality. Some companies experience this problem when they introduce by-the-

job rates for their mechanics. The following steps might be taken to motivate workers to balance

both quantity and quality:

1 Management can drop the piece-rate system and pay mechanics an hourly wage, a step that

de-emphasises the quantity of repair. Mechanics' promotions and pay increases can be deter-

mined on the basis of management's assessment of each mechanic's overall performance

regarding quantity and quality of repairs.

2 Management can evaluate employees, in part, using data such as customer-satisfaction surveys,

the number of dissatisfied customers or the number of customer complaints.

3 Management can also employ independent staff to randomly monitor whether the repairs

performed are of high quality.

Note that non-financial measures (such as customer-satisfaction measures) can play a central

role in motivating the mechanics to emphasise both quantity and quality. The goal is to measure

both aspects of the mechanics' jobs and to balance incentives so that both aspects are properly

emphasised.

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Environmental and ethical responsibilities

Managers in all organisations shoulder environmental and ethical responsibilities. Environmental

violations (such as water and air pollution) and unethical and illegal practices (such as bribery and

corruption) carry heavy fines and are prison offences under the laws of many European countries.

But environmental responsibilities and ethical conduct extend beyond legal requirements.

Socially responsible companies set stringent environmental targets and measure and report

their performance against them. German, Swiss, Dutch and Scandinavian companies report on

environmental performance as part of a larger set of social responsibility disclosures (which

include employee welfare and community development information). Some companies make envi-

ronmental performance a line item on every employee's salary appraisal sheet.

The UN Secretary General António Guterres noted in August 2021 that the climate projections

from the Intergovernmental Panel on Climate Change (IPCC) point to 'a code red for humanity.'

The report was published as climate crises were more and more evident including floods, uncon-

trollable fires and extreme heat being experienced in different parts of the world. The projections

suggest that environmental disasters will soon be far more common – and far more severe. The con-

cern with climate change is of paramount importance to organisations. Socially responsible com-

panies will stress not just shareholder returns but refocus their business premise on positive social

change and community impact. Many companies are embracing a wider corporate agenda such

that organisational activities embed actions that have wider outcomes than just increasing profit.

There is a recognition that corporates must address pressing environmental issues and social

concerns. They go beyond treating corporate social responsibility initiatives as a side activity

and instead, integrate these into the way in which they seek to create value. Socially responsible

activities will always be contextual and look different for different organisations. Initiatives can

include a mix of charitable funding, workplace condition improvements, more extensive social

benefits such as health care, diversity of workforce, consumer and community wellbeing and

certainly environmental damage reduction.

More and more firms are seeking to become more sustainable in their practices which is a

subset of the adoption of ESGs – or Environmental, Social, and Governance standards. ESG

is sometimes misinterpreted as being of principal concern to investors. But in fact, it concerns

stakeholders like customers, suppliers, employees among others. It can be viewed as enabling the

organisation to manage risks and opportunities related to environmental, social and governance

criteria but ESG priorities cannot be the sole domain of shareholders or investors (Peterdy, 2022).

The Deloitte 2022 CxO Sustainability Report indicated that of the over 2000 corporate leaders

from across 21 countries who were surveyed, two thirds stated that their organisations are using

more sustainable materials and increasing the efficiency of energy use. More than 50% have

adopted energy-efficient or climate-friendly machinery, technologies, and equipment.

The celebrated economist Milton Friedman had vehemently argued against spending sharehold-

er's money for anything that does not relate to increasing shareholder wealth. He won the Nobel

prize for his theorising but many today believe he was wrong to think that the idea of corporate

social responsibility was a 'fundamentally subversive doctrine in a free society' (Otten, 2017). The

rationale is that 'in doing business responsibly, companies can do good while also reaping positive

financial externalities' (Li, 2020).

Ethical behaviour on the part of managers is paramount. In particular, the numbers that sub-

unit managers report should not be tainted by 'cooking the books' – they should be uncontami-

nated by, for example, padded assets, understated liabilities, fictitious sales and understated costs.

It is clear that 'Not one single country, anywhere in the world, is corruption-free; 68% of the

countries worldwide have a serious corruption problem', according to the global corruption watch-

dog Transparency International (www.transparency.org/). Many of the world's largest organisations have had to face charges of engaging in corrupt business practices. Such companies include

Samsung, VW, Daimler, Uber, Johnson and Johnson and Alcatel-Lucent, among many others.

Penalties can be steep. Daimler faced a fine of $185 billion in a bribery scandal; Siemens had to pay

fines of $1.6 billion to the American and German governments. Volkswagen's fines to the US relating

to illegal emission-controlling software in vehicles exceeded $20 billion and amounted to $1.18 bil-

lion payable to German authorities. Many companies have an excellent anti-corruption reputation,

including Reebok, Novo Nordisk, Tata and Ikea among others. Companies adopting explicit codes

of conduct on corruption recognise that 'grease' is not an efficient way of doing business.

Codes of business conduct are circulated in some organisations to signal appropriate and

inappropriate individual behaviour. Division managers often cite enormous top-management

pressures ‘to make the budget’ as excuses or rationalisations for not adhering to ethical account-

ing policies and procedures. A healthy amount of motivational pressure is not bad – as long

as the ‘tone from the top’ simultaneously communicates the absolute need for all managers to

behave ethically at all times. Management should promptly and severely reprimand unethical con-

duct irrespective of the benefits that accrue to the company from such actions. Some companies

emphasise ethical behaviour by routinely evaluating employees against a business code of ethics.

Strategy and levers of control

Given the management accounting focus of this book, this chapter has emphasised the role of

quantitative financial and non-financial performance – evaluation measures that companies use

to implement their strategies. These measures – such as ROI, RI, EVA, customer satisfaction

and employee satisfaction – monitor critical performance variables that help managers track

progress towards achieving a company’s strategic goals. Because these measures help diagnose

whether a company is performing to expectations, they are collectively called diagnostic control

systems. Companies motivate managers to achieve these goals by holding managers accountable

for, and by rewarding them for, meeting these goals. The concern, however, is that the pressure to

perform may cause managers to cut corners and misreport numbers to make their performance

look better than it is, as happened at companies such as Enron, UBS, Satyam, Valient Pharma-

ceuticals, Toshiba, Autonomy, Panasonic and Satyam among others. Some companies fall foul of

other regulatory measures. For instance, the General Data Protection Regulation (GDPR) represents

a determination of the European Union legislators to unify data protection policies and laws

throughout the European economic zone and enforce it with heavy penalties. Still in 2021, there

was a 113% increase in both the number of GDPR fines issued so far and the individual amount

of fines. Amazon was fined €746 million, WhatsApp €225 million, British Airways €26.5 million

(GDPR Blog, 1 February 2022). To avoid unethical behaviour, companies need to balance the push

for performance resulting from diagnostic control systems, the first of four levers of control, with

three other levers: *boundary systems, belief systems* and *interactive control systems*.

Boundary systems describe standards of behaviour and codes of conduct expected of all

employees, especially action that are off-limits. Ethical behaviour on the part of managers is par-

amount. In particular, numbers that subunit managers' report should not be tainted by 'cooking

the books'. They should be free of, for example, overstated assets, understated liabilities, fictitious

revenues and understated costs.

Codes of practice conduct signal appropriate and inappropriate individual behaviours. The

following is from Daimler's Integrity Code:

'The foundation of our work at Daimler is built on our four corporate values: respect, passion,

discipline and integrity. We show respect for our employees, customers and business partners. Our

passion enables us to do our best every day; it is the basis of our success. For us, discipline means

taking on challenges and achieving our goals while taking various interests into account. Our

integrity makes us successful over the long term and contributes to a functioning society. These

values lay the foundation for the corporate values at all our Group companies' (Mercedes-Benz

Group AG, 2022).

Division managers often cite enormous pressure from top management ‘to make the budget’

as excuses or rationalisations for not adhering to ethical accounting policies and procedures. A

healthy amount of motivational pressure is desirable, as long as the ‘tone from the top’ and the

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code of conduct simultaneously communicate the absolute need for all managers to behave ethi-

cally at all times. Managers should train employees to behave ethically. They should promptly and

severely reprimand unethical conduct, regardless of the benefits that might accrue to the company

from unethical actions. Many organisations set explicit boundaries precluding actions that harm

the environment. Environmental violations (such as water and air pollution) carry heavy fines

and are prison offences under the laws of many nations. In many companies, environmental

responsibilities extend beyond legal requirements.

Socially responsible companies, such as BP and Unilever, set aggressive environmental goals and

measure and report their performance against them. German, Swiss, Dutch and Scandanavian

companies report on environmental performance as part of a larger set of social responsibility dis-

closures (such as employee welfare and community development activities). Some companies, such

as Dutch financial services giant ING incorporates social, ethical, and environmental objectives

as part of its top management's pay structure. Other firms in the Netherlands – including chem-

ical company Akzo Nobel, life sciences group DSM and mail operator TNT – also tie executive

compensation to environmental improvement. HSBC in its 'Ethical and Environmental Code of

Conduct for Suppliers of Goods and Services' (HSBC, 2020) states that 'At all times, our goal is

to work collaboratively with our supply chain partners on sustainability. In those cases where a

supplier or one of its subcontractors is found to not be in compliance with this Code, HSBC will

work with the supplier on an improvement plan. If the supplier continues to be not in compliance

with this Code, HSBC will take steps to review the terms of the contract, including reduction in

the order and exiting of the relationship'.

Belief systems articulate the mission, purpose and core values of a company. They describe the

accepted norms and patterns of behaviour expected of all managers and employees with respect to

each other, shareholders, customers and communities. Volkswagen's code of ethics does help the

company in meeting the company's social responsibility. 'It's about making life better for every-

one, not just a few.' From individuals to communities, environment to enterprise, Volkswagen's

credo is intended to inspire all managers and other employees to do their best. Belief systems play

to employees' intrinsic motivations.

Intrinsic motivation is the desire to achieve self-satisfaction from good performance regard-

less of external rewards such as bonuses or promotion. Intrinsic motivation comes from being

given greater responsibility, doing interesting and creative work, having pride in doing that work,

establishing commitment to the organisation, and developing personal bonds with co-workers.

High intrinsic motivation enhances performance because managers and worker have a sense of

achievement in doing something important, feel satisfied with their jobs, and see opportunities

for personal growth.

Interactive control systems are formal information systems that managers use to focus organ-

isation attention and learning on key strategic issues. An excessive focus on diagnostic control

systems and critical performance variables can cause an organisation to ignore emerging threats

and opportunities – changes in technology, customer preferences, regulations and industry com-

petition that can undercut a business.

Interactive control systems track strategic uncertainties that businesses face, such as the emer-

gence of digital imaging in the case of Kodak and Fujifilm, cryptocurrencies in the case of fiat

money and, and the shift in customer preferences towards the metaverse and in the case of Teams

and Zoom. The result is ongoing discussion and debate about assumptions and action plans. New

strategies emerge from the dialogue and debate surrounding the interactive process. Interactive

control systems force busy managers to step back from the actions needed to manage the business

today and to shift their focus forward to positioning the organisation for the opportunities and

threats of tomorrow.

Measuring and rewarding managers for achieving critical performance variables is an impor-

tant driver of corporate performance. But these diagnostic control systems must be counterbal-

anced by the other levers of control – boundary systems, belief systems and interactive control

systems – to ensure that proper business ethics, inspirational values and attention to future threats

and opportunities are not sacrificed while achieving business results.

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References and further reading

Summary

The following points are linked to the chapter's learning objectives.

1 Financial measures such as return on investment and residual income can capture important aspects of both

manager performance and organisation-subunit performance. In many cases, however, financial measures are

supplemented with non-financial measures of performance, such as those relating to customer-service time,

number of defects and productivity.

2 The DuPont method describes return on investment (ROI) as the product of two components: revenues divided

by investment and income divided by revenues. ROI can be increased in three ways: increase revenues, decrease

costs and decrease investment.

3 Residual income is income minus a required monetary return on the investment. Residual income was designed

to overcome some of the limitations of ROI. For example, residual income is more likely than ROI to promote

goal congruence. That is, actions that are in the best interests of the organisation maximise residual income. The

objective of maximising ROI, conversely, may induce managers of highly profitable divisions to reject projects that,

from the viewpoint of the organisation as a whole, should be accepted.

4 Economic value added (EVA®) is a variation of the residual-income calculation. It equals the after-tax operating

profit minus the after-tax weighted-average cost of capital multiplied by total assets minus current liabilities.

5 The current cost of an asset is the cost now of purchasing an identical asset to the one currently held. Historical-cost

asset measurement methods consider the original cost of the asset net of total depreciation.

6 Organisations create incentives by rewarding managers on the basis of performance. But managers may face risks

because random factors beyond their control may also affect performance. Owners choose a mix of salary and

incentive compensation to trade-off the incentive benefit against the cost of imposing risk.

7 Obtaining measures of employee performance that are superior is critical for implementing strong incentives.

Many management accounting practices, such as the design of responsibility centres and the establishment of

financial and non-financial measures, have as their goal better performance evaluation.

8 Most employees perform multiple tasks as part of their jobs. In some situations, one aspect of a job is easily

measured (for example, the quantity of work done), while another aspect is not (for example, the quality of work

done). Creating incentives to promote the aspect of the job that is easily measured (quantity) may cause workers

to ignore an aspect of their job that is more difficult to measure (quality).

9 Implementing the four levers of control can assist a company to achieve its pursued performance, engage in ethical

behaviour, inspire its employees and to act proactively in the face of strategic threats and opportunities.

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CHAPTER 19

Assessment material

Review questions

19.1 What factors affecting ROI does the DuPont method highlight?

19.2 'Residual income is not identical to ROI although both measures incorporate profit and invest-

ment into their computations.' Do you agree? Explain.

19.3 Describe economic value added (EVA®).

19.4 Give three definitions of investment used in practice when computing ROI.

19.5 Distinguish between measuring assets based on current cost and historical cost.

19.6 Why is it important to distinguish between the performance of a manager and the performance

of the organisation subunit for which the manager is responsible? Give examples.

19.7 Describe moral hazard.

19.8 'Managers should be rewarded only on the basis of their performance measures. They should be

paid no salary.' Do you agree? Explain.

19.9 Explain the management accountant's role in helping organisations design stronger incentive

systems for their employees.

19.10 Explain the role of benchmarking in evaluating managers.

Exercises

Basic level

19.11 ROI and residual profit (10–15 minutes)

Récré-Gaules SARL produces and distributes a wide variety of recreational products. One of

its divisions, the Idefix Division, manufactures and sells 'menhirs', which are very popular with

cross-country skiers. The demand for these menhirs is relatively insensitive to price changes. The

Idefix Division is considered to be an investment centre and in recent years has averaged a return

on investment of 20%. The following data are available for the Idefix Division and its product:

Total annual fixed costs

€1 000 000

Variable costs per menhir

€300

Average number of menhirs sold each year

10 000

Average operating assets invested in the division

€1 600 000

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Required

1 What is the minimum selling price per unit that the Idefix Division could charge in order for

Marie-Aimée Obelix, the division manager, to get a favourable performance rating? Manage-

ment considers an ROI below 20% to be unfavourable.

2 Assume that Récré-Gaules judges the performance of its investment centre managers on the

basis of residual income rather than ROI, as was assumed in requirement 1. The company's

required rate of return is considered to be 15%. What is the minimum selling price per unit

that the Idefix Division should charge for Obelix to receive a favourable performance rating?

19.12 Pricing and return on investment (30 minutes)

Salvador SA assembles motorcycles and uses long-run (defined as 3–5 years) average demand to

set the budgeted production level and costs for pricing. Prices are then adjusted only for large

changes in assembly wage rates or direct materials prices. You are given the following data:

Direct materials, assembly wages and other variable costs

€1320 per unit

Fixed costs

€300 000 000 per year

Target return on investment

20%

Normal utilisation of capacity (average output)

1 000 000 units

Investment (total assets)

€900 000 000

Required

1 What operating profit percentage on revenues is needed to attain the target return on invest-

ment of 20%? What is the selling price per unit?

2 Using the selling price per unit calculated in requirement 1, what rate of return on investment

will be earned if Salvador assembles and sells 1 500 000 units? 500 000 units?

3 The company has a management bonus plan based on yearly division performance. Assume

that Salvador assembled and sold 1 000 000 units, 1 500 000 units and 500 000 units in three

successive years. Each of three people served as divisional manager for one year before being

killed in a car accident. As the principal heir of the third manager, comment on the bonus plan.

***19.13 Residual income, economic value added (EVA®)** (25 minutes)

Intervilles SA operates two divisions, a Lorry Rental Division that rents to individuals and a

Transportation Division that transports goods from one city to another. Results reported for the

last year are as follows:

Lorry Rental

Transportation

Division

Division

Total assets

€650 000

€950 000

Current liabilities

120 000

200 000

Operating profit before tax

75 000

160 000

Required

1 Calculate the residual income for each division using operating profit before tax and investment

equal to total assets minus current liabilities. The required rate of return on investments is 12%.

2 The company has two sources of funds: long-term debt with a market value of €900 000 at an

interest rate of 10% and equity capital with a market value of €600 000 at a cost of equity of

15%. Intervilles' income tax rate is 40%. Intervilles applies the same weighted-average cost of

capital to both divisions, since each division faces similar risks. Calculate the economic value

added (EVA®) for each division.

3 Using your answers to requirements 1 and 2, what would you conclude about the performance

of each division? Explain briefly.

19.14 Ethics, manager's performance evaluation (25 minutes)

Serra-Mica Srl is a maker of ceramic coffee cups. It imprints company logos and other sayings on

the cups for both commercial and wholesale markets. The firm has the capacity to produce 3 000 000

cups per year, but the recession has cut production and sales last year to 1 500 000 cups. The summary

operating statement for 2022 was as follows:

Sales (1 500 000 × €2)

€3 000 000

Cost of goods sold

2 700 000

Gross profit

300 000

Marketing, distribution and administration costs (fixed)

400 000

Operating profit

€(100 000)

Cost of goods sold consists of variable costs of €750 000 (or €0.50 per cup) and fixed costs of €1

950 000 (or €1.30 per cup). There was no opening and no closing stock of finished goods in 2022.

Concerned about the loss, the board of directors hired a new CEO, Antonio Pirelli, and offered

him an incentive-based compensation contract rather than the fixed-salary contract of the pre-

vious CEO. Pirelli's contract paid €50 000 per year in salary plus a 15% bonus on the firm's

operating profits (if any) before deducting the bonus. Operating profits are calculated using full

absorption costing – that is, fixed manufacturing costs per unit manufactured are inventoried and

expensed only when the goods are sold.

Pirelli took the following actions for 2023:

a Increased production to 2 500 000 cups.

b Increased sales to 1 800 000 cups.

c Increased marketing, distribution and administration costs to €650 000. (Pirelli's salary of

€50 000 is included in these costs.)

The selling price per cup in 2023 of €2, the variable manufacturing costs per cup of €0.50 and

total fixed manufacturing costs of €1 950 000 were all unchanged from 2022.

At the end of 2023, Pirelli met with the board of directors and announced that he had accepted

another job. He noted that he had put Serra-Mica successfully on track and thanked the board

for the opportunity. His new job was to turn around another struggling company.

Required

1 Calculate Pirelli's bonus for 2023.

2 Evaluate Pirelli's performance. Did he do as good a job as the numbers in requirement 1 sug-

gest? Explain.

3 Did Pirelli behave ethically? Explain your answer.

Intermediate level

***19.15 Return on investment; comparisons of three companies** (CMA, adapted) (30 minutes)

Return on investment is often expressed as follows:

Income

= Revenues × Income

Investment

Investment

Revenues

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Required

1 What advantages are there in the breakdown of the computation into two separate components?

2 Fill in the following blanks:

Companies in same industry

A

B

C

Revenue

€1 000 000

€500 000

?

Profit

€100 000

€50 000

?

Investment

€500 000

?

€5 000 000

Profit as % of revenue

?

?

0.5%

Investment turnover

?

?

2

Return on investment

?

1%

?

After filling in the blanks, comment on the relative performance of these companies as thoroughly

as the data permit.

19.16 Financial and non-financial performance measures, goal congruence (CMA, adapted)

(25 minutes)

Thor-Equip AS specialises in the manufacture of medical equipment, a field that has become

increasingly competitive. Approximately two years ago, Knut Solbær, president of Thor-Equip,

decided to revise the bonus plan (based, at the time, entirely on operating profit) to encourage

divisional managers to focus on areas that were important to customers and that added value

without increasing cost. In addition to a profitability incentive, the revised plan also includes

incentives for reduced rework costs, reduced sales returns and on-time deliveries. Bonuses are

calculated and awarded semi-annually on the following basis. A base bonus is calculated at 2%

of operating profit. The bonus amount is then adjusted by the following amounts:

a (i) Reduced by excess of rework costs over 2% of operating profit.

(ii) No adjustment if rework costs are less than or equal to 2% of operating profit.

b Increased by €5000 if over 98% of deliveries are on time, by €2000 if 96–98% of deliveries are

on time and by €0 if on-time deliveries are below 96%.

c (i) Increased by €3000 if sales returns are less than or equal to 1.5% of sales.

(ii) Decreased by 50% of excess of sales returns over 1.5% of sales.

Note: If the calculation of the bonus results in a negative amount for a particular period, the

manager simply receives no bonus and the negative amount is not carried forward to the

next period.

Results for Thor-Equip's Kari and Siri Divisions for the year 2022 , the first year under the new

bonus plan, follow. In the previous year, 2017, under the old bonus plan, the Kari Division man-

ager earned a bonus of €27 060 and the Siri Division manager a bonus of €22 440.

Kari Division

Siri Division

1 January 2022

1 July 2022

1 July 2022

to

to

1 January 2022 to

to

30 June 2022 31 December 2022

30 June 2022

31 December 2022

Sales

€4 200 000

€4 400 000

€2 850 000

€2 900 000

Operating profit

€462 000

€440 000

€342 000

€406 000

On-time delivery

95.4%

97.3%

98.2%

94.6%

Rework costs

€11 500

€11 000

€6000

€8000

Sales returns

€84 000

€70 000

€44 750

€42 500

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Exercises

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Required

1 Why did Knut need to introduce these new performance measures? That is, why does he need

to use these performance measures over and above the operating profit numbers for the period?

2 Calculate the bonus earned by each manager for each six-month period and for the year 2022.

3 What effect did the change in the bonus plan have on each manager's behaviour? Did the new

bonus plan achieve what he desired? What changes, if any, would you make to the new bonus plan?

Advanced level

19.17 Risk sharing, incentives, benchmarking, multiple tasks (20–30 minutes)

The Portimão Division of Amica Lda sells car batteries. Amica's corporate management gives

Portimão management considerable operating and investment autonomy in running the division.

Amica is considering how it should compensate Manuel Belem, the general manager of the

Portimão Division. Proposal 1 calls for paying him a fixed salary. Proposal 2 calls for paying him

no salary and compensating him only on the basis of the division's ROI (calculated based on

operating profit before any bonus payments). Proposal 3 calls for paying him some salary and

some bonus based on ROI. Assume that Manuel does not like bearing risk.

Required

1 a Evaluate each of the three proposals, specifying the advantages and disadvantages of each.

b Suppose that Amica competes against Tiara-Iberica SA in the car battery business. Tiara

is roughly the same size and operates in a business environment that is very similar to Por-

timão's. The senior management of Amica is considering evaluating Manuel on the basis of

Portimão's ROI minus Tiara's ROI. He complains that this approach is unfair because the

performance of another firm, over which he has no control, is included in his performance

evaluation measure. Is his complaint valid? Why or why not?

2 Now suppose that Manuel has no authority for making capital investment decisions. Corporate

management makes these decisions. Is return on investment a good performance measure to

use to evaluate him? Is return on investment a good measure to evaluate the economic viability

of the Portimão Division? Explain.

3 Portimão's salespersons are responsible for selling and providing customer service and support.

Sales are easy to measure. Although customer service is very important to Portimão in the long

run, it has not yet implemented customer-service measures. Manuel wants to compensate his

salesforce only on the basis of sales commissions paid for each unit of product sold. He cites

two advantages to this plan: (a) it creates very strong incentives for the salesforce to work hard,

and (b) the company pays salespersons only when the company itself is earning revenues and

has cash. Do you like his plan? Why or why not?

19.18 Relevant costs, performance evaluation, goal congruence (30 minutes)

Mikkeli Oy has three operating divisions. The managers of these divisions are evaluated on their

divisional operating profit, a figure that includes an allocation of corporate overhead *proportional*

to the revenues of each division. The operating profit statement (in thousands) for the first quarter

of 2023 is as follows:

Tampere Division

Oulu Division

Kotka Division

Total

Revenues

€2000

€1200

€1600

€4800

Cost of goods sold

1050

540

640

2230

Gross profit

950

660

960

2570

Division overhead

250

125

160

535

Corporate overhead

400

240

320

960

Divisional operating profit

€300

€295

€480

€1075

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The manager of the Tampere Division is unhappy that his profitability is about the same as the

Oulu Division's and is much less than the Kotka Division's, even though his revenues are much

higher than either of these other two divisions'. The manager knows that he is carrying one line of

products with very low profitability. He was going to replace this line of business as soon as more

profitable product opportunities became available, but he has kept it because the line is marginally

profitable and uses facilities that would otherwise be idle. That manager now realises, however,

that the sales from this product line are attracting a fair amount of corporate overhead because

of the allocation procedure and maybe the line is already unprofitable for him. This low- margin

line of products had the following characteristics for the most recent quarter (in thousands):

Revenues

€800

Cost of goods sold

600

Avoidable division overhead

100

Required

1 Prepare the operating profit statement for Mikkeli Oy for the second quarter of 2023. Assume

that revenues and operating results are identical to the first quarter except that the manager

of the Tampere Division has dropped the low-margin product line from his product group.

2 Is Mikkeli Oy better off from this action?

3 Is the Tampere Division manager better off from this action?

4 Suggest changes for Mikkeli's system of division reporting and evaluation that will motivate

division managers to make decisions that are in the best interest of Mikkeli Oy as a whole.

Discuss any potential disadvantages of your proposal.

***19.19 Evaluating managers, ROI, value-chain analysis of cost structure** (40–50 minutes)

User Friendly Computer is one of the largest personal computer companies in the world. The

board of directors was recently (March 2023) informed that User Friendly's president, Felix

Lechat, was resigning to ‘pursue other interests’. An executive search firm recommends that the

board consider appointing Peter Diamond (current CEO of Computer Power) or Rachida Kamel

(current CEO of Plum Computer). You collect the following financial information on Computer

Power and Plum Computer for 2021 and 2022 (in millions):

Computer Power

Plum Computer

2021

2022

2021

2022

Total assets

€360.0

€340.0

€160.0

€240.0

Revenues

€400.0

€320.0

€200.0

€350.0

Costs

R&D

36.0

16.8

18.0

43.5

Design

15.0

8.4

3.6

11.6

Production

102.0

112.0

82.8

98.6

Marketing

75.0

92.4

36.0

66.7

Distribution

27.0

22.4

18.0

23.2

Customer service

45.0

28.0

21.6

46.4

Total costs

300.0

280.0

180.0

290.0

Operating profit

€100.0

€40.0

€20.0

€60.0

In early 2023, a computer magazine gave Plum Computer's main product five stars (its highest

rating on a five-point scale). Computer Power's main product was given three stars, down from

five stars a year ago because of customer-service problems. The computer magazine also ran an

article on new-product introductions in the personal computer industry. Plum Computer received

high marks for new products in 2018. Computer Power's performance was called 'mediocre'. One

'unnamed insider' of Computer Power commented: 'Our new-product cupboard is empty.'

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Required

1 Use the DuPont method to analyse the ROI of Computer Power and Plum Computer in 2021

and 2022. Comment on the results.

2 Calculate the percentage of costs in each of the six business-function cost categories for Com-

puter Power and Plum Computer in 2021 and 2022. Comment on the results.

3 Rank Diamond and Kamel as potential candidates for CEO of User Friendly Computer.

19.20 ROI, residual income, investment decisions, division manager's compensation (CMA,

adapted) (50 minutes)

Faulkenheim GmbH is a manufacturer of tool and die machinery. Faulkenheim is a vertically

integrated company that is organised into two divisions. The Frankfurt Steel Division manufac-

tures alloy steel plates. The Tool and Die Machinery Division uses the alloy steel plates to make

machines. Faulkenheim operates each of its divisions as an investment centre.

Faulkenheim monitors its divisions on the basis of return on investment (ROI) with investment

defined as average operating assets employed. Faulkenheim uses ROI to determine management

bonuses. All investments in operating assets are expected to earn a minimum return of 11% before

income taxes. For many years, Frankfurt's ROI has ranged from 11.8% to 14.7%. During the fiscal

year ending 31 December 2022, Frankfurt contemplated a capital acquisition with an estimated

ROI of 11.5%; division management, however, decided against the investment because it believed

that the investment would decrease Frankfurt's overall ROI.

Frankfurt's 2022 operating income statement follows. The division's operating assets employed

were €15 750 000 at 31 December 2022, a 5% increase over the previous year-end balance.

Frankfurt Steel Division operating profit statement for

the year ending 31 December 2022

Revenue

€25 000 000

Cost of goods sold

16 500 000

Gross profit

8 500 000

Operating costs

Administrative

€3 955 000

Marketing

2 700 000

Total operating costs

6 655 000

Operating profit

€1 845 000

Required

1 Calculate the return on investment in average operating assets employed (ROI) for 2022 for the

Frankfurt Steel Division.

2 Calculate Frankfurt Steel Division's residual income on the basis of average operating assets

employed.

3 Would the management of Frankfurt Steel Division have been more likely to accept the invest-

ment opportunity it had in 2022 if residual income were used as a performance measure instead

of ROI? Explain.

4 Frank Weissmann, the Chairman of Faulkenheim GmbH is considering one of four alternative

ways to compensate division managers.

a Pay each division manager only a flat salary and no bonus.

b Make all of each division manager's compensation depend on division residual income.

c Make all of each division manager’s compensation depend on company-wide (Faulkenheim

GmbH) residual income rather than divisional residual income.

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d Use benchmarking and compensate each division manager on the basis of his or her own

division’s residual income minus the residual profit of the other division. Assume the two

divisions have comparable levels of investment and required rates of return.

Assume that division managers do not like bearing risk. Evaluate each of the four alternatives

Weissmann is considering, in the context of the structure and businesses of Faulkenheim

GmbH. Indicate the positive and negative features of each proposal.

5 What compensation arrangement would you recommend? Explain your answer briefly.

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PART IV

Case study problems

Case 401

BBR plc

Clive Emmanuel, University of Glasgow

This case highlights a transfer-pricing problem where divisional interests are pitted against total

corporate profitability. The case requires some analysis of the potential costs and benefits of a

transfer-pricing procedure based on divisional management negotiation.

‘BBR prides itself on being a growing, prosperous company, its success being partly due to a good

management team which fully participates in its development via a decentralised control system.’

This statement was questioned at the meeting which took place between John North, group

finance director of BBR and Paul Giddings, divisional general manager of the Shrewsbury plant.

The surprise came when Paul revealed that he did not believe he was responsible for his division’s

profitability. This, he claimed, was due to the company’s transfer-pricing policy.

Historically, Paul’s division bought over 50% of its total input of rubber hose from a sister

division located in Preston. This trade annually accounted for about 25–35% of the Preston divi-

sion's total output. Paul felt that the transfer price was unfair, and hence his division's reported

profit was not a true reflection of his operational effectiveness. In the ensuing conversation both

men agreed in principle that divisional general managers are delegated discretionary control over

short-term strategy development, day-to-day operating decisions and capital expenditure deci-

sions up to a prescribed limit. However, Paul claimed that in practice other factors intervened to

reduce the divisional manager's degree of control and took, as an example, the inter-divisional

trade in rubber hose.

The rubber hose trade

Fundamentally, the Preston division produces rubber hose which is then sold to, among others,

Paul's Shrewsbury division where it is 'tailored' for hydraulic uses in pit props, aircraft undercar-

riages and heavy plant and equipment.

Before the annual budgets are compiled, the divisional general managers enter into negotiations

about fixing the transfer price. Three months' notice is required before any mutually agreed price

can be revised. The managers themselves spend one or two days negotiating the transfer price for

the forthcoming months. At this meeting, information provided by their respective management

Source: Emmanuel, C.R. (1988) 'BBR plc', in D. Otley, D. Brown and C. Wilkinson (eds) *Case Studies in Management Accounting* (Hemel Hempstead, UK: Philip Allan Publishers). Reproduced with permission.

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accountants and annual cost variances provided by the central purchasing officer of BBR are

available. The Preston division provides cost data relating to standard variable and fixed costs

traceable to the division, plus an apportionment for selling, administrative and distribution costs.

Normally, these data provide a platform price for the negotiations. The forecasts given by the

central purchasing officer are included in these cost estimates. The Preston subsidiary is unaware

of the assumptions on which the purchasing forecasts are based, but nevertheless accepts them as

relevant to the fixing of the transfer price.

The Shrewsbury division also compiles standard cost data, and in addition presents price list

information with the likely allowable discounts it can hope to receive from alternative suppliers.

On some occasions these latter estimates form the ceiling price for the negotiations on the transfer

price. One of the difficulties that has been experienced is that the range between the cost estimates

at Preston and the competitor list prices at Shrewsbury can be vast. So much so that the platform

price exceeds the ceiling price. This may occur when excess supply is expected to characterise the

external market. Hard-nosed negotiations can result in the ultimate transfer price being less than

satisfactory to both parties and there is always the possibility for unrelated disputes to interfere

with the unstructured negotiations on the transfer price.

When a transfer price has been negotiated, this is incorporated in the annual budgets of the

divisions resulting in separate profit targets. The Preston division requires large volume produc-

tion in order to obtain economies of scale and to maintain its competitive position in the exter-

nal market. Manufacturing set-up costs are high, and hence there are real cost savings in having

long production runs. The Shrewsbury division, on the other hand, is committed to increasing

its share of the final product market which is price-sensitive. The end-users are mainly multina-

tional companies and have access to worldwide suppliers. The differing orientations are perhaps

best illustrated by the responses to a question put to the respective divisional managers about the

degree of autonomy which they exercise.

Does the authority to use external markets freely, to develop and

innovate products, and to plan the division's future:

Preston

Shrewsbury

division

division

(a) reduce the interdependence between the companies of

Agree

Disagree

the group?

(b) make compliance with corporate plans more difficult?

Agree

Disagree

(c) allow your division's performance to be a more realistic

Agree

Agree

reflection of your worth or effort?

(d) motivate you to use more your ingenuity, imagination, and

Agree

Agree

creativity?

(e) cause corporate/group objectives to give ground to the

Agree

Disagree

division's goals?

(f) enhance the competitive effectiveness of the group as a whole? Disagree

Agree

Paul Giddings feels that at the transfer-price negotiating stage, he is always in a weak position.

There are only two other domestic suppliers and three overseas who could supply the rubber

hose in the volume he requires. Even then it is unlikely that any one of these five external sup-

pliers would be willing to handle more than 20% of his division's total needs. His input to the

negotiations is based on volume discounts likely to be available from the external suppliers and

he argues that the Preston division should give a substantially better discount when he is buying

internally because Preston avoids the problems of the settlement and payments, advertising and

some transportation costs. In fact, he argues that the economies of scale Preston enjoys from the

internal trade are being passed on in disproportionately lower prices to potential competitors

of the Shrewsbury division. The Preston division counters that the savings obtained by the large

volume of internal sales enables it to be cost-efficient and innovative in developing new production

techniques.

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Exhibit 401.1 provides cost data which the managers are using in their current negotiations.

The transfer price proposed by the Preston division is £12.50 per metre of rubber hose.

Exhibit 401.1

Cost data available for the transfer-pricing negotiations

Preston Division

Output

Average

Average

('000 metres

material cost

direct labour

of rubber hose)

(£ per metre)

cost (£ per metre)

100

8.00

5.00

200

7.70

4.80

300

7.50

4.70

400

7.20

4.50

500

7.00

4.10

600

6.50

4.00

700

6.00

3.80

800

5.50

3.60

900

5.00

3.40

1000

4.50

3.20

s

Annual budgeted divisional fixed costs

£160 000

Annual budgeted allocation of selling,

roblem

administration and

£40 000

transportation costs

Proposed transfer price

£12.50 per metre

tudy p

Shrewsbury Division

Buy-in order size

Average external

Average

V Case s

(’000 metres of

suppliers list price

discount

RT I

rubber hose)

(£ per metre)

(% per metre)

PA

100

14

nil

200

14

3.57

300

14

7.15

400

14

11.6

500

14

15.0

Overlaying all of this is the difficulty both parties have in trying to forecast whether the future

market will exhibit excess demand or excess supply. It is this problem which had led to the regular

revision of the transfer price during the budget year in which it has been set.

Questions

1 Using the data provided, explain Paul Giddings' misgivings about a transfer price of £12.50.

Indicate the actions he may take to source his rubber hose requirements and identify those

which are in BBR's best interests.

2 Analyse the transfer-pricing procedure of BBR within the management-control system

(Exhibit 401.2). Outline clearly all the hidden costs associated with the existing procedure.

3 Suggest and examine alternative transfer-pricing procedures and transfer prices which may

lead to an improvement.

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Exhibit 401.2

Procedures governing transfer-price setting

A Policy

1 The transfer price between operating units of the *same* operating company is purely a matter

for the Chief Executive of the operating company concerned, for he is responsible for the total

profitability of the organisation under his management. However, where supply/demand is

between operating units of the *same* operating company it is important that a check is main-

tained on the market, or 'going' price for the products/services in question to enable the effi-

ciency of the supplier to be reviewed.

2 Transfer prices, where applicable, will be between operating companies/units who are organ-

isationally separate, i.e. those who are an independent operating unit not within an operating

company or who are within a different operating company to the unit with whom they are

dealing.

3 Operating companies/units will *normally* draw their requirements from within Group resources

except where:

a fiscal/political constraints make this impossible

b added cost (e.g. freight, transport, duty, etc.) make the price wholly uncompetitive

c the supplying operating unit requires a transfer price in excess of that *actually paid* by the

purchasing operating unit to third parties for 25% of their annual consumption for compa-

rable quality, delivery and quantities of the product in question.

B Guidelines

4 Transfer prices agreed between supplying operating units and purchasing operating units will

have reference to the market price on the willing buyer/willing seller basis for the comparable

qualities and deliveries.

5 The agreed quantities and prices of products to be transferred between operating companies

to be clearly and separately shown in the documentation submitted by each operating com-

pany.

6 It is not in the interests of the Group for the purchasing operating units to play off a Group

supplier against a third party; such action serves to debase the whole market price where sig-

nificant quantities are involved.

C Reference

7 If the purchasing operating unit is unable to arrive at an agreed transfer price with the supply-

ing operating unit and where the quantities of products involved are in excess of £10 000 p.a.,

the matter will be referred to the Headquarters Office, in which event the Chief Executive (or

the executive concerned) of the purchasing operating unit will be expected to show that:

a he can buy on a regular basis (NOT spot lots) at significantly lower prices than his colleague

is offering

b he is unable to maintain the gross margins that he has heretofore achieved, or, if selling

retail, his standard mark-up inclusive of quantity or special discounts

c his operations are seriously prejudiced by his having to accept an inflated transfer price

from Group resources.

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8 It will be important that (a) a firm supply/demand plan is established and (b) the buying

operating unit can rely on the same quality and service which is available to them from third

parties. Thus the provision contained in para. 5 (i.e. that the *planned* Inter-Group Transfer

Price is shown in the documentation, working programme section and represents the basis

on which *both* parties are operating) will establish a quasi-contractual situation between the

parties concerned.

9 If operating unit A erects a plant for the purpose of supplying operating unit B then clearly B

is committed to accepting the planned transfer price over the planned time scale, while A is

responsible for ensuring that its output costs are in accordance with the original plan submit-

ted in the sanction documents.

D Conclusion

10 Nothing in the foregoing will be interpreted as an intention that one operating unit should

subsidise inefficient (in quality) or uneconomic (in cost) production of another; it is intended

that the policy set out in paras 2 and 3 above shall be complied with in order that maximum

throughput at transfer prices which will optimise the total Group profitability can be achieved.

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PART V

Strategy, quality, time and

emerging issues

The first four parts of the book provided an overview of management and cost

accounting concepts and practices. As suggested in previous chapters, not only are

many organisations concerned with the cost issues within a narrow focus, but they

also take into account how cost management is linked to quality, time, strategy and

economic challenges. This last part aims to discuss how such concerns are addressed

by management accountants. Specifically, Chapters 20, 21 and 22 discuss strategy,

quality, time, sustainability concerns, digitalisation and other emerging issues

affecting modern enterprises today.

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Strategy, the balanced scorecard and quality

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Chapter 21

Accounting, time and efficiency

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Chapter 22

Emerging issues: digitalisation and sustainability

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CHAPTER 20

Strategy, the balanced scorecard

and quality

Many enterprises want to see their management accounting systems more closely aligned with their strategies. This requires management

Learning objectives

accountants to understand strategy and to devise ways in which a more strategic management accounting (SMA) orientation can be adopted

After studying this chapter, you

in practice. We have already discussed in previous chapters the cost

should be able to:

management implications of customer profitability analysis, life-

- Recognise that different perspectives

cycle issues, activity-based management and target costing practices

of strategy exist and identify key

which may be viewed as SMA approaches. We consider here the

aspects of SMA practices

balanced scorecard as an approach to performance measurement and management control. Additionally, as we stated in Chapter 1, global

- Consider how some organisations

competition and demanding customers have forced managers to improve

adopt generic strategies such as

the quality of their products. Many firms compete in their markets by

product differentiation and cost

focusing on quality characteristics of their product offerings. We examine

leadership

therefore also how management accounting can assist managers in

-

Understand the objectives of

accounting for and managing quality.

balanced scorecards as systems of

We start by discussing what strategy is and consider ways in which

performance measurement

organisations attempt to integrate strategic concepts into management

-

Explain four cost categories in a

accounting practices. We then consider quality issues that relate to

cost of quality programme

management accounting.

-

Describe financial and non-

financial measures and identify

three methods that companies use

to track quality

●

Identify the relevant costs and

benefits of quality improvements

●

Understand why companies use

both financial and non-financial

measures of quality

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Strategy and strategic management accounting

There is no single, universally accepted definition of strategy. The origins of the term strategy go

back to ancient Greece whereby *strategos* signified the role of a general in command of an army.

By 450 BC, the term was associated with skills in administration, leadership and oration. The

term has since evolved. For instance, we can view strategy that is *deliberate* and formal and strat-

egy as being *emergent,* sometimes arising by accident, and often from some level of bottom-up

input from the lower reaches of the enterprise (a view espoused by Mintzberg). For our purposes,

it is sufficient to recognise that some managers and consultants see strategy in terms of how it

should be according to them (the 'prescriptive' or 'deliberate' approach) while others regard strat-

egy as arising partially from informal processes (the 'descriptive' or 'emergent' approach). While

the prescriptive approach has tended to dominate thinking on the design of strategic management

accounting systems and techniques, the descriptive perspective has been useful in explaining the

process by which strategies emerge and affect firms. It is important to keep in mind both views.

As Martin (2014) notes: 'Mintzberg's thinking was informed by his observation that managers

overestimate their ability to predict the future and to plan for it in a precise and technocratic

way. By drawing a distinction between deliberate and emergent strategy, he wanted to encourage

managers to watch carefully for changes in their environment and make course corrections in

their deliberate strategy accordingly.'

The Chartered Institute of Management Accountants in the UK defines strategic management

accounting as being a form of management accounting which places emphasis on information

which relates to factors external to the firm, as well as non-financial information and internally

generated information. While conventional management accounting generally adopts a historical

orientation that focuses on single decisions, single periods and single entities, SMA is oriented

towards the future and the enterprise's position relative to that of its competitors. Many factors

may be relevant to SMA including financial and non-financial elements, competitor activities,

product characteristics, market share data and other value-chain-related information. Some busi-

nesses have used conventional approaches which take account of internal organisational concerns

in the face of external changes. These include benchmarking, total quality management, just-in-

time methods, SWOT (strengths, weaknesses, opportunities and threats) analysis as well as the

Boston Consulting Group's growth–share matrix and balanced scorecards. We discuss some of

these in this last part of the book in relation to management accounting.

The term ‘strategic management accounting’ is not used extensively in organisations, but many

firms engage in collecting and using information about competitors, matching accounting metrics

and qualitative data with the strategic intents of the firm, pursuing cost-reduction opportunities

manifested by the value chain, undertaking cost driver and competitive advantage analyses and

using customer/marketing information. We have discussed in earlier chapters how external factors

relating to the consumer, the market and technological advances have given rise to management

accounting innovations such as activity-based management (Chapter 11), target costing (Chap-

ter 12), product life-cycle costing (Chapter 12), and customer profitability analysis (Chapter 12).

These can be viewed as facets of SMA and we could add the balanced scorecard discussed in this

chapter, which has been adopted by many enterprises around the world in an attempt to explic-

itly link an organisation’s operational activities to its strategic objectives. We also consider the

balanced scorecard and its French precursor – the *tableau de bord* – in more detail below.

Some business commentators think of strategy in terms of militaristic moves which is a view

that captures aspects of SMA (see Porter, 1980, 1996; Quinn, 1980; Shank, 2006; Simmonds, 1981;

Simmonds et al., 1997). Under this view, we might describe strategy in terms of how an organi-

sation uses its resources to accomplish specific market objectives. So, in formulating its strategy,

an organisation would want to assess the industry in which it operates. This is often performed

through the lens of Porter's five forces: (a) competitors, (b) potential entrants into the market,

(c) equivalent products, (d) bargaining power of customers, and (e) bargaining power of input

suppliers. These forces shape an organisation's profits where usually greater competition, stronger

potential entrants, products that are similar, and tougher customers and suppliers constrain

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profits. This type of visualisation can be useful for traditional industrial organisations to do but

as we will see in Chapter 22, digitally advanced companies often operate on a different premise.

We illustrate an analysis of the five forces using the example of Chipset Ltd, a maker of linear

integrated circuit devices (LICDs) used in amplifiers and communication networks. We will then

look at the construction of a balanced scorecard. Chipset produces a single specialised product,

CX1. This standard, high-performance microchip can be used in numerous applications that

require instant processing of real-time data. CX1 was designed with extensive inputs from key

customers. Porter's five forces can be evaluated as follows for Chipset:

● *Competitors.* Chipset has many growth opportunities, but it also faces significant competition

from many small competitors. Companies in the industry have high fixed costs. There is steady

pressure to utilise capacity fully; in turn, there is ceaseless pressure on selling prices. Reducing

prices of products is critical for industry growth because it allows LICDs to be incorporated

into mass-market modems. CX1 enjoys a reputation of having slightly superior product fea-

tures relative to competitive products, but competition is severe along the dimensions of price,

timely delivery and quality. Quality is important because LICD failure disrupts the communi-

cation network.

● *Potential entrants into the market.* This is not an attractive industry for new entrants. Com-

petition keeps profit margins small, and significant capital is needed to set-up a new manufac-

turing facility. Companies that have been making LICDs are further down the learning curve

and hence are likely to have lower costs. Existing companies also have the advantage of close

relationships with customers.

● *Equivalent products.* Chipset uses a technology that allows its customers to use CX1 flexibly

to best meet their needs. The flexible design of CX1, and the fact that it is closely integrated

into end-products made by Chipset's customers, reduces the potential for equivalent products

or new technologies to replace CX1 during the next few years. This risk is reduced even further

if Chipset continuously improves CX1's design and processes to decrease costs.

● *Bargaining power of customers.* Customers have bargaining power because each buys large

quantities of product. Customers can also obtain microchips from other potential suppliers.

Signing a contract to deliver microchips is very important to Chipset. Recognising this fact,

customers negotiate hard to keep prices down.

● *Bargaining power of input suppliers.* Chipset purchases high-quality materials such as silicon

wafers, pins for connectivity, and plastic or ceramic packaging from its suppliers. Chipset

also requires skilled engineers, technicians and manufacturing labour. Materials suppliers and

employees have some bargaining power to demand higher prices and higher wages.

In summary, strong competition and the bargaining powers of customers and suppliers put

significant pressure on prices. Chipset is considering responding to these challenges by adopting

one of two basic strategies: *differentiating its product* or *achieving cost leadership.*

Product differentiation is an organisation's ability to offer products or services that are perceived

by its customers to be superior and unique relative to those of its competitors. For example,

Samsung has successfully differentiated its products in the mobile telephony industry, as have

Cross with pens, Rolex with watches and Coca-Cola with soft drinks. Through innovative product

R&D, and by developing processes that bring products to market rapidly, each of these compa-

nies has been able to provide enhanced and differentiated products. This differentiation increases

brand loyalty and the prices that customers are willing to pay.

Cost leadership is an organisation's ability to achieve lower costs relative to competitors through pro-

ductivity and efficiency improvements, elimination of waste, and tight cost control. Some cost leaders

in their respective industries are Citroën (cars), Staedtler (stationary), Dell (PCs) and Aldi (consumer

retailing). These companies all provide products and services that are similar to, not differentiated

from, those of their competitors, but generally at a lower cost to the customer. Lower selling prices –

rather than unique products or services – provide a competitive advantage for these cost leaders.

To evaluate the success of its strategy, a company must be able to trace the sources of its prof-

itability to its strategy of product differentiation or cost leadership. For example, Porsche's source



of profitability is closely tied to successfully differentiating its cars from those of its competi-

tors. Product differentiation enables Porsche to increase its profit margins and grow sales. Aldi's

profitability roots lie in the company's successful implementation of its cost-leadership strategy

through in-store layout and no-frills branding.

What strategy should Chipset follow? CX1 is already somewhat differentiated from competing

products. Differentiating CX1 further will be costly but it may allow Chipset to charge a higher

price. Conversely, reducing the cost of manufacturing and selling CX1 will allow Chipset to reduce

the price of CX1 and spur growth. The CX1 technology allows Chipset's customers to achieve

different performance levels by simply altering the number of CX1 units in their products. This

solution is more cost effective than designing new, customised microchips for different applica-

tions. Customers want Chipset to keep the current design of CX1 but to lower its price. Chipset's

current engineering staff is also more oriented towards making product and process improvements

than towards creatively designing brand new products and technologies. Chipset concludes that

it should pursue a cost-leadership strategy. Of course, successful cost leadership would generally

increase Chipset's market share and help the company to grow.

Concepts in action

Strategic renewal at Puma

In 1948, Rudolf Dassler had an argument

with his brother, Adi, in the German town of

Herzogenaurach where they had founded a

sports-shoe company. Adi set up the company

Adidas and, across the road, Rudolf founded

Puma. Like Adidas, Puma grew swiftly until 1986,

when Rudolf's son Armin took the company

public and retired. The company faced numerous

problems, not least the lack of a focused strategy

given the rapid succession of chief executives

appointed to the helm. In 1993, Puma asked

Jochen Zeitz, the company's marketing director,

to become chief executive of what was, in his

own words, 'probably the most undesirable

sports name around'. Zeitz tackled three related problems head-on: Puma's centralised corporate structure, the high-cost

German production base and the company's inability to keep pace with global trends. Strategic management accounting

recognises that organisational structure, market intelligence and cost management are intimately intertwined. Zeitz's

strategy, based on such information, worked. In 2013, Bjørn Gulden, Puma's then new CEO, introduced a new strategy

for the company: 'To be the fastest sports brand in the world'. The objective for Puma was 'to be fast in reacting to new

trends, fast in bringing new innovations, fast in decision making and fast in problem solving for our partners'. Today,

Gulden continues efforts to ensure growth is echoed in regional markets through sponsoring of top athlete stars and

partnering with celebrities such as singer Rihanna and Davido, one of Africa's most successful music artists.

Speed as well as strategic renewal is of the essence for Puma's global operations. In 2021, the company had LaMelo

Ball debut its PUMS MB.01 basketball shoes. Its creative director launched a new 'Women's basketball clothing

collection' and it advanced RE:SUEDE to test biodegradable footwear. Puma also reaffirmed its commitment to fight

against climate change at the UN Climate Conference COP26. Across 16 countries, Puma was named a top employer

and 2021 saw Puma's sales grow 32% to € 6,805 mil ion with an earnings growth of 166% to € 557 mil ion. Gulden

noted that: 'Despite all the issues and obstacles related to COVID-19 and political tensions around the world, we had the

best year in PUMA's history,' adding that, 'Our strategy of working closely together with our suppliers and retail partners

to manoeuvre through all the short-term issues and obstacles without hindering our mid-term momentum paid off.'

Sources: 'The cat that came back', *Fortune* (European edition), 2 March, pp. 60–4; puma.com; Smith, K. (2014) 'In the money: forever faster strategy to drive Puma turnaround' (www.just-style.com), 21 February; Puma Group Management Report 2013; https://about.puma.com/en/newsroom/corporate-

news/2022/02-23-2022-q4-results.

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The balanced scorecard

Consistent with the scorekeeping function, the management accountant has an important

role to play in the implementation of strategy. This role takes the form of designing reports to

help managers track progress in implementing strategy. Many organisations including Bank of

Montreal, British Petroleum, Dow Chemical and Siemens have introduced a balanced scorecard

or a French precursor – the tableau de bord – of the approach to manage the implementation of

their strategies.

The balanced scorecard translates an organisation's mission and strategy into a comprehensive

set of performance measures that provides the framework for implementing its strategy. The

balanced scorecard advanced almost three decades ago by Kaplan and Norton (1996) does not

focus solely on achieving financial objectives. It also highlights the non-financial objectives that

an organisation must achieve in order to meet its financial objectives. The balanced scorecard

measures an organisation's performance from four key perspectives: (1) financial, (2) customer,

(3) internal business process, and (4) learning and growth. A company's strategy influences the

measures used in each of these perspectives.

The balanced scorecard gets its name from the attempt to balance financial and non-financial

performance measures to evaluate both short-run and long-run performance in a single report.

Consequently, the balanced scorecard reduces managers' emphasis on short-run financial perfor-

mance, such as quarterly earnings. Why? Because the non-financial and operational indicators

measure fundamental changes that a company is making. The financial benefits of these changes

may not be captured in short-run earnings, but strong improvements in non-financial measures

signal the prospect of creating economic value in the future. For example, an increase in customer

satisfaction signals higher sales and income in the future. By balancing the mix of financial and

non-financial measures, the balanced scorecard focuses management's attention on both short-

run and long-run performance.

We illustrate the four perspectives of the balanced scorecard using the Chipset example. To

understand the measures Chipset uses to monitor progress under each perspective, it is impor-

tant to recognise the chief elements of Chipset's cost-leadership strategy: improve quality and

reengineer processes. As a result of these initiatives, Chipset plans to reduce costs and downsize

and eliminate capacity in excess of that needed to support future growth. However, it does not

want to make deep cuts in personnel that would adversely affect employee morale and hinder

future growth.

Quality improvement and reengineering at Chipset

One key element of Chipset's strategy to reduce costs is improving quality – that is, reducing

defects and improving yields in its manufacturing process. To improve quality, Chipset needs

to obtain real-time data about manufacturing process parameters and to implement advanced

process control methods. The goal is to ensure that process parameters such as temperature and

pressure are maintained within tight ranges. Chipset must also train its frontline workers in qual-

ity management techniques to help them identify and resolve defects and problems. Following

this training, Chipset desires to give its workforce greater ability both to make timely decisions

and continuously improve the process.

Another key element of Chipset's strategy to reduce costs is reengineering its order delivery

process. Reengineering is the fundamental rethinking and redesign of business processes in seeking

to achieve improvements in critical measures of performance such as cost, quality, service, speed

and customer satisfaction. To illustrate the concept of reengineering, we examine the order deliv-

ery system at Chipset in 2022. Chipset's salespeople work with customers to identify and plan

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customer needs. A copy of each purchase order received from a customer is sent to Manufacturing

where a production scheduler begins the planning for manufacturing the order. Frequently, there

is a long waiting time before production begins. After manufacturing is complete, the CX1 chips

are sent to the Shipping Department, which matches the quantities of CX1 to be shipped against

customer purchase orders. Often, the completed CX1 chips are held in inventory until a vehicle

is available for shipment to the customer. If the quantity shipped does not match the number of

chips requested by the customer, a special shipment is scheduled. The shipping documents are

sent to the Invoicing Department for issuing of invoices. Credit controllers in the Accounting

Department follow up customer payments.

Chipset discovered that the many transfers across departments (Sales, Manufacturing, Shipping,

Invoicing and Accounting) to satisfy a customer order slowed down the process and created delays.

A multifunction team from the various departments has reengineered the order delivery process

for 2023. Its goal is to make the entire organisation more customer-focused and reduce delays by

eliminating the number of interdepartmental transfers. Under the new system, a customer rela-

tionship manager will be responsible for the entire customer relationship. Chipset will enter into

long-term contracts with customers that specify quantities and prices. The customer relationship

manager will work closely with the customer and with manufacturing to specify delivery sched-

ules for CX1 one month in advance. The schedule of customer orders will be sent electronically

to Manufacturing. Completed chips will be shipped directly from Manufacturing to customer

sites. Each shipment will automatically trigger an invoice that will be sent electronically to the

customer.

The experiences of many companies, such as British Telecom, British American Tobacco,

Banca di America e di Italia, Hewlett-Packard and Siemens, indicate that the benefits from reengi-

neering are most significant when reengineering cuts across functional lines to focus on an entire

business process (as in the Chipset example). Reengineering only the shipping or invoicing activity

at Chipset rather than the entire order delivery process would not be particularly beneficial. Suc-

cessful reengineering efforts involve changing roles and responsibilities, eliminating unnecessary

activities and tasks, using information technology, and developing employee skills. Chipset's bal-

anced scorecard for 2023 must track Chipset's progress in reengineering the order delivery process

from both a non-financial and a financial perspective.

The four perspectives of the balanced scorecard

Exhibit 20.1 presents Chipset's balanced scorecard. It highlights the four key perspectives of

performance: financial, customer, internal business process, and learning and growth. At the

beginning of the year 2023, Chipset specifies the objectives, measures, initiatives to achieve the

objectives, and target performance (the first four columns of Exhibit 20.1). The target perfor-

mance levels for non-financial measures are based on competitor benchmarks. They indicate the

performance levels necessary to meet customer needs, compete effectively and achieve financial

goals. The fifth column, which describes actual performance, is completed at the end of the year

2023. This column shows how well Chipset has performed relative to its target performance.

1 *Financial perspective.* This perspective evaluates the profitability of the strategy. Because cost

reduction relative to competitors and growth are Chipset's key strategic initiatives, the financial

perspective focuses on how much of operating income and return on capital employed results

from reducing costs and selling more units of CX1.

2 *Customer perspective.* This perspective identifies the targeted market segments and measures

the company's success in these segments. To monitor its growth objectives, Chipset uses

measures such as market share in the communication networks segment, number of new cus-

tomers and customer satisfaction.

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3 *Internal business process perspective.* This perspective focuses on internal operations that fur-

ther both the customer perspective by creating value for customers and the financial perspective

by increasing shareholder wealth. Chipset determines internal business process improvement

targets after benchmarking against key competitors. There are different sources of competitor

cost analysis: published financial statements, prevailing prices, customers, suppliers, former

employees, industry experts and financial analysts. Chipset also physically takes apart com-

petitors' products to compare them with its own designs. This activity also helps Chipset to

estimate competitors' costs. The internal business process perspective comprises three principal

subprocesses:

a *The innovation process* – creating products, services and processes that will meet the needs

of customers. At Chipset, the key to lowering costs and promoting growth is improving the

technology of manufacturing.

b *The operations process* – producing and delivering existing products and services to custom-

ers. Chipset's key strategic initiatives are (a) improving manufacturing quality, (b) reducing

delivery time to customers, and (c) meeting specified delivery dates.

c *After-sales service* – providing service and support to the customer after the sale or delivery

of a product or service. Chipset's sales staff work closely with customers to monitor and

understand how well product features of CX1 match customer needs.

4 *Learning and growth perspective.* This perspective identifies the capabilities in which the organ-

isation must excel in order to achieve superior internal processes that create value for customers

and shareholders. Chipset's learning and growth perspective emphasises three capabilities: (1)

employee capabilities measured using employee education and skill levels, surveys of employee

satisfaction, employee turnover (proportion of employees who have left the company annu-

ally) and employee productivity; (2) information system capabilities measured by percentage

of frontline employees that have online access to customer information, and percentage of

business processes with real-time feedback; and (3) motivation and empowerment measured by

number of suggestions per employee, percentage of suggestions implemented, and percentage

of compensation based on individual and team incentives.

The arrows in Exhibit 20.1 indicate how gains in the learning and growth perspective lead to

improvements in internal business processes, which in turn lead to higher customer satisfaction

and market share, and finally to superior financial performance. Note how key elements of Chip-

set's strategy implementation – empowering workers, training, information systems, quality and

process improvements, reengineering and customer focus – filter through the scorecard. These

initiatives have been successful from a financial perspective in 2023. Chipset has earned significant

operating income from its cost-leadership strategy that has also translated into growth.

Aligning the balanced scorecard to strategy

Different strategies call for different scorecards. Suppose that Visilog, another company in the

microchip industry, follows a product differentiation strategy by designing custom chips for the

communication networks business. Visilog designs its balanced scorecard to fit its strategy. For

example, in the financial perspective, Visilog evaluates how much of its operating income comes

from charging premium prices for its products. In the customer perspective, Visilog measures

the percentage of its revenues from new products (and new customers). In the internal business

process perspective, Visilog measures the development of advanced manufacturing capabilities

to produce custom chips. In the learning and growth perspective, Visilog measures new product

development time. Of course, Visilog uses some of the measures described in the balanced score-

card in Exhibit 20.1. For example, revenue growth, customer satisfaction ratings, order delivery

time, on-time delivery, percentage of frontline workers empowered to manage processes, and

employee satisfaction ratings, are important measures under the new strategy. The key point,

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Exhibit 20.1

The balanced scorecard for Chipset Ltd for the year 2023

Target

Actual

Objectives

Measures

Initiatives

performance

performance

Financial perspective

⌋ | Operating profit from Manage costs and

£2 000 000

£2 100 000

|

productivity gain

unused capacity

⌉

Increase shareholder

Operating profit from

Build strong customer

£3 000 000

£3 420 000

|

value

|

growth

relationships

] Revenue growth

Build strong customer

6%

6.48%*

relationships

Customer perspective

Increase market share

Market share in

Identify future needs of 6%

7%

communication

customers

networks segment

New customers

Identify new target

5

66†

customer segments

Increase customer

Customer satisfaction

Increase customer

90% of customers 87% of customers

satisfaction

survey

focus of sales

give top two

give top two

organisation

ratings

ratings

Internal business process perspective

Improve manufacturing

Percentage of processes Organise R&D/

75%

75%

capability

with advanced

manufacturing

controls

teams to implement

advanced controls

Improve manufacturing

Yield

Identify root causes

78%

79.3%‡

quality and productivity

of problems and

improve quality

Reduce delivery time to

Order delivery time

Reengineer order

30 days

30 days

customers

delivery process

Meet specified delivery

On-time delivery

Reengineer order

92%

90%

dates

delivery process

Learning and growth perspective

Develop process skill

Percentage of

Employee training

90%

92%

employees trained

programmes

in process and

quality management

Empower workforce

Percentage of front-line Have supervisors act as 85%

90%

workers empowered

coaches rather than

to manage processes

decision makers

Align employee and

Employee satisfaction

Employee participation 80% of

88% of

organisation goals

survey

and suggestions

employees

employees

programme to build

give top two

give top two

teamwork

ratings

ratings

Enhance information

Percentage of

Improve offline data

80%

80%

system capabilities

manufacturing

gathering

processes with real-

time feedback

Improve manufacturing

Number of major

Organise R&D/

5

5

processes

improvements in

manufacturing teams

process controls

to modify processes

* Revenues in 2023 − Revenues in 2018) ÷ Revenues in 2018 = (£28 750 000 − £27 000 000) ÷ £27 000 000 = 6.48%.

† Customers increased from 40 to 46 in the year 2023.

‡ Yield = Units of CX1 produced ÷ Units of CX1 started × 100 = 1150 000 ÷ 1 450 000 × 100 = 79.3%.

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Exhibit 20.2

Frequently cited balanced scorecard measures

Financial perspective

● Operating profit, revenue growth, revenues from new products, gross margin percentage, cost

reductions in key areas, economic value added (EVA®)*, return on investment*.

Customer perspective

● Market share, customer satisfaction, customer retention percentage, time taken to fulfil customer's

requests.

Internal business process perspective

● *Innovation process* – manufacturing capabilities, number of new products or services, new product

development times, number of new patents.

● *Operations process* – yield, defect rates, time taken to deliver product to customers, percentage

of on-time deliveries, average time taken to manufacture orders, set-up time, manufacturing

downtime.

● *After-sales service* – time taken to replace or repair defective products, hours of customer training

for using the product.

Learning and growth perspective

● Employee education and skill levels, employee satisfaction scores, employee turnover rates,

information system availability, percentage of processes with advanced controls, percentage of

employee suggestions implemented, percentage of compensation based on individual and team

incentives.

* These measures are described in Chapter 19.

though, is to align the balanced scorecard to company strategy. For simplicity, we have presented

the balanced scorecard in the context of companies that have followed either a cost-leadership

or a product differentiation strategy. Of course, a company may have some products for which

cost leadership is critical and other products for which product differentiation is important.

The company will then develop separate scorecards to implement the different product strategies.

In still other contexts, product differentiation may be of primary importance, but some cost lead-

ership must also be achieved. The balanced scorecard measures would then link to this strategy.

Exhibit 20.2 presents some common balanced scorecard measures that companies have used.

Features of a good balanced scorecard

A good balanced scorecard design has several features:

1 It tells the story of a company's strategy by articulating a sequence of cause-and-effect rela-

tionships. For example, because Chipset's goal is to be a low-cost producer and to emphasise

growth, the balanced scorecard describes the specific objectives and measures in the learning

and growth perspective that lead to improvements in internal business processes. These, in turn,

lead to increased customer satisfaction and market share, as well as higher operating profit

and shareholder wealth. Each measure in the scorecard is part of a cause-and-effect chain, a

linkage from strategy formulation to financial outcomes.

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2 It helps to communicate the strategy to all members of the organisation by translating the

strategy into a coherent and linked set of understandable and measurable operational targets.

Guided by the scorecard, managers and employees take actions and make decisions that aim to

achieve the company's strategy. To focus these actions, some companies, such as Halifax and

Barclays, have pushed down and developed scorecards at the division and department levels.

3 In for-profit companies, the balanced scorecard places strong emphasis on financial objectives

and measures. Managers sometimes tend to focus too much on innovation, quality and cus-

tomer satisfaction as ends in themselves even if they do not lead to tangible pay-offs. A bal-

anced scorecard emphasises non-financial measures as a part of a programme to achieve future

financial performance. When financial and non-financial performance measures are properly

linked, many of the non-financial measures serve as leading indicators of future financial per-

formance. In the Chipset example, the improvements in non-financial factors have, in fact, led

to improvements in financial factors.

4 The balanced scorecard limits the number of measures used by identifying only the most crit-

ical ones. Avoiding a proliferation of measures focuses management's attention on those that

are key to the implementation of strategy.

5 The scorecard highlights suboptimal trade-offs that managers may make when they fail to

consider operational and financial measures together. For example, a company for which inno-

vation is key could achieve superior short-run financial performance by reducing spending on

R&D. A good balanced scorecard would signal that the short-run financial performance may

have been achieved by taking actions that hurt future financial performance because a leading

indicator of that performance, R&D spending and R&D output, has declined.

Many unintended forces can shape the way in which a balanced scorecard is ultimately imple-

mented. If there is incorrect implementation then, 'the organisation may actually go faster in the

wrong direction' (Rousseau and Rousseau, 2000, p. 25; Kloot and Martin, 2000). There is some

evidence that successful balanced scorecard implementation depends on managers' understanding

of the linkages between performance measures, business units' strategy and firm decisions (Ding

and Beaulieu, 2011; Hasan and Chyi, 2017; Nielsen et al., 2017). Experience with the balanced

scorecard suggests that correct implementation and the presence of common objectives for using

a balanced scorecard within an organisation whether public sector, industrial or service or large

or small are both key to achieving satisfaction (Bergeron, 2017; Malagueño et al., 2018).

Pitfalls to avoid when implementing a balanced scorecard

Points to note when implementing a balanced scorecard include the following:

1 Do not assume the cause-and-effect linkages to be precise. A critical challenge is to identify

the strength and speed of the causal linkages among the non-financial and financial measures.

Hence, a firm must gather evidence of these linkages over time. With experience, enterprises

should alter their scorecards to include those non-financial objectives and measures that are

the best leading indicators of subsequent financial performance (a lagging indicator). Com-

mitting to evolve the scorecard over time avoids the paralysis associated with trying to design

the perfect scorecard at the outset.

2 Do not seek improvements across all of the measures all of the time. This approach may be

inappropriate because trade-offs may need to be made across various strategic goals. For exam-

ple, emphasising quality and on-time performance beyond a point may not be worthwhile –

further improvement in these objectives may be inconsistent with profit maximisation.

3 Do not use only objective measures in the scorecard. Chipset's scorecard includes both objective

measures (such as operating income from cost leadership, market share and manufacturing yield),

as well as subjective measures (such as customer and employee satisfaction ratings). When using

subjective measures, though, management must be careful to trade off the benefits of the richer

information these measures provide against the imprecision and potential for manipulation.



4 Do not fail to consider both costs and benefits of initiatives such as spending on information

technology and R&D before including these objectives in the scorecard. Otherwise, manage-

ment may focus the organisation on measures that will not result in overall long-run financial

benefits.

5 Do not ignore non-financial measures when evaluating managers and employees. Managers

tend to focus on what their performance is measured by. Excluding non-financial measures

when evaluating performance will reduce the significance and importance that managers give

to non-financial scorecard measures.

In reviewing the evidence available on the balanced scorecard, Mitchell and NØrreklit (2014,

p. 426) noted that ‘BSC (balanced scorecards) implementation can vary among organisations due

to different interpretations of the BSC’ and ‘few organisations seem to follow the instructions of

linking compensation to all areas of measurements’. Hoque (2014, p. 56) notes that ‘Until another

improved innovation appears, the balanced scorecard will continue to provide organisations with

a valuable option as a strategy map, an enabler of policy implementation, and an organisational

control and accountability tool’.

Evaluating the success of a strategy

To evaluate how successful it has been in implementing its strategy, Chipset compares the target

and actual performance columns of its balanced scorecard in Exhibit 20.1. This comparison

indicates that Chipset met most of the targets it had set on the basis of competitor benchmarks.

Meeting the targets suggests that the strategic initiatives that Chipset had identified and meas-

ured for learning and growth resulted in improvements in internal business processes, customer

measures and financial performance. The financial measures show that Chipset achieved targeted

cost savings and growth. The key question is: How does Chipset isolate operating profit from

specific sources such as cost savings and growth instead of emphasising only the aggregate change

in operating profit?

Concepts in action

Barclays turns to the balanced scorecard

A series of scandals from 2008 to 2012 tarnished the

reputation of Barclays, the British multinational bank.

From fraudulently selling mortgage-backed securi-

ties in the run-up to the financial crisis to rigging a

key interest rate called LIBOR, a benchmark rate that

helps set global borrowing costs, Barclays' image and

financial performance took a beating. When new

leadership was tasked with turning Barclays around,

the company turned to the balanced scorecard to

change the company's performance goals and incen-

tive structure. Introduced in 2014, Barclays' balanced

scorecard set out specific goals and metrics across

each of the company's '5Cs': customer and client,

colleague, citizenship, conduct, and company. With the goal of becoming the world's 'go to' bank, the balanced

scorecard became the instrument to ensuring Barclays was 'helping people achieve their ambitions – in the right

way' and balancing 'stakeholders' needs across the short and long term'. Rather than focusing solely on short-term

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financial results, Barclays' balanced scorecard aligned the company's 5Cs with the broader perspectives of the bal-

anced scorecard. Most notably, the learning and growth perspective incorporated Barclays' conduct and citizenship

goals, which included new purpose and value statements for the company. The company even took the extraordinary

step of tying the performance bonuses of managers to Barclays' corporate ethics and citizenship goals, rather than

just quarterly profits and stock price gains. The company evolved its balanced scorecard performance measurement

in 2016 to identify new key performance indicators (KPIs) that continued to prioritise customer and client, colleague,

and citizenship metrics, underpinned by conduct and culture (renamed from company) firmwide. By 2018, Barclays

was making significant progress toward its new KPIs. The company's recent annual report noted, 'By incorporating a

broad range of financial and non-financial measures, our framework is focused on achieving positive and sustainable

outcomes for our diverse group of stakeholders, and influences incentive outcomes for Barclays' employees.'

Sources: Horowitz, J. (2012) 'New Barclays' chief ties executive compensation to societal goals', Reuters, 24 September (http://www.reuters.com/article/

us-barclays-jenkins-idUSBRE88N0YY20120924); Brownsell, A. (2014) 'Barclays reveals '5Cs' values scorecard in drive for brand transformation', *Marketing,* 2 November (http://www.marketingmagazine.co.uk/article/1230626/barclaysreveals-5cs-values-scorecard-drive-brand-transformation); Shubber, K. (2018)

'Barclays to pay $2bn to settle US mortgage mis-selling probe', *Financial Times,* 29 March (https://www.ft.com/content/9ff69988-3352-11e8-ac48-10c6fdc22f03);

Barclays PLC (2018) 'Barclays' balanced scorecard' (https://www.home.barclays/about-barclays/balanced-scorecard.html); Barclays PLC, 2017 Annual Report (London: Barclays PLC, 2018)

Some companies might be tempted to gauge the success of their strategies by measuring the

change in their operating profits from one year to the next, but this approach is inadequate. For

example, operating profit can increase simply because entire markets are expanding, not because a

specific strategy has been successful. Also, changes in operating profit might be caused by factors

outside the strategy. For example, a company such as Chipset that has chosen a cost-leadership

strategy may find that operating profit increases have instead been caused incidentally by some

degree of product differentiation. Managers and accountants need to evaluate the success of a

strategy on the basis of whether the sources of operating profit increases are the result of imple-

menting the chosen strategy.

To use operating profit numbers for evaluating the success of a strategy, a company needs to

isolate the operating profit due to cost leadership from the operating profit due to product dif-

ferentiation. Of course, successful cost leadership or product differentiation generally increases

market share and helps a company to grow. To evaluate the success of a company's strategy, one

can subdivide changes in operating profit into components that can be identified with growth,

product differentiation and cost leadership. Subdividing the change in operating profit to evaluate

the success of a company's strategy is similar to variance analysis, discussed in Chapters 15 and

16. The focus is on comparing actual operating performance over two different time periods and

explicitly linking it to strategic choices. A company is considered to be successful in implementing

its strategy when the amounts of the product differentiation, cost leadership and growth compo-

nents align closely with its strategy.

Although organisations differ in the way that they use the balanced scorecard, there is some

evidence that there are country-specific ways in which it is implemented and deployed. Thus, the

notion of a specifically ‘Scandinavian balanced scorecard’ has been reported (Ax and Bjornenak,

2007). In France, the tableau de bord (effectively a ‘dashboard’) has been used as a performance

measurement and control approach by many enterprises for over five decades. Possibly there

may be socio-economic reasons for this (Mendoza and Zrihen, 1999). The French reaction to

the balanced scorecard may be rooted in the nature of the ‘French ideology’ (Nørreklit, 2003).

Broadly, there is growing evidence that managers place different values on different aspects of

management accounting systems including balanced scorecards. While organisational values are

an important element in the implementation of balanced scorecards, broader-level factors, includ-

ing nation-specificity can also influence their nature and use (Bhimani, 2005; 2006).

The tableau de bord (TdB) is a management tool bearing similarities to the balanced score-

card (see Exhibit 20.3) which is used by many French enterprises, including Air France, Lafarge,

Pechiney, Saint-Gobain and IBM (France). TdBs are founded on multicriteria models of control

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Exhibit 20.3

The distinctive features of French and American societies and related differences in performance management systems

Name	France	USA
Performance measurement system		
Tableau de bord		
Balanced scorecard		
Underlying strategic concept		

Managers' subjective perception

External (objective)

Focus

Process of construction (conceptual)

Ready-to-use indicators

Deployment

Open to local initiative

Strictly top-down

Main emphasis

Learning

Rewards

Basic elements of society

Individualism

Lower

Higher

Hierarchy in society

Omnipresent

No hierarchy

Centralisation

Higher

Lower

Basic social demand

Respect of honour

Respect of contract and fairness

Demand for objectivity

Lower

Higher

Social ascension

Perceived as limited

Perceived as unlimited

Perception of performance-based

Threat

Opportunity

rewards

Social control

Self-control

External control

Attitude towards external control

Negative

Positive

Employee dismissal

Almost taboo

Legitimate

Dominating professional culture

Engineer

Manager

Top management

Practically no management

Extensive management

education

education

Perception regarding manager’s

Given by birth

Given by education

qualities

Social status of management

Lower

Higher

Belief in management tools

Lower

Higher

Future orientation

Lower

Higher

Political past

Absolutist monarchy and revolution

Contractual agreement

Philosophical tradition

Intellectualism and idealism

Pragmatism

Grammatical structure of language

Clear, with many exceptions

Less clear

Source: Adapted from NØrreklit (2003).

that use financial as well as non-financial means to identify and measure objectives, key vari-

ables and indicators. French companies use a series of TdBs carved to overlay their organisa-

tional structure. Localised responsibilities are assigned and hierarchical lines of authority are

respected.

At the apex of the pyramid, the managing director has a TdB detailing overall company objec-

tives and attainments. The managing director's TdB aggregates data from subordinate TdBs

such as those of divisional heads, functional heads, geographical heads or product group heads

as the case may be. For instance, there might be TdBs for manufacturing, finance and marketing.

The manufacturing TdB itself would aggregate those of its departments: production, purchases,

receiving and storage. Production in turn would have TdBs for line A, line B and so on down

to the nadir of the pyramid. Exhibit 20.4 provides an illustration of a network of tableaux de

bord nesting one inside the other. TdBs consist of a range of diverse information. TdBs report

forecasts, actual results and variances in the conventional manner, but this information relates

to non-financial data as well as financial data. Thus, a TdB might report number of units pro-

duced, consumption of different materials, production hours, reject rates, returns and unsold

products, in addition to financial information such as contribution margins. Beyond financial and

non-financial informational differences, TdBs include externally sourced information and general

information on the business environment.

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Exhibit 20.4

Illustration of a network of tableaux de bord nesting one inside

the other

Costs of quality under the balanced scorecard

Many companies throughout the world – for example, BMW in Germany, British Telecom in the

UK, Renault in France, Fujitsu in Japan, Crysel in Mexico, and Samsung in Korea – view total

quality management as providing an important competitive edge. This is because a quality focus

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can reduce costs and increase customer satisfaction. Several prestigious, high-profile awards – for

example, the European Quality Award, the UK Quality Award, the Malcolm Baldrige Quality

Award (USA) and the Deming Prize (Japan) – have been instituted to recognise exceptional quality.

International quality standards have emerged. For example, ISO 9000, developed by the Inter-

national Organisation for Standardisation, is a set of five international standards for quality man-

agement adopted by more than 85 countries with over one million organisations worldwide being

independently certified. ISO 9000 was created to enable companies to document and certify their

quality system elements effectively. Some companies, such as BT and General Electric, require

their suppliers to obtain ISO 9000 certification. Why? To reduce their own costs by evaluating,

assessing and working to improve the quality of their suppliers' products. Thus, certification

and an emphasis on quality are rapidly becoming conditions for competing in the global market.

Why this emphasis on quality? Because quality costs can be as much as 20% of sales revenue

for many organisations. Quality-improvement programmes can result in substantial savings and

higher revenues. Consider a general effect that quality has on revenues. If competitors are improv-

ing quality, then a company that does not invest in quality improvement will probably suffer a

decline in its market share and revenues. In this case, the benefit of better quality is in preventing

lower revenues, not in generating higher revenues.

Quality improvement also has non-financial and qualitative effects that improve a company's

long-term performance. For example, managers and workers focusing on quality gain expertise

about product and process. This knowledge may lead to lower costs in the future. Manufacturing

a product of high quality can enhance a company's reputation and increase customer goodwill,

which may lead to higher future revenues.

Quality has been defined in many different ways as it can mean different things to different

people. Generally, the term *quality* refers to a wide variety of factors: fitness for use, the degree

to which a product satisfies the needs of a customer and the degree to which a product conforms

to design specification and engineering requirements. We discuss two basic aspects of quality:

quality of design and *conformance quality* (see Oakland et al., 2018; Sharma, 2018 for detailed

discussions).

Quality of design measures how closely the characteristics of products or services match the

needs and wants of customers. Suppose customers of photocopying machines want copiers that

combine copying, faxing, scanning and electronic printing. Photocopying machines that fail to

meet these customers' needs fail in the quality of their design. Similarly, if customers of a bank

want an online banking system, then not providing this facility would be a quality of design

failure.

Conformance quality is the performance of a product or service according to design and pro-

duction specifications. For example, if a photocopying machine mishandles paper or breaks down,

it will have failed to satisfy conformance quality. Products not conforming to specifications must

be repaired, reworked or scrapped at an additional cost to the organisation. If non-conformance

errors are not corrected within the plant and the product breaks down at the customer site, even

greater repair costs as well as the loss of customer goodwill – often the highest quality cost of

all – may result. In the banking industry, depositing a customer's cheque into the wrong bank

account is an example of conformance quality failure.

The following diagram illustrates our framework:

Actual

Design

Customer

performance

specifications

satisfaction

Conformance

Quality

quality

of design

To travel the road from actual performance to customer satisfaction, companies must meet

design specifications through conformance quality, but they must also design products to satisfy

customers through quality of design.

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Quality has both financial and non-financial components relating to customer satisfaction,

improving internal quality processes, reducing defects, and the training and empowering of work-

ers. To provide some structure, we discuss quality from the four perspectives of the balanced

scorecard: financial in the next section and customer, internal-business-process, and learning-

and-growth in the following section.

The financial perspective: costs of quality

The costs of quality (COQ) are costs incurred to prevent, or costs arising as a result of, the produc-

tion of a low-quality product. These costs focus on conformance quality and are incurred in all

business functions of the value chain. Costs of quality are classified into four categories:

1 Prevention costs – costs incurred in precluding the production of products that do not conform

to specifications.

2 Appraisal costs – costs incurred in detecting which of the individual units of products do not

conform to specifications.

3 Internal failure costs – costs incurred when a non-conforming product is detected before it is

shipped to customers.

4 External failure costs – costs incurred when a non-conforming product is detected after it is

shipped to customers.

Exhibit 20.5 presents examples of individual cost of quality items in each of these four categories

reported on COQ reports. Note that the items included in Exhibit 20.5 come from all value-chain

business functions and are broader than the internal failure costs of spoilage, rework and scrap

in manufacturing.

We illustrate the various issues in managing quality – from computing the costs of quality,

to identifying quality problems, to taking actions to improve quality – using Braganza Lda as

our example. Braganza makes many products. Our presentation focuses on Braganza's pho-

tocopying machines, which earned an operating profit of €24 million on sales of €300 million

(20 000 copiers) in 2018. Braganza determines its costs of quality using an activity-based approach

with five steps.

Exhibit 20.5

Items pertaining to costs of quality reports

Prevention costs

Appraisal costs

Internal failure costs External failure costs

Design engineering

Inspection

Spoilage

Customer support

Process

Online product

Rework

Transportation

engineering

manufacturing

Scrap

costs

Quality engineering

and process

Breakdown

Manufacturing/

Supplier

inspection

maintenance

process

evaluations

Product testing

Manufacturing/

engineering

Preventive

process

Warranty repair

equipment

engineering on

costs

maintenance

internal failure

Liability claims

Quality training

New materials used

to manufacture

Products

● **Step 1.** Identify all quality-related activities and activity cost pools. Column 1 of Exhibit 20.6,

Panel A, classifies costs into prevention, appraisal, internal failure and external failure cate-

gories and indicates the value-chain functions in which the costs occur. One such activity is

inspecting (including testing) the photocopying machines.

● **Step 2.** Determine the quantity of the cost-allocation base for each quality-related activity

(see Exhibit 20.6, Panel A, column 2). For example, Braganza identifies inspection hours,

the primary cost driver, as the cost-allocation base of the inspection activity. Assume that

photocopying machines use 240 000 hours (12 hours per copier × 20 000 copiers) of the

cost-allocation base.

● **Step 3.** Calculate the rate per unit of each cost-allocation base (see Exhibit 20.6, Panel A,

column 3). Owing to space considerations, we do not provide details of the calculations.

Allocation rates are calculated using methods described in Chapters 3 and 11. In the Braganza

example, the total (fixed and variable) costs of inspection are €40 per hour.

● **Step 4.** Calculate the costs of each quality-related activity for photocopying machines by mul-

tiplying the quantity of the cost-allocation base determined in step 2 by the rate per unit of the

cost-allocation base calculated in step 3 (see Exhibit 20.6, Panel A, column 4). In our example,

quality-related inspection costs are €9 600 000 (240 000 hours × €40 per hour).

● **Step 5.** Obtain the total costs of quality by adding the costs of all quality-related activities for

photocopying machines in all value-chain business functions. Exhibit 20.6, Panel A, shows

Braganza's total costs of quality reported on the COQ report for photocopying machines at

€40.02 million, of which the largest categories are €14.52 million in total external failure costs

and €10 million in total internal failure costs – a sum of €24.52 million. Total reported costs

of quality are 13.34% of current sales.

Do not assume, however, that costs reported on COQ reports represent the total costs of qual-

ity for a company. COQ reports typically exclude opportunity costs, such as forgone contribu-

tion margins and profit from lost sales, lost production or lower prices that result from poor

quality. Why? Because opportunity costs are difficult to estimate and generally not recorded

in accounting systems. Nevertheless, opportunity costs can be substantial and important driv-

ing forces in quality-improvement programmes. Exhibit 20.6, Panel B, presents the analysis of

the opportunity costs of poor quality at Braganza. Braganza Corporation's Market Research

Department estimates lost sales of 2000 photocopying machines because of external failures.

The forgone contribution and operating profit of €12 million measures the financial costs from

dissatisfied customers who have returned machines to Braganza and from sales lost because

of quality problems. Total costs of quality (including opportunity costs) equal €52.02 million

(Panel A, €40.02 million + Panel B, €12 million), or 17.34% of current sales. Opportunity

costs account for 23% (€12 million ÷ €52.02 million) of Braganza's total costs of quality.

The COQ report and the opportunity cost analysis highlight Braganza's high internal and

external failure costs. To reduce costs of quality, Braganza must identify and reduce failures

caused by quality problems.

The customer perspective: non-financial measures of customer

satisfaction

Braganza's managers track the following measures of customer satisfaction:

● market research information on customer preferences for and customer satisfaction with spe-

cific product features (as measures of design quality)

● market share

● percentage of highly satisfied customers

● number of defective units shipped to customers as a percentage of total units shipped

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Exhibit 20.6

Activity-based cost of quality analysis for Braganza

Panel A: Cost of quality report

Allocation base or cost driver

Percentage

Costs of quality and

Rate

of sales

value-’chain category

Quantity

(number assumed)

Total costs

(5) = (4) ÷

(1)

(2)

(3)

(4) = (2) × (3) €300 000 000

Prevention costs

Design engineering

(R&D/Design)

40 000* hours

€80 per hour

€3 200 000

1.07%

Process engineering

(R&D/Design)

45 000* hours

€60 per hour

2 700 000

0.90

Total prevention costs

5 900 000

1.97

Appraisal costs

Inspection (Manufacturing)

240 000† hours

€40 per hour

9 600 000

3.20

Total appraisal costs

9 600 000

3.20

Internal failure costs

Rework (Manufacturing)

2500‡ copiers

€4000 per copier

reworked

reworked

10 000 000

3.33

Total internal failure costs

10 000 000

3.33

External failure costs

Customer support

3000§ copiers

€200 per copier

(Marketing)

repaired

repaired

600 000

0.20

Transportation costs

3000 copiers

€240 per copier

(Distribution)

repaired

repaired

720 000

0.24

Warranty repair

3000 copiers

€4400 per copier

(Customer service)

repaired

repaired

13 200 000

4.40

Total external failure costs

14 520 000

4.84

Total costs of quality

€40 020 000

13.34%

Panel B: Opportunity cost analysis

Contribution

Total

margin

estimated

per copier

contribution

Percentage

Quantity of

(number

margin

of sales

Costs of quality

lost sales

assumed)

lost

(5) = (4) ÷

category (1)

(2)

(3)

(4) = (2) × (3) €300 000 000

External failure costs

Estimated forgone

contribution margin

2000#

and income on lost sales

copiers

€6000

€12 000 000

4.00%

Total costs of quality

€12 000 000

4.00%

* Based on special studies.

† 12 hours per copier × 20 000 copiers.

‡ 12.5% of 20 000 copiers manufactured required rework.

§ 15% of 20 000 copiers manufactured required warranty repair service.

Estimated by Braganza's Market Research Department.

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● number of customer complaints (Companies estimate that for every customer who actually

complains, there are 10 to 20 others who have had bad experiences with the product or service

but did not complain.)

● percentage of products that fail soon after they have been delivered to customers

● average delivery delays (difference between the scheduled delivery date and the date requested

by the customer)

● on-time delivery rate (percentage of shipments delivered on or before the scheduled delivery

date).

Braganza's managers monitor these numbers over time. Higher customer satisfaction should lead

to lower external failure costs, lower costs of quality, and higher future revenues due to greater

customer retention, loyalty, and positive word-of-mouth advertising. Lower customer satisfaction

is indicative of higher future external failure costs and costs of quality. We next discuss internal

business processes to identify and analyse quality problems that help to improve quality and

increase customer satisfaction.

The internal-business-process perspective: analysing quality problems

We present three techniques for identifying and analysing quality problems: control charts, Pareto

diagrams and cause-and-effect diagrams.

Control charts

Statistical quality control (SQC) or statistical process control (SPC) is a formal means of distin-

guishing between random variation and non-random variation in an operating process. A key

tool in SQC is a control chart. A control chart is a graph of a series of successive observations of

a particular step, procedure or operation taken at regular intervals of time. Each observation is

plotted relative to specified ranges that represent the expected distribution. Only those observa-

tions outside the specified limits are ordinarily regarded as non-random and worth investigating.

Exhibit 20.7 presents control charts for the daily defect rates observed at Braganza's three

production lines. Defect rates in the prior 60 days for each plant were assumed to provide a good

basis from which to calculate the distribution of daily defect rates. The arithmetic mean (μ ±

, r 2 σ

ead

mu) and standard deviation (σ, read sigma) are the two parameters of the distribution that are

used in the control charts in Exhibit 20.7. On the basis of experience, the company decides that

any observation outside the $\mu \pm 2\ \sigma$ range should be investigated.

Exhibit 20.7

Statistical quality-control charts: daily defect rate at Braganza

Production line A

Production line B

Production line C

$\mu + 2$

$\mu + 2$

$\mu + 2$

$\mu +$

$\mu +$

$\mu +$

$\mu -$

$\mu -$

$\mu -$

Defect rate

Defect rate

Defect rate

$\mu - 2$

$\mu - 2$

$\mu - 2$

1 2 3 4 5 6 7 8 9 10

1 2 3 4 5 6 7 8 9 10

1 2 3 4 5 6 7 8 9 10

Days

Days

Days

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For production line A in Exhibit 20.7, all observations are within the range of $\mu \pm 2\ \sigma$ from

the mean. Management, then, believes no investigation is necessary. For production line B, the

last two observations signal that an out-of-control occurrence is highly likely. Given the $\mu \pm 2\ \sigma$

rule, both observations would lead to an investigation. Production line C illustrates a process

that would not prompt an investigation under the $\mu \pm 2\ \sigma$ rule but may well be out of control.

Note that the last eight observations show a clear direction and that the direction by day 5 (the

third point in the last eight) is away from the mean. Statistical procedures have been developed

using the trend as well as the level of the variable in question to evaluate whether a process is

out of control.

Pareto diagrams

Observations outside control limits serve as inputs to *Pareto diagrams.* A Pareto diagram indi-

cates how frequently each type of failure (defect) occurs. Exhibit 20.8 presents a Pareto diagram

for Braganza's quality problems. Fuzzy and unclear copies are the most frequently recurring

problem.

The fuzzy copy problem results in high rework costs because, in many cases, Braganza discov-

ers the fuzzy image problem only after the copier has been built. Sometimes fuzzy images occur

at customer sites, resulting in high warranty and repair costs.

Cause-and-effect diagrams

The most frequently occurring problems identified by the Pareto diagram are analysed using

cause-and-effect diagrams. A cause-and-effect diagram identifies potential causes of failures or

defects. As a first step, Braganza analyses the causes of the most frequently occurring failure,

fuzzy and unclear copies. Exhibit 20.9 presents the cause-and-effect diagram for this problem.

The exhibit identifies four major categories of potential causes of failure: human factors, methods

and design factors, machine-related factors, and materials and components factors. As additional

arrows are added for each cause, the general appearance of the diagram begins to resemble a

fishbone (hence, cause-and-effect diagrams are also called *fishbone diagrams*).

Exhibit 20.8

Pareto diagram for Braganza

Fuzzy

and

unclear

copies

700

Copies are

too light

600

or too

dark

500

400

Paper

gets

Copies

300

jammed

are not

square

Toner is

Paper

200

on

not

Number of times defect observed

smudged

page

on page

feeding

100

properly

Type of defect

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Chapter 20 Strategy, the balanced scorecard and quality

Exhibit 20.9

Cause-and-effect diagram for fuzzy and unclear copies at Braganza

Methods and

Human factors

design factors

Flawed

Poor training

part design

New operator

Incorrect

Inadequate

manufacturing

supervision

sequence

Poor maintenance

Multiple suppliers

Poorly

Variation

machined parts

in purchased

components

Incorrect speed

Mishandling

Inadequate

of purchased

Incorrect

measurement

parts

component

tools

specification

Machine-related

Materials and

factors

components factors

Non-financial measures of internal-business-process quality

Companies routinely use non-financial measures to track the quality improvements they are

making. Braganza's managers use the following non-financial measures of internal-business

process quality:

● percentage of defective products manufactured

● percentage of reworked products

● number of different types of defects analysed using control charts, Pareto diagrams and cause-

and-effect diagrams

● number of design and process changes made to improve design quality or reduce the costs of

quality.

Braganza's managers believe that improving these measures will lead to greater customer satis-

faction, lower costs of quality, and better financial performance.

The learning-and-growth perspective: quality improvements

What are the learning-and-growth drivers that improve internal-business-process quality?

Braganza's managers identify the following drivers: recruiting outstanding design engineers,

training employees in quality management techniques, lowering employee turnover, and increasing

employee empowerment and satisfaction and creating a quality-first culture of identifying and

eliminating the root causes of defects. Braganza measures the following factors in the learning

and growth perspective in the balanced scorecard:

● experience and qualifications of design engineers

● employee training (percentage of employees trained in different quality-enhancing methods)

● employee turnover (ratio of number of employees who leave the company to the average total

number of employees)

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● employee empowerment (ratio of the number of processes in which employees have the author-

ity to make decisions without consulting supervisors to the total number of processes)

● employee satisfaction (ratio of employees indicating high satisfaction ratings to the total num-

ber of employees surveyed).

Careful analysis of the cause-and-effect diagram reveals that the steel frame (or chassis) of the

copier is often mishandled as it travels from the suppliers' warehouses to Braganza's plant. The

frame must satisfy very precise specifications and tolerances; otherwise, various copier com-

ponents (such as drums, mirrors and lenses) attached to the frame will be improperly aligned.

Mishandling causes the dimensions of the frame to vary from specifications, resulting in fuzzy

images.

Suppose the team of engineers working to solve the fuzzy image problem offers two alternative

solutions: (1) to improve the inspection of the frame immediately upon delivery, or (2) to redesign

and strengthen the frame and the containers used to transport them to better withstand mishan-

dling during transportation.

Should Braganza inspect incoming frames more carefully or redesign them and their con-

tainers? Exhibit 20.10 shows the costs and benefits of each choice. Management estimates that

additional inspection will cost €400 000 (€40 per hour × 10 000 hours). Redesign will cost

Exhibit 20.10

Estimated effect of quality-improvement actions on costs of quality

Incremental costs and benefits of:

Further inspecting

incoming frame

Redesigning frame

Description

(1)

(2)

Costs of quality items

Additional design engineering costs

€80 × 2 000 hours

–

€160 000

Additional process engineering costs

€60 × 5 000 hours

–

300 000

Additional inspection and testing costs

€40 × 10 000 hours

€400 000

–

Savings in rework costs

€1 600 × 600 fewer copiers reworked

(960 000)

€1 600 × 800 fewer copiers reworked

(1 280 000)

Savings in customer-support costs

€80 × 500 fewer copiers repaired

(40 000)

€80 × 700 fewer copiers repaired

(56 000)

Savings in transportation costs for repair parts

€180 × 500 fewer copiers repaired

(90 000)

€180 × 700 fewer copiers repaired

(126 000)

Savings in warranty repair costs

€1800 × 500 fewer copiers repaired

(900 000)

€1800 × 700 fewer copiers repaired

(1 260 000)

Opportunity costs

Contribution margin from increased sales

€6 000 × 250 additional copiers sold

(1 500 000)

€6 000 × 300 additional copiers sold

–

(1 800 000)

Net cost savings and additional

contribution margin

€(3 090 000)

€(4 062 000)

Difference in favour of redesigning frame

€972 000

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an additional €460 000 (design engineering, €80 per hour × 2000 hours; process engineering,

€60 per hour × 5000 hours). The potential benefits of incurring these costs are lower internal

and external failure costs. The key question here is: What are the relevant cost savings and other

relevant benefits? Braganza considers only a one-year time horizon for analysing this decision

because Braganza plans to introduce a completely new line of copiers at the end of the year.

Braganza believes that even as it improves quality, it will not be able to save any of the fixed costs

of internal and external failure. To identify the relevant cost savings, Braganza divides each cat-

egory of failure costs into its fixed and variable components.

Consider first the internal failure costs of rework. Fixed and variable costs for each reworked

copier are:

Variable costs (including direct materials, direct rework labour and supplies)

€1600

Allocated fixed costs (equipment, space and allocated overhead)

2400

Total costs (Exhibit 20.6, Panel A, column 3)

€4000

If Braganza chooses to inspect the frame more carefully, it expects to eliminate rework on

600 copiers and save variable costs of €960 000 (€1600 × 600) in rework: see Exhibit 20.10, col-

umn 1. Braganza believes that fixed rework costs will be unaffected. If Braganza chooses the rede-

sign alternative, it expects to eliminate rework on 800 copiers, saving €1280 000 (€1600 × 800):

see Exhibit 20.10, column 2.

Next consider external failure costs. Braganza currently repairs 3000 copiers at customer sites.

If incoming frames are inspected more carefully, Braganza estimates that 500 fewer copiers will

require warranty repair and that it will be able to sell 250 additional copiers. If the frame is rede-

signed, Braganza estimates that 700 fewer copiers will require warranty repair and that it will be

able to sell 300 additional copiers.

Variable and fixed costs per copier repaired of individual external failure COQ items described

in Exhibit 20.6 (Panel A, column 4) are as follows:

Variable costs

Fixed costs

Total costs

Customer-support costs

€80

€120

€200

Transportation costs

180

60

240

Warranty repair costs

1800

2600

4400

As Braganza eliminates repair work on copiers, it expects to save only the variable costs of

customer support, transportation and warranty repair.

Note that the savings per copier in cost of rework, customer-support, transportation and

warranty repair in Exhibit 20.10 differ from the costs per copier for each of these items in

Exhibit 20.6. Why? Because Exhibit 20.10 shows only the variable costs that Braganza expects to

save. Exhibit 20.6 shows the total (fixed and variable) costs of each of these items. Also note that

Exhibit 20.10 includes the incremental contribution margin from the estimated increases in sales

due to the improved quality and performance of Braganza's copiers.

Braganza's management chooses to redesign the frame since Exhibit 20.10 indicates that the net

estimated cost savings are €972 000 greater under this alternative. The costs of a poorly designed

frame appear in the form of higher manufacturing, marketing, distribution and customer-service

costs as internal and external failures begin to mount. But these costs are locked in when the frame

is designed. Thus, it is not surprising that redesign will yield significant savings.

In the Braganza example, lost contribution margin occurs because Braganza's repeated external

failures damage its reputation for quality, resulting in lost sales. Lost contribution margin can also

occur as a result of internal failures. Suppose Braganza's manufacturing capacity is fully used.

In this case, rework uses up valuable manufacturing capacity and causes the company to forgo

contribution margin from producing and selling additional copiers. Suppose Braganza could

produce (and subsequently) sell an additional 600 copiers by improving quality and reducing

rework. The costs of internal failure would then include lost contribution margin of €3 600 000

(€6000 contribution margin per copier × 600 copiers). This €3 600 000 is the opportunity cost

of poor quality.

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The learning-and-growth perspective: quality improvements

Concepts in action

Does Mercedes really stand for quality? What about Toyota?

Mercedes buyers across the world have voiced their concerns over quality problems during the past three decades. Complaints have included faulty key fobs, leaky sunroofs, faulty electronics, airbags that failed to inflate in accidents, mal-functioning navigation systems, electric window problems, automatic gearbox issues and many others. One customer who faced more than 60 mechanical problems with his C-class car, parked it in front of his dealership with a sign that read: 'Mercedes is unfair to consumers'. Web forums such as lemonmb.com, mercedesproblems.com and troublebenz.com became vocal, with customers complaining about Mercedes quality.

The Reliability Index report by Which? takes into account the number of problems car owners experienced over the 12 months prior to the report. In 2019, Mercedes was placed 30 out of 40 manufacturers in the listings. Even following a focused drive to improve its quality, Mercedes-Benz ranked 19th out of 24 car brands by J.D. Power and Associates in 2019 with 136 problems per 100 vehicles versus an industry average of 119. The number of problems

reported went up steeply from 2014.

Another car maker with a long established reputation for building high-quality cars found its reputation severely

damaged from mid-2009. As part of an aggressive growth strategy, Toyota surpassed General Motors as the world's

largest carmaker in 2008. But the company's focus on rapid growth came at a cost to its reputation for quality. Toyota

issued a dozen recalls covering defects from faulty accelerator pedals to rusted spare-tyre carriers. The company

appointed a Chief Quality Officer and restructured its reporting system to communicate defect issues in a timelier

manner. However, again in April 2014 Toyota recalled 6.5 million cars worldwide to fix a variety of problems includ-

ing faulty steering wheels and seats. The company established a quality committee, added a brake override system,

expanded quality training, and increased testing. By 2012, Toyota reclaimed the title of world's largest automaker. In

2016, Toyota confronted new quality problems but this time quickly announced the voluntary recall of 3.37 million

vehicles for possibly defective fuel tanks and air bags. Its J.D. Power and Associates rating in 2019 placed it 18th

with 134 problems per 100 vehicles, faring better than Mercedes. Quality defects can lead to huge costs of non-

conformance. Following the loss of a class action suit, Toyota in 2022 faced having to compensate buyers for a 17.5%

reduction in value of 264,170 cars sold with a defective diesel exhaust after-treatment system. This would cost the

company $2 billion.

Regaining lost reputation for quality can prove expensive for an auto company in paying fines, dealing with pay-

outs in class-action lawsuits and spending on marketing incentives. The reputational costs are difficult to quantify but

always prove to be high. The car in front is not always a Toyota – for 2019, it was Peugeot!

Sources: Taylor, A. (2010) 'How Toyota lost its way', *Fortune,* 26 July, pp. 84–90; https://europe.jdpower.com/press-releases/2019-uk-vehicle-dependability-

study; www.wolterskluwer.com/en-au/expert-insights/toyota-faces-2-billion-compensation-bill-for-defective-cars

Braganza can use its COQ report to examine interdependencies across the four categories of

quality-related costs. In our example, redesigning the frame increases costs of prevention activ-

ities (design and process engineering), decreases costs of internal failure (rework) and decreases

costs of external failure (warranty repairs). Costs of quality give more insight when managers

compare trends over time. In successful quality programmes, the costs of quality as a percentage

of sales and the costs of internal and external failure as a percentage of total costs of quality

should decrease over time. Many companies believe they should eliminate all failure costs and

have zero defects.

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Evaluating quality performance

Measuring the financial costs of quality and the non-financial aspects of quality have distinctly

different advantages. Those of costs of quality (COQ) measures are as follows:

1 COQ focuses attention on how costly poor quality can be.

2 Financial COQ measures are a useful way of comparing different quality-improvement

programmes and setting priorities for achieving maximum cost reduction.

3 Financial COQ measures serve as a common denominator for evaluating trade-offs among

prevention and failure costs. COQ provides a single, summary measure of quality performance.

The advantages of non-financial measures of quality are:

1 Non-financial measures of quality are often easy to quantify and easy to understand.

2 Non-financial measures direct attention to physical processes and hence focus attention on the

precise problem areas that need improvement.

3 Non-financial measures provide immediate short-run feedback on whether quality improve-

ment efforts have, in fact, succeeded in improving quality.

The advantages cited for COQ are disadvantages of non-financial measures and vice versa.

Most organisations use both financial and non-financial quality measures to measure quality

performance.

Summary

The following points are linked to the chapter's learning objectives.

1 Many perspectives of what strategy is exist. Strategic management accounting (SMA) places particular emphasis on

blending external with internal organisational information. SMA encompasses both financial and non-financial information.

2 Two formal strategies organisations pursue are product differentiation and cost leadership. Product differentia-

tion refers to offering products and services that are perceived by customers as being superior and unique. Cost

leadership refers to the pursuit of low costs relative to those of competitors.

3 The balanced scorecard tries to view an organisation's strategy in terms of a set of performance measures that

enable strategic performance management and measurement. It provides measure dimensions from four key

perspectives: (1) financial, (2) customer, (3) internal business process, and (4) learning and growth.

4 Four cost categories in a costs of quality programme are *prevention costs* (costs incurred in precluding the man-

ufacture of products that do not conform to specifications), *appraisal costs* (costs incurred in detecting which of

the individual products produced do not conform to specifications), *internal failure costs* (costs incurred when a

non-conforming product is detected before its shipment to customers) and *external failure costs* (costs incurred

when a non-conforming product is detected after its shipment to customers).

5 Non-financial quality measures managers can use include customer satisfaction measures such as the number of

customer complaints and percentage of defective units shipped to customers; internal business-process measures

such as the percentage of defective and reworked products; and learning-and-growth measures such as the per-

centage of employees trained in and empowered to use quality principles. Three methods that companies use to

improve quality are *control charts,* to distinguish random variations from other sources of variation in an operating

process; *Pareto diagrams,* which indicate how frequently each type of failure occurs; and *cause-and-effect diagrams,* which identify potential factors or causes of failure.

6 The relevant costs of quality improvement are the incremental costs incurred to implement the quality programme.

The relevant benefits are the savings in total costs and the estimated increase in contribution margin from the

higher sales that will result from the quality improvements.

7 Financial measures help managers evaluate the trade-offs among prevention costs, appraisal costs, and failure costs.

Non-financial measures identify problem areas that need improvement and serve as indicators of future financial

performance.

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References and further reading

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CHAPTER 20

Assessment material

Review questions

20.1 Define strategy.

20.2 Describe two generic strategies.

20.3 What are the four key perspectives in the balanced scorecard?

20.4 What is strategic management accounting?

20.5 Describe three features of a good balanced scorecard.

20.6 Describe some of the benefits of improving quality.

20.7 Name two items classified as prevention costs.

20.8 Distinguish between internal failure costs and external failure costs.

20.9 'Companies should focus on financial measures of quality because these are the only measures of

quality that can be linked to bottom-line performance.' Do you agree? Explain.

20.10 Give examples of non-financial measures of customer satisfaction.

Exercises

Basic level

***20.11 Balanced scorecard** (20 minutes)

La Quinta Ltd manufactures corrugated cardboard boxes. It competes and plans to grow by pro-

ducing high-quality boxes at a low cost that are delivered to customers in a timely manner. There

are many other manufacturers who produce similar boxes. La Quinta believes that continuously

improving its manufacturing processes and having satisfied employees are critical to implementing

its strategy in 2023.

Required

1 Is La Quinta's 2023 strategy one of product differentiation or cost leadership? Explain briefly.

2 Indicate two measures you would expect to see under each perspective in La Quinta's balanced

scorecard for 2023. Explain your answer briefly.

20.12 Strategy, balanced scorecard (30 minutes)

Meredith Ltd makes a special-purpose machine D4H used in the textile industry. Meredith has

designed the D4H machine for 2022 to be distinct from its competitors. It has been generally

regarded as a superior machine. Meredith presents the following data for the years 2021 and 2022.

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Chapter 20 Strategy, the balanced scorecard and quality

2021

2022

1 Units of D4H produced and sold

200

210

2 Selling price

£40 000

£42 000

3 Direct materials (kilograms)

300 000

310 000

4 Direct materials cost per kilogram

£8

£8.50

5 Manufacturing capacity in units of D4H

250

250

6 Total conversion costs

£2 000 000

£2 025 000

7 Conversion costs per unit of capacity

£8 000

£8 100

8 Selling and customer-service capacity

100 customers

95 customers

9 Total selling and customer-service costs

£1 000 000

£940 500

10 Selling and customer-service capacity cost per customer

£10 000

£9 900

11 Design staff

12

12

12 Total design costs

£1 200 000

£1 212 000

13 Design costs per employee

£100 000

£101 000

Meredith produces no defective machines, but it wants to reduce direct materials usage per D4H

machine in 2022. Conversion costs in each year depend on production capacity defined in terms

of D4H units that can be produced, not the actual units of D4H produced. Selling and customer-

service costs depend on the number of customers that Meredith can support, not the actual

number of customers Meredith serves. Meredith has 75 customers in 2021 and 80 customers in

2022. At the start of each year, management uses its discretion to determine the number of design

staff for the year. The design staff and costs have no direct relationship with the quantity of D4H

produced or the number of customers to whom D4H is sold.

Required

1 Is Meredith's strategy one of product differentiation or cost leadership? Explain briefly.

2 Describe briefly key elements that you would include in Meredith's balanced scorecard and the

reasons for doing so.

***20.13 Strategy, balanced scorecard, service company** (30 minutes)

Snyder & Partners is a small information systems consulting firm that specialises in helping com-

panies implement sales management software. The market for Snyder's products is very competi-

tive. To compete, Snyder must deliver quality service at a low cost. Snyder invoices clients in terms

of units of work performed, which depends on the size and complexity of the sales management

system. Snyder presents the following data for the years 2021 and 2022.

2021

2022

1 Units of work performed

60

70

2 Selling price

£50 000

£48 000

3 Software implementation labour-hours

30 000

32 000

4 Cost per software implementation labour-hour

£60

£63

5 Software implementation support capacity (in units of work)

90

90

6 Total cost of software implementation support

£360 000

£369 000

7 Software implementation support capacity cost per unit of work

£4 000

£4 100

8 Number of employees doing software development

3

3

9 Total software development costs

£375 000

£390 000

10 Software development costs per employee

£125 000

£130 000

Software implementation labour-hour costs are variable costs. Software implementation support

costs for each year depend on the software implementation support capacity (defined in terms of

units of work) that Snyder chooses to maintain each year. It does not vary with the actual units of

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work performed that year. At the start of each year, management uses its discretion to determine

the number of software development employees. The software development staff and costs have

no direct relationship with the number of units of work performed.

Required

1 Is Snyder's strategy one of product differentiation or cost leadership? Explain briefly.

2 Describe briefly key elements that you would include in Snyder's balanced scorecard and your

reasons for doing so.

***20.14 Balanced scorecard** (R. Kaplan, adapted) (40 minutes)

Caltex GmbH refines petrol and sells it through its own Caltex petrol stations.On the basis of

market research, Caltex determines that 60% of the overall petrol market consists of ‘service-

oriented customers’, medium- to high-income individuals who are willing to pay a higher price

for petrol if the petrol stations can provide excellent customer service such as a clean facility, a

convenience store, friendly employees, a quick turnround, the ability to pay by credit card, and

high-octane premium fuel. The remaining 40% of the overall market are ‘price shoppers’ who

look to buy the cheapest petrol available. Caltex’s strategy is to focus on the 60% of service-

oriented customers. Caltex’s balanced scorecard for the year 2021 is given below. For brevity, the

initiatives taken under each objective are omitted.

Target

Actual

Objectives

Measures

performance

performance

Financial perspective

Increase shareholder value

Operating profit changes from price

€90 000 000

€95 000 000

recovery

Operating profit changes from growth €65 000 000

€67 000 000

Customer perspective

Increase market share

Market share of overall petrol market

10%

9.8%

Internal business process perspective

Improve petrol quality

Quality index

94 points

95 points

Improve refinery performance

Refinery reliability index (%)

91%

91%

Ensure petrol availability

Product availability index (%)

99%

100%

Learning and growth perspective

Increase refinery process capability

Percentage of refinery processes with

88%

90%

advanced controls

Required

1 Was Caltex successful in implementing its strategy in 2021? Explain your answer.

2 Would you have included some measure of employee satisfaction and employee training in the

learning and growth perspective? Are these objectives critical to Caltex for implementing its

strategy? Why or why not? Explain briefly.

3 Explain how Caltex did not achieve its target market share in the total petrol market but still

exceeded its financial targets. Is ‘market share of overall petrol market’ the correct measure of

market share? Explain briefly.

4 Is there a cause-and-effect linkage between improvements in the measures in the internal busi-

ness process perspective and the measures in the customer perspective? That is, would you add

other measures to the internal business process perspective or the customer perspective? Why

or why not? Explain briefly.

5 Do you agree with Caltex’s decision not to include measures of changes in operating profit

from productivity improvements under the financial perspective of the balanced scorecard?

Explain briefly.

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20.15 Cost of quality programme, non-financial quality measures (15 minutes)

Zaccaria Srl manufactures automotive parts. A major customer has just given Zaccaria an edict:

‘Improve quality or no more business.’ Lorenzo Da Ponte, the controller of Zaccaria, is given the

task of developing a COQ programme. He seeks your advice on classifying each of items (a) to

(g) as (i) a prevention cost, (ii) an appraisal cost, (iii) an internal failure cost, or (iv) an external

failure cost.

a Cost of inspecting products on the production line by Zaccaria quality inspectors.

b Payment of travel costs for a Zaccaria customer representative to meet a customer who detected

defective products.

c Costs of reworking defective parts detected by Zaccaria’s quality-assurance group.

d Labour cost of the product designer at Zaccaria whose task is to design components that will

not break under extreme temperature variations.

e Cost of automotive parts returned by customers.

f Seminar costs for ‘Supplier Day’, a programme aimed at communicating to suppliers the new

quality requirements for purchased components.

g Costs of spoiled parts.

Required

1 Classify the seven individual cost items into one of the four categories of prevention, appraisal,

internal failure or external failure.

2 Give two examples of non-financial performance measures Zaccaria could monitor as part of

a total-quality-control effort.

20.16 Quality improvement, relevant costs and revenues, service (25 minutes)

Colombe-Déménagements SA is a removals company that transports household goods from

one Belgian city to another. It measures service quality in terms of (a) time required to trans-

port goods, (b) on-time delivery (within two days of agreed-upon delivery date) and (c) lost or

damaged shipments. Colombe-Déménagements is considering investing in a new scheduling and

tracking system costing €160 000 per year that should help it improve performance with respect

to items (b) and (c). The following information describes Colombe-Déménagements' current

performance and the expected performance if the new system is implemented:

Current	**Future expected**
performance	**performance**
On-time delivery performance	
85%	95%
Variable costs per carton lost or damaged	
€60	€60
Number of cartons lost or damaged per year	
3000 cartons	1000 cartons

Colombe-Déménagements expects that each percentage point increase in on-time performance

will result in sales increases of €20 000 per year. Colombe-Déménagements' contribution margin

percentage is 45%.

Required

1 What are the annual additional costs to Colombe-Déménagements of choosing the new

scheduling and tracking system?

2 What are the annual additional benefits of the new system?

3 Should Colombe-Déménagements acquire the new system?

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Intermediate level

20.17 Balanced scorecard (40 minutes)

Lee SA manufactures various types of colour laser printer in a highly automated facility with

high fixed costs. The market for laser printers is competitive. The various colour laser printers on

the market are comparable in terms of features and price. Lee believes that satisfying customers

with products of high quality at low costs is key to achieving its target profitability. For 2023, Lee

plans to achieve higher quality and lower costs by improving yields and reducing defects in its

manufacturing operations. Lee will train workers and encourage and empower them to take the

necessary actions. Currently, a significant amount of Lee's capacity is used to produce products

that are defective and cannot be sold. Lee expects that higher yields will reduce the capacity that

Lee needs to use to manufacture products. Lee does not anticipate that improving manufacturing

will automatically lead to lower costs because Lee has high fixed costs. To reduce fixed costs per

unit, Lee could lay off employees and sell equipment or use the capacity to produce and sell more

of its current products or improved models of its current products.

Lee's balanced scorecard for the just-completed financial year 2022 is shown below. For brevity,

the initiatives taken under each objective are omitted.

Target

Actual

Objectives

Measures

performance performance

Financial perspective

Increase shareholder value

Operating profit changes

€1 000 000

€400 000

from productivity

Operating profit changes

€1 500 000

€600 000

from growth

Customer perspective

Increase market share

Market share in colour

5%

4.6%

laser printers

Internal business process perspective

Improve manufacturing quality

Yield

82%

85%

Reduce delivery time to customers

Order delivery time

25 days

22 days

Learning and growth perspective

Develop process skills

Percentage of employees

90%

92%

trained in process and

quality management

Enhance information system

Percentage of

85%

87%

capabilities

manufacturing processes

with real-time feedback

Required

1 Was Lee successful in implementing its strategy in 2022? Explain.

2 Is Lee's balanced scorecard useful in helping Lee understand why it did not reach its target

market share in 2022? If it is, explain why. If it is not, explain what other measures you might

want to add under the customer perspective and why.

3 Would you have included some measure of employee satisfaction in the learning and growth

perspective and new product development in the internal business process perspective? That

is, do you think employee satisfaction and development of new products are critical to Lee for

implementing its strategy? Why or why not? Explain briefly.

4 What problems, if any, do you see in Lee's improving quality and significantly downsizing to

eliminate unused capacity?

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20.18 Balanced scorecard, ethics (40 minutes)

John Emburey, division manager of the Household Products Division, a maker of kitchen dish-

washers, has just seen the balanced scorecard for his division for the year. He immediately calls

Patricia Conley, the management accountant for the division into his office for a meeting. 'I think

the employee satisfaction and customer satisfaction numbers are way too low. These numbers are

based on a random sample of subjective assessments made by individual managers and customer

representatives. My own experience indicates that we are doing well on both these dimensions.

Until we do a formal survey of employees and customers sometime next year, I think we are

doing a disservice to ourselves and this company by reporting such low scores for employee and

customer satisfaction. These scores will be an embarrassment for us at the division managers'

meeting next month. We need to get these numbers up.'

Patricia knows that the employee and customer satisfaction scores are subjective, but the proce-

dure she used is identical to the procedures she has used in the past. She knows from the comments

she had asked for that the scores represent the unhappiness of employees with the latest work rules

and the unhappiness of customers with missed delivery dates. She also knows that these problems

will be corrected in time.

Required

1 Do you think that the Household Products Division should include subjective measures of

employee satisfaction and customer satisfaction in its balanced scorecard? Explain.

2 What should Patricia do?

20.19 Costs of quality analysis, non-financial quality measures (20 minutes)

Alcazarquivir Lda manufactures and sells industrial grinders. The following table presents finan-

cial information pertaining to quality in 2021 and 2022 (in €000):

2022

2021

Sales

€12 500

€10 000

Line inspection

85

110

Scrap

200

250

Design engineering

240

100

Cost of returned goods

145

60

Product-testing equipment

50

50

Customer support

30

40

Rework costs

135

160

Preventive equipment maintenance

90

35

Product liability claims

100

200

Incoming materials inspection

40

20

Breakdown maintenance

40

90

Product-testing labour

75

220

Training

120

45

Warranty repair

200

300

Supplier evaluation

50

20

Required

1 Classify the cost items in the table into prevention, appraisal, internal failure or external failure

categories.

2 Calculate the ratio of each COQ category to sales in 2021 and 2022. Comment on the trends

in costs of quality between 2021 and 2022.

3 Give two examples of non-financial quality measures that Alcazarquivir could monitor as part

of a total-quality-control effort.

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20.20 Quality improvement, relevant costs and relevant revenues (25 minutes)

Braganza manufactures and sells 20 000 copiers each year. The variable and fixed costs of rework-

ing and repairing copiers are as follows:

Variable costs

Fixed costs

Total costs

Rework costs per copier

€1600

€2400

€4000

Repair costs per copier

Customer-support costs

80

120

200

Transportation costs for repair parts

180

60

240

Warranty repair costs

1800

2600

4400

Braganza's engineers are currently working to solve the problem of copies being too light or too

dark. They propose changing the lens of the copier. The new lens will cost €50 more than the old

lens. Each copier uses one lens. Braganza uses a one-year time horizon for this decision, since it

plans to introduce a new copier at the end of the year. Braganza believes that even as it improves

quality, it will not be able to save any of the fixed costs of rework or repair.

By changing the lens, Braganza expects that it will (1) rework 300 fewer copiers, (2) repair 200

fewer copiers and (3) sell 100 additional copiers. Braganza's unit contribution margin on its exist-

ing copier is €6000.

Required

1 What are the additional costs of choosing the new lens?

2 What are the additional benefits of choosing the new lens?

3 Should Braganza use the new lens?

20.21 Quality improvement, relevant costs and relevant revenues (30 minutes)

Carmody Ltd sells 300 000 V262 valves to the car and truck industry. Carmody has a capacity

of 110 000 machine-hours and can produce three valves per machine-hour. V262's contribution

margin per unit is €8. Carmody sells only 300 000 valves because 30 000 valves (10% of the good

valves) need to be reworked. It takes one machine-hour to rework three valves so that 10 000 hours

of capacity are lost in the rework process. Carmody's rework costs are €210 000. Rework costs

consist of:

Direct materials and direct rework labour (variable costs)

€3 per unit

Fixed costs of equipment, rent and overhead allocation

€4 per unit

Carmody's process designers have come up with a modification that would maintain the speed

of the process and would ensure 100% quality and no rework. The new process would cost

€315 000 per year. The following additional information is available:

● The demand for Carmody's V262 valves is 370 000 per year.

● Clohisey has asked Carmody to supply 22 000 T971 valves if Carmody implements the new

design. The contribution margin per T971 valve is €10. Carmody can make two T971 valves

per machine-hour on the existing machine with 100% quality and no rework.

Required

1 Suppose Carmody's designers implemented the new design. Should Carmody accept Clohisey's

order for 22 000 T971 valves? Explain.

2 Should Carmody implement the new design?

3 What non-financial and qualitative factors should Carmody consider in deciding whether to

implement the new design?

20.22 Ethics and quality (30–35 minutes)

Anna-Greta Lantto, the assistant controller of Kiruna AB had recently prepared the following

quality report comparing 2022 and 2021 quality performances.

	2022	**2021**
Sales	€90 000 000	€80 000 000
Online inspection	€700 000	€600 000
Warranty liability	€2 250 000	€3 600 000
Product testing	€2 000 000	€1 000 000

Scrap

€2 700 000

€2 000 000

Design engineering

€1 800 000

€800 000

Percentage of customers

3%

4%

complaining about quality

Just two days after preparing the report, Lars Törnman, the controller, had called Lantto into

his office. ‘Our plant manager, Sven Töyr, is quite upset with the recent costs of quality and non-

financial measures of quality reports that you prepared. He feels his workers have made significant

progress in improving quality at the plant but that our reports are just not showing this. He wants

to apply for various quality awards that would bring a lot of prestige to Kiruna, but he obviously

cannot do so on the basis of the numbers we are reporting. Can you look over these quality num-

bers and see what you can do? I think Sven has a point. Nobody wants Kiruna to miss out on all

the wonderful press we'd get if we won one of these quality awards.' Lantto is quite certain that

her numbers are correct. Yet she would very much like Kiruna to win these prestigious quality

awards. She is confused about how to handle Törnman's request.

Required

1 Calculate the ratio of each costs of quality category (prevention, appraisal, internal failure and

external failure) to sales in 2021 and 2022.

2 What do the reports indicate about the plant's quality performance?

3 Is Lars Törnman's suggestion to Lantto to recalculate her quality numbers unethical? Would it

be unethical for Lantto to modify her analysis? What steps should Lantto take to resolve this

situation?

Advanced level

***20.23 Statistical quality control, airline operations** (30–40 minutes)

Air Gascogne operates daily round-trip flights on the Toulouse–Stockholm route using a fleet of

three 747s, the Eclair des Cévennes, the Eclair des Vosges and the Eclair des Alpilles. The budg-

eted quantity of fuel for each round-trip flight is the mean (average) fuel usage. Over the last

12 months, the average fuel usage per round-trip is 1000 litre-units with a standard deviation of

100 litre-units. A litre-unit is 1000 litres.

Gervaise Plassans, the operations manager of Air Gascogne, uses a statistical quality control

(SQC) approach in deciding whether to investigate fuel usage per round-trip flight. She investigates

those flights with fuel usage greater than two standard deviations from the mean.

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Exercises

In October, Plassans receives the following report for round-trip fuel usage by the three planes

operating on the Toulouse–Stockholm route:

Eclair des

Eclair des

Eclair des

Cévennes

Vosges

Alpilles

Flight

(litre-units)

(litre-units)

(litre-units)

1

1040

1030

970

2

940

940

1040

3

970

960

1110

4

1010

1070

1040

5

1050

920

1220

6

1070

1130

1180

7

1110

990

1260

8

1120

1060

1140

9

1150

1010

1170

10

1190

930

1230

Required

1 Using the ±2 σ rule, what variance investigation decisions would be made?

2 Present SQC charts for round-trip fuel usage for each of the three 747s in October. What

inferences can you draw from them?

3 Some managers propose that Air Gascogne present its SQC charts in monetary terms rather

than in physical quantity terms (litre-units). What are the advantages and disadvantages of

using euro fuel costs rather than litre-units in the SQC charts?

20.24 Question from ACCA Performance Management, Section B, December 2014 *(40 minutes)*

Jamair was founded in September 2007 and is one of a growing number of low-cost airlines in

the country of Shania. Jamair's strategy is to operate as a low-cost, high-efficiency airline, and it

does this by:

● Operating mostly in secondary cities to reduce landing costs.

● Using only one type of aircraft in order to reduce maintenance and operational costs. These

planes are leased rather than bought outright.

● Having only one category of seat class.

● Having no pre-allocated seats or in-flight entertainment.

● Focusing on e-commerce with customers both booking tickets and checking in for flights

online.

The airline was given an ‘on-time arrival’ ranking of seventh best by the country’s aviation author-

ity, who rank all 50 of the country’s airlines based on the number of flights which arrive on-time at

their destinations. 48 Jamair flights were cancelled in 2013 compared to 35 in 2012. This increase

was due to an increase in the staff absentee rate at Jamair from 3 days per staff member per year

to 4–5 days.

The average ‘ground turnaround time’ for airlines in Shania is 50 minutes, meaning that, on aver-

age, planes are on the ground for cleaning, refuelling, etc. for 50 minutes before departing again.

Customer satisfaction surveys have shown that 85% of customers are happy with the standard

of cleanliness on Jamair's planes.

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The number of passengers carried by the airline has grown from 300 000 passengers on a total

of 3428 flights in 2007 to 920 000 passengers on 7650 flights in 2013. The overall growth of the

airline has been helped by the limited route licensing policy of the Shanian government, which

has given Jamair almost monopoly status on some of its routes. However, the government is now

set to change this policy with almost immediate effect, and it has become more important than

ever to monitor performance effectively.

Required

1 Describe each of the four perspectives of the balanced scorecard.

2 For each perspective of the balanced scorecard, identify one goal together with a corresponding

performance measure which could be used by Jamair to measure the company's performance.

The goals and measures should be specifically relevant to Jamair. For each pair of goals and

measures, explain why you have chosen them.

20.25 Question from CIMA Performance Management, section A, November 2014 (20 minutes)

YY is a large banking organisation. It has a branch in most of the towns in the country in which

it operates. The bank's business is mainly concerned with private individuals. It is a very 'tradi-

tional' bank that offers only 'over the counter' services during limited opening hours.

At a recent board meeting, the directors of the bank stated that they were worried that the bank

was losing customers to the new style banks that offer a much more friendly service, longer open-

ing hours, internet banking and a diverse range of banking services.

It has now been decided that the bank will pursue strategies to achieve the goal of being 'The bank

that people choose' and will use a balanced scorecard to monitor progress towards that goal.

Required

Produce, for each of the three non-financial perspectives of a balanced scorecard, an objective and

a performance measure that the bank could use. (In your answer you must state each perspective,

and the objective and performance measure for that perspective and explain why they support

the goal of YY becoming ‘The bank that people choose’.)

20.26 Question from CIMA Performance Management, section A, September 2014 *(20 minutes)*

TSH provides courses for students who are studying for accountancy examinations. The account-

ancy education sector is extremely competitive; it is dominated by a small number of national

organisations but there is also a large number of smaller regional training providers.

The majority of TSH students are part-time students and fit their studies around their employ-

ment. TSH has developed a reputation for understanding its students’ needs and delivering a

high-quality service that meets their requirements.

TSH has grown in recent years from a small regional company to a position where it now has col-

leges in several of the country’s large cities. The company directors now wish TSH to grow further

and have implemented a strategy to achieve the objective of becoming ‘the largest accountancy

study provider in the country’.

TSH’s Board of Directors currently uses financial reports to monitor the company’s performance

but are thinking about implementing a balanced scorecard approach to performance management.

Required

1 Explain the disadvantages of using financial performance indicators alone to assess

performance.

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2 Explain TWO non-financial performance measures, each from a different perspective of the

balanced scorecard, which TSH could use to measure the performance of the business against

the new strategy. (You must state the perspectives that your measures relate to and explain why

the measures would be effective.)

20.27 Question from CIMA Performance Management, section A, May 2014 *(20 minutes)*

AST is a grocery and general merchandise retail group. AST has supermarkets located in most

towns and cities in its home country. Over the last few years, profits have fallen and AST has

recognised that it has paid insufficient attention to customer care.

AST has now realised the importance of the customer experience at its supermarkets. In an attempt

to earn the loyalty of its customers, AST has introduced a loyalty card scheme that rewards cus-

tomers with discount vouchers based on their spend and buying patterns at supermarkets.

The management of AST is considering the introduction of a balanced scorecard approach to

manage the performance of its stores.

Required

Recommend an objective and a suitable performance measure for each of three non-financial

perspectives of a balanced scorecard that AST could use to support its new strategy of improving

the customer experience.

Note: in your answer you should state three perspectives and then recommend with reasons an

objective and a performance measure for each one of your three perspectives.

20.28 Questions from CIMA Performance Management, section A, March 2014 (20 minutes)

PB is a car production company. PB uses a system of standard costing to set its budgets. Budgets

are set annually by the Finance department and approved by the Board of Directors of PB. The

Finance department prepares variance reports each month for review at the Board of Directors

meeting, where actual performance is monitored by comparison to budgeted figures.

A new Finance Director has recently joined PB from a competitor organisation where there was

a Total Quality Management culture. The new Finance Director of PB is keen to discuss the

implementation of Kaizen costing at the next meeting of the Board of Directors. The new Finance

Director would like to review the current planning and control system at PB with a view to making

changes so that it could support Kaizen costing concepts.

Required

1 Explain TWO basic principles of Total Quality Management.

2 Explain THREE changes required to PB's planning and control system to support the adoption

of Kaizen costing concepts.

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CHAPTER 21

Accounting, time and efficiency

Enterprises have to manage costs in the context of a variety of constraints.

Time has always been of the essence for organisations and so this extends

Learning objectives

to management accounting. When is the best time for materials or merchandise to be purchased? How should purchasing arrangements

After studying this chapter, you

with suppliers be structured? What is the best way to handle materials should be able to:

or merchandise once received? Are there essential trade-offs between

- Describe a just-in-time (JIT)

ordering and carrying and storage costs? Stock management is a major production system

part of profit planning for manufacturing and merchandising companies. Material costs often account for more than 40% of total costs of

- Identify the major features of a JIT

manufacturing companies and over 70% of total costs in merchandising production system

companies. In this chapter, we look at just-in-time production and

- Describe journal entries for

purchasing issues and we consider how some firms manage efficiency

backflush-costing systems

issues and profit pursuits when faced with different constraints.

- Explain the economic order quantity (EOQ) decision model and how it balances ordering costs and carrying costs
- Explain the reorder point and safety stocks
- Compare EOQ and JIT purchasing models
- Determine the relevant benefits and relevant costs in JIT purchasing and JIT production
- Define the three main measurements in the theory of

constraints

- Explain how to manage bottlenecks
- Explore time-based measures using the balanced scorecard framework

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Major features of JIT production systems

Just-in-time systems

Just-in-time (JIT) refers to a system in which materials arrive exactly as they are needed. Demand drives the procurement or production of any needed materials and immediate delivery eliminates waiting times and the need for stock. Managers in such companies as Renault in France, AT&T in the USA, Honda Motors in Japan, Siemens in Germany, Cummins Engines in the UK and

DAF Trucks in Holland, which have implemented just-in-time systems, believe stock is waste that

should be minimised and even eliminated through careful planning. A key element of a just-in-

time system is *just-in-time production.*

Just-in-time production is a mechanism in which each component on a production line is pro-

duced immediately as needed by the next step in the production line. In a JIT production line,

manufacturing activity at any particular workstation is prompted by the need for that station's

output at the following station. Demand triggers each step of the production process, starting

with customer demand for a finished product at one end of the process and working all the way

back to the demand for direct materials at the other end of the process. In this way, demand

pulls a product through the production line. The demand-pull feature of JIT production sys-

tems achieves close coordination among work centres. It smooths the flow of goods, despite low

quantities of stock.

There are many ways to implement the demand-pull feature of JIT production, but perhaps

the most common is a kanban system. *Kanban* is the Japanese term for a visual record or card.

In the simplest kanban system, workers at one operation use a kanban card to signal those at

another operation to produce a specified quantity of a particular part. For example, suppose the

assembly department of a silencer manufacturer receives an order for ten silencers. The assem-

bly department triggers production of the ten metal pipes it needs to make the ten silencers by

sending a kanban card to the machining department. Only after receiving the kanban card does

the machining department begin production of the pipes. When production is complete, the

machining department attaches the kanban card to the box containing the metal pipes and ships

the package downstream to the assembly department. The assembly department starts the cycle

over again when it receives the next customer order.

Major features of JIT production systems

There are five main features in a JIT production system:

1 Production is organised in manufacturing cells, a grouping of all the different types of equip-

ment used to manufacture a given product.

2 Workers are trained to be multiskilled so that they are capable of performing a variety of

operations and tasks.

3 Total quality management is aggressively pursued to eliminate defects.

4 Emphasis is placed on reducing *set-up time,* which is the time required to get equipment, tools

and materials ready to start the production of a component or product, and *manufacturing*

lead time, which is the time from when an order is ready to start on the production line to when

it becomes a finished good.

5 Suppliers are carefully selected to obtain delivery of quality-tested parts in a timely manner.

Organising manufacturing cells

Conventional manufacturing plants generally have a *functional layout,* in which machines that

perform the same function are located in the same area or department. JIT plants, however,

organise machines in cells designed around products. Different types of machines that perform

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different functions needed to manufacture a product, or a family of products, are placed close to

each other. Materials move from one machine to another where various operations are performed

in sequence. Incoming and outgoing material stock points for individual cells are located near the

cell rather than at a central location. Cells reduce materials handling costs. Forklifts and forklift

operators are no longer needed to transport materials between central storerooms and between

departments as in conventional manufacturing. Instead, workers or small conveyor belts carry

materials from one cell station to the next.

Consider the manufacture of metal pipes for silencer assembly described earlier. Exhibit 21.1

contrasts the functional layout in conventional manufacturing with the cell layout in JIT plants in

this case. Note the U-shaped layout of the cell. This layout ensures that all machines and workers

are located near each other. Multiskilled workers may then be able to operate more than one

machine.

Exhibit 21.1

Comparing layouts of conventional manufacturing and JIT

plants for the manufacture of metal pipes

Functional layout in a conventional manufacturing plant

Materials for

Department 1

steel pipes

Department 2

Department 3

Steel pipes

Cutting

Galvanised

Grinding

Forming

Materials for

machines

pipes

machines

machines

galvanised

pipes

Product-oriented layout in a JIT plant

Cell to manufacture steel pipes

Cell to manufacture galvanised pipes

Grinding

Grinding

machine

machine

Forming

Forming

Cutting

machine

Cutting

machine

machine

machine

Steel

Galvanised

Materials for

pipes

Materials for

pipes

steel pipes

galvanised pipes

Multiskilled workers

Workers in a cell are trained to perform all operations within the cell. Workers can then be

assigned to different machines as needed to achieve smooth production flow. Workers are also

trained and expected to perform minor repairs and do routine maintenance. Quality testing and

inspection are also the responsibility of the workers in a cell rather than of a quality assurance

department.

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Total quality management

If a worker at any cell discovers a defect, he or she must set off an alarm to alert others of the

problem and that operation is shut down. Because of the dynamics of the demand-pull system,

when one operation shuts down, all production shuts down until the problem is solved. JIT cre-

ates an urgency for solving problems immediately and eliminating the root causes of defects as

quickly as possible. Therefore, total quality management is an essential component of any JIT

production system.

In contrast, in many traditional production systems, extra parts and sub-assemblies are held at

workstations in anticipation of shortages or production breakdowns. These stocks can service a

downstream operation even if a defect occurs. Consequently, there is less need for and emphasis

on preventing rework and spoilage relative to JIT systems.

Reducing manufacturing lead time and set-up time

Reducing manufacturing lead time enables a company to respond better to changes in customer

demand. For example, a short manufacturing lead time enables Siemens to rapidly restock those

models of mobile phones that, at any given time, are the most popular with consumers. An

important aspect of reducing manufacturing lead time is reducing set-up time. When set-up time

is long, plant managers tend to manufacture many units of a product because they want to spread

the costs of the set-up over as many units as possible. The higher production causes stock to build

up until such time as the units are sold.

Reducing set-up time makes production in smaller batches economical and worthwhile, which

in turn reduces stock levels. Companies use multiple approaches to reduce set-up time. One

way is to use manufacturing cells dedicated to the manufacture of a product or product family

Concepts in action

Just-in-time live-concert recordings

Each year, millions of music fans flock to see concerts from artists ranging from Billie Eilish to Bruce Springsteen.

When fans stop by the merchandise stand to pick up a T-shirt or poster after the show ends, they often have another

option: buying a processional recording of the concert they just saw! Just-in-time production, enabled by advances

in technology, now allows fans to relive the live-concert experience just a few minutes after the final chord is played.

During the album and CD era, live-concert recordings were hampered by production and distribution difficulties.

Live albums typically sold few copies, and retail outlets that profited from volume-driven merchandise turnover, like

Best Buy, were reluctant to carry them. In today's digital music environment, however, instant live recordings are

highly valued by fans.

Several companies, including Aderra, Nugs.net and Set.fm, use microphones, state-of-the-art recording and audio

mixing hardware and software, and an army of high-speed computers to produce concert recordings during the

show. As soon as each song is complete, engineers burn that track onto hundreds of flash drives and Micro SD cards.

At the end of the show, they only have to burn one last song. Once completed, the recordings are packaged and

rushed to merchandise stands throughout the venue for instant sale. Many artists also sell the recordings via online

download, creating another revenue stream from fans who were not at the show. With artists and music publishers

starting to crack down on unauthorised concert bootlegs posted on YouTube and elsewhere, just-in-time recordings

allow musicians to provide fans with high-quality memories of their concerts while creating another revenue stream

in today's music business.

Sources: 'On the concert circuit, rock is king' (2018) *The Wall Street Journal,* 4 October (https://www.wsj.com/articles/rap-is-huge-but-on-the-concert-circuit-

rock-is-king-1538575751); Knopper, S. (2012) 'Nine ways musicians actually make money yoday', *Rolling Stone*, 28 August (www.rollingstone.com/music/

lists/9-ways-musicians-actually-make-money-today-20120828/instant-concert-recordings-19691231); Stilwell, R. and Cox, M. (2017) 'Phone recordings of concerts are more than just annoying, they're potentially illegal: guest post', *Billboard,* 17 March (https://www.billboard.com/pro/vnue-acquires-set-fm-

from-pledge-music/); Hu, C. (2017) 'VNUE acquires live music distribution platform Set.fm from PledgeMusic', *Billboard,* 17 October

(https://www.billboard.

com/articles/business/8005727/vnueacquires-set-fm-from-pledge-music); Iahn, B. (2018) 'Rob Thomas offering instant live recordings via VNUE', The

Music Universe.com, 3 January (https://themusicuniverse.com/rob-thomas-offering-instant-live-recordings-via-vnue/); http://aderra.net/.

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rather than multiple products. Another way is to improve set-up processes and train workers to

do set-ups more quickly. By far the most important way, however, is to automate the set-up and

production process by investing in *computer-integrated manufacturing* (CIM) (see Bhimani and

Bromwich, 2010). In CIM plants, computers give instructions that automatically set-up and run

equipment.

Strong supplier relationships

Many companies implementing JIT production also implement *JIT purchasing*. Just-in-time

purchasing is the purchase of goods or materials such that delivery immediately precedes demand

or use. JIT plants expect JIT suppliers to provide high-quality goods and make frequent deliveries

of the exact quantities specified on a timely basis. Suppliers often deliver materials directly to the

plant floor to be immediately placed into production. Consequently, JIT plants require suppliers

to inspect their own goods and guarantee their quality. These procedures completely eliminate

the non-value-adding costs of incoming inspection, storage, stock and materials handling and

this saves the JIT purchaser money.

Strong relationships with suppliers are a critical component of JIT purchasing because pro-

duction stops if a supplier fails to deliver materials on time. Building partnerships with suppliers

is time consuming and costly. It entails the negotiation of long-run contracts so that minimal

paperwork is involved in each individual transaction. A single telephone call or computer entry

via an electronic link triggers the delivery of material. Hence, JIT companies choose to work with

only a few reliable and dependable suppliers. Since JIT purchasing demands a lot from supplier

companies, many suppliers are unable to provide the needed service levels.

Financial benefits of JIT

JIT tends to focus broadly on the control of *total manufacturing costs* instead of individual costs

such as direct manufacturing labour. For example, idle time may rise because production lines are

starved of materials more frequently than before. Nevertheless, many manufacturing costs will

decline. JIT can provide many financial benefits, including:

- lower investment in stocks
- reductions in carrying and handling costs of stocks
- reductions in risk of obsolescence of stocks
- lower investment in plant space for stocks and production
- reductions in set-up costs and total manufacturing costs
- reduction in costs of waste and spoilage as a result of improved quality
- higher revenues as a result of responding faster to customers
- reductions in paperwork.

Exhibit 21.2 summarises the effects Hewlett-Packard reported after adopting JIT at several of

its production plants.

Product-costing benefits of JIT

In reducing the need for materials handling, warehousing, inspection of supplies and other activ-

ities, JIT systems reduce overhead costs. JIT systems also facilitate the direct tracing of some

costs that were formerly classified as overhead. For example, the use of manufacturing cells makes

it easy to trace materials handling and machine operating costs to specific products or product

families made in specific cells. These costs then become direct costs of those products. Also, the

use of multiskilled workers in these cells allows the costs of set-up, minor maintenance and quality

inspection to become easily traced, direct costs.

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Exhibit 21.2

The effects of JIT production at Hewlett-Packard

Just-in-time

production

Heightened awareness

of problems and

problem causes

Faster feedback

on defects

Ideas for

Ideas for

Ideas for

cutting

improving

controlling

production

JIT delivery

defects

run quantities

performance

Production run

Faster

Scrap,

quantity

delivery

quality control

reductions

Lower indirect costs for:

Less

interest on idle stock,

Fewer

Less

stock

space and equipment to

rework

materials

in the

handle stock,

labour-hours

waste

system

stock accounting,

physical stock control

Less materials, labour and indirect inputs for the same or higher output = higher productivity

Less stock in the system = faster market response to changed demand

Less detailed accounting and physical records = lower staff costs

Enterprise resource planning (ERP) systems

The success of a JIT system hinges on the speed of information flows from customers to manu-

facturers to suppliers. Information flows is a problem for large companies that have fragmented

information systems (for sales, manufacturing and purchasing) spread over dozens of unlinked

computer systems. The enterprise resources planning (ERP) system comprises a single database

that collects data and feeds it into applications supporting all of a company's business activi-

ties. For example, using an ERP system, a salesperson can generate a contract for a customer in

Germany, verify the customer's credit limits and place a production order. The system schedules

manufacturing in, say, Brazil; requisitions materials from inventory, orders components from

suppliers; and schedules shipment. It also credits sales commissions to the salesperson and records

all the costing and financial accounting information.

ERP systems give low-level managers, workers, customers and suppliers access to operating

information. This benefit, coupled with tight coordination across business function, enables ERP

systems to rapidly shift manufacturing and distribution plans in response to changes in supply and

demand. Companies believe that an ERP system is essential to support JIT initiatives because of

the effect it has on lead times. Using an ERP system, Autodesk, a maker of computer-aided design

software, reduced order lead times from 2 weeks to 1 day; Fujitsu reduced lead times from 18 to

1.5 days. ERP systems also help in demand forecasting and materials requirements planning as

part of their operations and logistics modules.

Although the tight coupling of systems throughout a business streamlines administrative and

financial processes and saves costs, it can also make the system large and unwieldly. Because of

its complexity, suppliers of ERP systems such as SAP, Sage, Microsoft dynamics and Oracle pro-

vide software packages that are standard, but that can be customised, although at some cost. In

recent years, providers of ERP systems have increasingly been offering cloud-based products and

providing the software as a service. Cloud-based products require less upfront investment and

can be adapted more easily than previous generations of ERP systems, which required customers

to purchase licences and to make hardware investments.

Concepts in action

How big data and machine learning helps with stock management

Big data and machine learning help firms increase profit through enhanced stock management. Companies analyse

huge amounts of data in real time to identify patterns, correlations, and relationships that affect important stock

decisions, such as when to order stock, how many items of stock to order, where to ship stock, and so on. Walmart,

the globe's biggest retailer with sales in 2022 of $572.8 billion has one of the world's largest and most complex supply

chains. Walmart CEO, Doug McMillon believes that: 'The internet of things, drones, delivery robots, 3D-printing and

self-driving cars will allow retailers to further automate and optimize supply chains.'

The company uses drones in its massive warehouses to improve inventory management. Walmart has also created

a standard way for suppliers to share data to create a rich database to improve customer experience, hone product

selection, and offer more competitive pricing, especially online. For example, Walmart analyses information on about

1000 types of mint toothpaste to determine which three or four tubes to sell. Similar, high-quality data leads to more

targeted customer recommendations. Data on previous films watched, lists of awards won, and other details about

each film helps Walmart make accurate predictions and recommend a curated list of films a customer will enjoy. Big

data also helps Walmart with online pricing decisions. If a competitor, for example, offers a pair of red running shoes

for $199 while Walmart is selling a similar item for $239, Walmart mines detailed product descriptions of the two pairs

of shoes within its big data ecosystem to match attributes, features, and quality to help decide whether to reprice the

shoes. Walmart also is able to achieve sales through suggesting products to customers. The company leverages deep

learning AI to explore hundreds of variables – size, type, brand, price, aggregate shopper data, individual customer

preference, current inventory and more. Its substitution tool can deliver a product recommendation for substitution

within seconds. The result is that customer acceptance of substitutions is over 95%.

IBM's Watson enables companies to harness the power of artificial intelligence and turn data into new ways of

doing business. Walmart recognises that weather is a major determinant to what consumers buy, as well as where

and when they do their shopping. Walmart uses data from Wilson on weather predictions to help determine supply

chain availability and demand. Watson not only accesses weather data from disparate stations, but also uses news

feeds and social media to create a picture of likely conditions.

Source: Praveen, K.B, Prateek, J., Kumar, P. Pragathi, G. (2020) Inventory Management Using Machine Learning, *International Journal of Engineering Research*

& Technology, 9(6) (https://www.ijert.org/research/inventory-management-using-machine-learning-IJERTV9IS060661.pdf); Mixon, E. (2021) 'Walmart's new weapon in its fight against Amazon: Artificial Intelligence', AI Data & Analytics Network, 11 February (https://www.aidataanalytics.network/data-science-ai/

articles/walmarts-new-weapon-in-its-fight-against-amazon-artificial-intelligence-ai).

Backflush costing

A unique production system such as JIT leads to its own unique costing system. Organising

manufacturing in cells, reducing defects and manufacturing lead time and ensuring timely delivery

of materials enables purchasing, production and sales to occur in quick succession with minimal

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stocks. The absence of stocks makes choices about cost-flow assumptions (such as weighted-

average or first-in, first-out) or stock costing methods (such as absorption or variable costing)

unimportant – all manufacturing costs of a period flow directly into cost of goods sold. The rapid

conversion of direct materials to finished goods that are immediately sold simplifies job costing.

Simplified normal or standard job costing

Traditional normal and standard costing systems (discussed in Chapters 3, 15 and 16) use sequen-

tial tracking (also called synchronous tracking), which is any product-costing method in which the

accounting system entries occur in the same order as actual purchases and production. These

traditional systems track costs sequentially as products pass from direct materials, to work in

progress, to finished goods and finally to sales. Sequential tracking is often expensive, especially

if management tries to track direct materials requisitions and labour time tickets to individual

operations and products.

An alternative to the sequential tracking approach in many costing systems is to delay the

recording of journal entries until after the physical sequences have occurred. The term backflush

costing (also called delayed costing**,** endpoint costing or post-deduct costing) describes a costing

system that delays recording changes in the status of a product being produced until good finished

units appear; it then uses budgeted or standard costs to work backwards to flush out manufactur-

ing costs for the units produced. An extreme form of such delay is to wait until sale of finished

units has occurred. Typically, no record of work in progress appears in backflush costing.

In companies that adopt backflush costing, the following occurs:

1 Management wants a simple accounting system. Detailed tracking of direct costs through each

step of the production system to the point of completion is deemed unnecessary.

2 Each product has a set of budgeted or standard costs.

3 Backflush-costing reports approximately the same financial results as sequential tracking would

generate.

If stocks are low, managers may not believe it worthwhile to spend resources tracking costs

through Work in Progress, Finished Goods and Cost of Goods Sold. Backflush costing, therefore,

is especially attractive in companies that have low stocks resulting from JIT. Backflush costing

and sequential tracking will also produce approximately the same results, however, when stock

is present, provided stocks maintain stable values. Constant amounts of costs will be deferred in

stock each period.

The following examples illustrate backflush costing. To underscore basic concepts, we assume

no direct materials variances in any of the examples. (We do, however, discuss variances in a

separate section following Example 21.1.) These examples differ in the number and placement

of points at which journal entries are made in the accounting system to accumulate production

costs of units (also called trigger points):

Number of journal

entry trigger points

Location of journal entry trigger points

Example 21.1

2

1 Purchase of direct materials (also called raw

materials)

2 Completion of good finished units of product

Example 21.2

2

1 Purchase of raw materials

2 Sale of good finished units of product

Example 21.3

1

1 Completion of good finished units of product

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Example 21.1

Trigger points are materials purchases and finished goods completion

This example uses two trigger points to illustrate how backflushing can eliminate the need for a separate

Work in Progress account. A hypothetical company, Henley-on-Thames Computer (HTC), produces key-

boards for personal computers. For April, there were no opening stocks of raw materials. Moreover, there

is zero opening and closing work in progress.

HTC has only one direct manufacturing cost category (direct or raw materials) and one indirect man-

ufacturing cost category (conversion costs). All labour costs at the manufacturing facility are included in

conversion costs. From its bill of materials (description of the types and quantities of materials) and an

operations list (description of operations to be undergone), HTC determines the April standard direct mate-

rials costs per keyboard unit of €19 and the standard conversion costs of €12. HTC has two stock accounts:

Type

Account title

Combined direct materials and any direct

Stock: Raw and In-Progress Control

materials in work in progress

Finished goods

Finished Goods Control

Trigger point 1 occurs when materials are purchased. These costs are charged to Stock: Raw and

In-Progress Control.

Actual conversion costs are recorded as incurred under backflush costing, just as in other costing sys-

tems and charged to Conversion Costs Control. Conversion costs are allocated to products at trigger point

2 – the transfer of units to Finished Goods. This example assumes that under- or overallocated conversion

costs are written off to cost of goods sold monthly.

HTC takes the following steps when assigning costs to units sold and to stocks.

Step 1: Record the direct materials purchased during the accounting period

Assume April purchases of €1 950 000:

Entry (a) Stock: Raw and In-Progress Control

1 950 000

Creditors Control

1 950 000

Step 2: Record the incurrence of conversion costs during the accounting period

Assume that conversion costs are €1 260 000:

Entry (b) Conversion Costs Control

1 260 000

Various accounts (such as, Creditors

1 260 000

Control and Wages Payable)

Step 3: Determine the number of finished units manufactured during the accounting period

Assume that 100 000 keyboard units were manufactured in April.

Step 4: Calculate the budgeted or standard costs of each finished unit

The standard cost is per unit.

Step 5: Record the cost of finished goods completed during the accounting period

In this case, 100 000 units 100 000 unit × €31 = €3 100 000. This step gives backflush costing its name.

Up to this point in the operations, the costs have not been recorded sequentially with the flow of product

along its production route. Instead, the output trigger reaches back and pulls the standard costs of direct

materials from Stock: Raw and In-Progress Control and the standard conversion costs for manufacturing

the finished goods.

Entry (c) Finished Goods Control

3 100 000

Stock: Raw and In-Progress Control

1 900 000

Conversion Costs Allocated

1 200 000

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Step 6: Record the cost of goods sold during the accounting period

Assume that 99 000 units were sold in April (99 000 units × €31 = €3 069 000).

Entry (d) Cost of Goods Sold

3 069 000

Finished Goods Control

3 069 000

Step 7: Record under- or overallocated conversion costs

Actual conversion costs may be under- or overallocated in any given accounting period. Chapter 11 dis-

cussed various ways to account for under- or overallocated manufacturing overhead costs. Many compa-

nies write-off underallocations or overallocations to cost of goods sold only at year-end; other companies,

like HTC, do so monthly. Companies that use backflush costing typically have low stocks, so proration of

under- or overallocated costs between finished goods and cost of goods sold is less often necessary. The

journal entry for the €60 000 difference between actual conversion costs incurred and standard conversion

costs allocated would be:

Entry (e) Conversion Costs Allocated

1 200 000

Cost of Goods Sold

60 000

Conversion Costs Control

1 260 000

The April closing stock balances are:

Stock: Raw and In-Progress Control

€50 000

Finished Goods, 1000 units × €31

31 000

Total stocks

€81 000

Exhibit 21.3, Panel A, summarises the journal entries for this example. Exhibit 21.4 provides an overview

of this version of backflush costing. The elimination of the typical Work in Progress account reduces the

amount of detail in the accounting system. Units on the production line may still be tracked in physical

terms, but there is ‘no attaching of costs’ to specific work orders as they flow along the production cycle.

In fact, there are no work orders or labour time tickets in the accounting system.

Exhibit 21.3

Journal entries in backflush costing (€)

Panel A: Example 21.1. Two trigger points – purchases of raw materials and finished units produced

Transactions

a Purchases of raw materials

Stock: Raw and In-Progress Control

1 950 000

Creditors Control

1 950 000

b Incur conversion costs

Conversion Costs Control

1 260 000

Various Accounts

1 260 000

c Finished units produced

Finished Goods Control

3 100 000

Stock: Raw and In-Progress Control

1 900 000

Conversion Costs Allocated

1 200 000

d Finished units sold

Cost of Goods Sold

3 069 000

Finished Goods Control

3 069 000

e Under- or overallocated

Conversion Costs Allocated

1 200 000

conversion costs

Cost of Goods Sold

60 000

Conversion Costs Control

1 260 000

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Exhibit 21.3

continued

Panel B: Example 22.2. Two trigger points – in purchases of raw materials and finished units sold

Transactions

a Purchases of raw materials

Stock Control

1 950 000

Creditors Control

1 950 000

b Incur conversion costs

Conversion Costs Control

1 260 000

Various Accounts

1 260 000

c Finished units produced

No entry

d Finished units sold

Cost of Goods Sold

3 069 000

Stock Control

1 881 000

Conversion Costs Allocated

1 188 000

e Under- or overallocated

Conversion Costs Allocated

1 188 000

conversion costs

Cost of Goods Sold

72 000

Conversion Costs Control

1 260 000

Panel C: Example 21.3. One trigger point – finished units produced

Transactions

a Purchases of raw materials

No entry

b Incur conversion costs

Conversion Costs Control

1 260 000

Various Account

1 260 000

c Finished units produced

Finished Goods Control

3 100 000

Creditors Control

1 900 000

Conversion Costs Allocated

1 200 000

d Finished units sold

Cost of Goods Sold

3 069 000

Finished Goods Control

3 069 000

e Under- or overallocated

Conversion Costs Allocated

1 200 000

conversion costs

Cost of Goods Sold

60 000

Conversion Costs Control

1 260 000

Exhibit 21.4

Overview of backflush costing, Example 21.1

Stock:

Raw and In-Progress Control

Finished Goods Control

Cost of Goods Sold

Direct

(a) 1

(c) 1

(c) 3

(d) 3

(d) 3

materials

950 000

900 000

100 000

069 000

069 000

Balance 50 000

Balance 31 000

Conversion Cost Allocated

Conversion

(e) 1 200 000

(c) 1 200 000

costs

(e) 60 000

Conversion Costs Control

(b) 1 260 000

(e) 1 260 000

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Backflush costing

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Accounting for variances

The accounting for variances between actual costs incurred and standard costs allowed and the

disposition of variances is basically the same under all standard costing systems. The procedures

are described in Chapters 15 and 16. In Example 21.1, suppose the direct materials purchased

had an unfavourable price variance of €42 000. Entry (a) would then be:

Stock: Raw and In-Progress Control

1 950 000

Raw Materials Price Variance

42 000

Creditors Control

1 992 000

Example 21.2

Trigger points are materials purchases and finished goods sales

This example, also based on HTC and using the same data, presents a backflush-costing system that, relative

to Example 21.1, is a more dramatic departure from a sequential tracking stock costing system. The first

trigger point in this example is the same as the first trigger point in Example 21.1 (the purchase of direct

materials), but the second trigger point is the sale – not the completed manufacture – of finished units.

Toyota's cost accounting at its Burnaston (UK) plant is similar to this type of costing system. There are two

justifications for this accounting system:

1 To remove the incentive for managers to produce for stock. If the value of finished goods stock includes

conversion costs, managers can bolster operating profit by producing more units than are sold. Having

trigger point 2 as the sale instead of the completion of production, however, reduces the attractiveness

of producing for stock by recording conversion costs as period costs instead of capitalising them as

inventoriable costs.

2 To increase managers' focus on selling units.

The stock account in this example is confined solely to direct materials (whether they are in storerooms,

in process or in finished goods). There is only one stock account:

Type

Account title

Combined direct materials stock and any direct

Stock Control

materials in work in progress and finished goods

Exhibit 21.3, Panel B, presents the journal entries in this case. Entry (a) is prompted by the same

trigger point 1 as in Example 21.1, the purchase of direct materials. Entry (b) for the conversion costs

incurred is recorded in an identical manner as in Example 21.1. Trigger point 2 is the sale of good fin-

ished units (not their production, as in Example 21.1), so there is no entry corresponding to entry (c)

of Example 21.1. The cost of finished units is calculated only when finished units are sold (which corre-

sponds to entry (d) of Example 21.1): 99 000 units sold × €31 = €3 069 000, consisting of direct materials

(99 000 × €19 = €1 881 000) and conversion costs allocated (99 000 × €12 = €1 188 000).

No conversion costs are inventoried. That is, compared with Example 21.1, Example 21.2 does not attach

€12 000 (€12 per unit × 1000 units) of conversion costs to finished goods stock. Hence, Example 21.2

allocates €12 000 less in conversion costs relative to Example 21.1. Of the €1 260 000 in conversion costs,

€1 188 000 is al ocated at standard cost to the units sold. The remaining €72 000 (€1 260 000 − €1 188 000)

of conversion costs is underallocated. Entry (e) in Exhibit 21.3, Panel B, presents the journal entry if HTC,

like many companies, writes off these underallocated costs monthly as additions to cost of goods sold.

The April ending balance of Stock Control is €69 000 (€50 000 direct materials still on

hand + €19 000 direct materials embodied in the 1000 units manufactured but not sold during the

period). Exhibit 21.5 provides an overview of this version of backflush costing. Entries are keyed to

Exhibit 21.3, Panel B. The approach described in Example 21.2 closely approximates the costs calculated

using sequential tracking when a company holds minimal work in progress and finished goods stocks

because the approach in Example 21.2 does not maintain these stock accounts.

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Exhibit 21.5

Overview of backflash costing, Example 21.2

Stock Control

Cost of Goods Sold

Direct

(a) 1 950 000

(d)1 881 000

(d) 3 069 000

materials

Balance 69 000

Conversion Costs Allocated

(e) 1 188 000

(d) 1 188 000

Conversion

(e) 72 000

costs

Conversion Costs Control

(b) 1 260 000

(e) 1 260 000

Direct materials are often a large proportion of total manufacturing costs, sometimes over

60%. Consequently, many companies will at least measure the direct materials efficiency variance

in total by physically comparing what remains in direct materials stock against what should be

remaining, given the output of finished goods for the accounting period. In our example, suppose

that such a comparison showed an unfavourable materials efficiency variance of €90 000. The

journal entry would be:

Raw Materials Efficiency Variance

90 000

Stock: Raw and In-Progress Control

90 000

The under- or overallocated manufacturing overhead costs may be split into various overhead

variances (spending variance, efficiency variance and production-volume variance) as explained

in Chapters 15 and 16.

Extending Example 21.3, backflush-costing systems could also use the sale of finished goods

(instead of the production of finished goods) as the only trigger point. This version of back-

flush costing would be most suitable for a JIT production system with minimal direct materials,

work-in-progress and finished goods stocks. Why? Because this backflush-costing system would

maintain no stock accounts.

Special considerations in backflush costing

The accounting illustrated in Examples 21.1, 21.2 and 21.3 does not strictly adhere to generally

accepted accounting principles of external reporting. For example, work in progress (an asset)

exists but is not recognised in the accounting system. Advocates of backflush costing, however,

cite the materiality concept in support of these versions of backflushing. They claim that if stocks

are low or their total costs are not subject to significant change from one accounting period to

the next, operating profit and stock costs developed in a backflush-costing system will not differ

materially from the results generated by a system that adheres to generally accepted accounting

principles.

Suppose material differences in operating profit and stocks do exist between the results of a

backflush-costing system and those of a conventional standard costing system. An adjustment can

be recorded to make the backflush numbers satisfy external reporting requirements. For example,

the backflush entries in Example 21.2 would result in regarding all conversion costs as a part of

Cost of Goods Sold (€1 188 000 at standard costs + €72 000 write-off of underallocated conver-

sion costs = €1 260 000). But suppose conversion costs were regarded as sufficiently material in

amount to be included in Stock Control. Then entry (d), closing the Conversion Costs accounts,

would change as shown below.

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Example 21.3

Trigger point is finished goods completion

This example presents an extreme and simpler version of backflush costing. It has only one trigger point

for making journal entries to stock. The trigger point is HTC's completion of finished units. Exhibit 21.3,

Panel C, presents the journal entries in this case, using the same data as in Examples 21.1 and 21.2. Note

that since the purchase of direct materials is not a trigger point, there is no entry corresponding to entry

(a), purchases of direct materials. Exhibit 21.6 provides an overview of this version of backflush costing.

Entries are keyed to Exhibit 21.3, Panel C.

Compare entry (c) in Exhibit 21.3, Panel C, with entries (a) and (c) in Exhibit 21.3, Panel A. The simpler

version in Example 21.3 ignores the €1 950 000 purchases of direct materials (entry (a) of Example 21.1).

At the end of April, €50 000 of direct materials purchased has not yet been placed into production

(€1 950 000 − €1 900 000 = €50 000), nor has it been entered into the stock costing system. The

Example 21.3 version of backflush costing is suitable for a JIT production system with virtually no direct

materials stock and minimal work-in-progress stocks because Example 21.3 does not maintain these stock

accounts. It is less feasible otherwise.

Exhibit 21.6

Overview of backflush costing, Example 21.3

Finished Goods Control

Cost of Goods Sold

Direct

(c) 3

(d) 3

(d) 3

materials

100 000

069 000

069 000

Balance 31 000

Conversion Costs Allocated

(e) 1

Conversion

200 000

(c) 1 200 000

costs

(e) 60 000

Conversion Costs Control

(b) 1 260 000

(e) 1 260 000

Original entry (d) Conversion Costs Allocated

1 188 000

Cost of Goods Sold

72 000

Conversion Costs Control

1 260 000

Revised entry (d) Conversion Costs Allocated

1 188 000

Stock Control (1000 units × €12)

12 000

Cost of Goods Sold

60 000

Conversion Costs Control

1 260 000

Criticisms of backflush-costing focus mainly on the absence of audit trails – the ability of the

accounting system to pinpoint the uses of resources at each step of the production process. The

absence of large amounts of materials and work-in-progress stock means that managers can keep

track of operations by personal observations, computer monitoring and non-financial measures.

What are the implications of JIT and backflush-costing systems for activity-based costing

(ABC) systems? Simplifying the production process, as in a JIT system, makes more of the costs

direct and so reduces the extent of overhead cost allocations. Simplified ABC systems are often

adequate for companies implementing JIT. But even these simpler ABC systems can enhance

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backflush costing. Costs from ABC systems give more accurate budgeted conversion costs per unit

for different products, which are then used in the backflush-costing system. The activity-based

cost data are also useful for product costing, decision making and cost management.

Managing goods for sale in retail organisations

Accounting information can play a key role in stock management. This section illustrates the

importance of accounting information in two areas:

1 the management of goods for sale in retail organisations;

2 the management of materials, work in progress and finished goods in organisations with man-

ufacturing operations.

Stock management is of little concern in service companies since these companies hold minimal

materials and stock.

Cost of goods sold measures the costs of stock sold, including the costs of purchasing and

managing stock. Cost of goods sold constitutes the largest single cost item for most retailers.

Sales

100.0%

Less costs:

Cost of goods sold

75.8%

Selling, general and administration costs

19.7

Other costs, interest and taxes

3.3

Total costs

98.8

Net profit

1.2%

This means that better decisions regarding the purchasing and managing of goods for sale can

cause dramatic percentage increases in net income.

Costs associated with goods for sale

The following cost categories are important when managing stocks and goods for sale.

1 Purchasing costs consist of the costs of goods acquired from suppliers including incoming

freight or transportation costs. These costs usually make up the largest single cost category

of goods for sale. Discounts for different purchase-order sizes and supplier credit terms affect

purchasing costs.

2 Ordering costs consist of the costs of preparing and issuing a purchase order. Related to the

number of purchase orders processed are special processing, receiving, inspection and payment

costs.

3 Carrying costs arise when a business holds stocks of goods for sale. These costs include the

opportunity cost of the investment tied up in stock (see Chapter 10) and the costs associated

with storage, such as storage-space rental and insurance, obsolescence and spoilage.

4 Stockout costs. A stockout occurs when a company runs out of a particular item for which

there is customer demand. A company may respond to the shortfall or stockout by expediting

an order from a supplier. Expediting costs of a stockout include the additional ordering costs

plus any associated transportation costs. Alternatively, the company may lose a sale owing to

the stockout. In this case, stockout costs include the lost contribution margin on the sale plus

any contribution margin lost on future sales hurt by customer ill-will caused by the stockout.

5 Quality costs. The quality of a product or service is its conformance with a pre-announced or

pre-specified standard. As described in Chapter 20, four categories of costs of quality are often

distinguished: (a) prevention costs, (b) appraisal costs, (c) internal failure costs and (d) external

failure costs.

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6 Shrinkage costs result from theft by outsiders, embezzlement by employees, and misclassifica-

tion or misplacement of inventory. Shrinkage is measured by the difference between (a) the cost

of stock recorded on the books (after correcting errors) and (b) the cost of stock when phys-

ically counted. Shrinkage can often be an important measure of management performance.

Consider, for example, a grocery business, where operating income hovers around 2% of sales.

With such small margins, it is easy to see why one of a store manager's prime responsibilities

is controlling stock shrinkage. A £1000 increase in shrinkage will erase the operating income

from sales of

*

£50 000 (2% £50 000 = £1000). Because shrinkage costs generally increase

when a firm's stock increases, most firms try not to hold more stock than necessary.

The descriptions of the cost categories indicate that some of the relevant costs for making stock

decisions and managing goods for sale are not available in existing accounting systems. Opportu-

nity costs, which are not typically recorded in accounting systems, are an important component

in several of these cost categories.

The inclusion of costs from all six categories makes cost of goods sold substantial. Advances

in information-gathering technology, however, are attempting to increase the reliability and

timeliness of stock data and reduce costs in these five categories. For example, electronic data

interchange (EDI) links a company to its suppliers via computers. An order is often initiated by

a single keystroke, increasing timeliness and reducing costs of ordering. Similarly, barcoding

technology allows a scanner to capture purchases and sales of individual units. This creates an

instantaneous record of stock movements and helps in the management of purchasing, carrying

and stockout costs.

Economic order quantity decision model

The first major decision in managing goods for sale is deciding how much of a given product to

order. The economic order quantity (EOQ) decision model calculates the optimal quantity of stock

to order. The simplest version of this model incorporates only ordering costs and carrying costs

into the calculation. It assumes the following:

1 The same fixed quantity is ordered at each reorder point.

2 Demand, ordering costs and carrying costs are certain. The purchase-order lead time – the time

between the placement of an order and its delivery – is also certain.

3 Purchasing costs per unit are unaffected by the quantity ordered. This assumption makes pur-

chasing costs irrelevant to determining EOQ, because purchasing costs of all units acquired

will be the same, whatever the order size in which the units are ordered.

4 No stockouts occur. One justification for this assumption is that the costs of a stockout are

prohibitively high. We assume that to avoid these potential costs, management always main-

tains adequate stock so that no stockout can occur.

5 In deciding the size of the purchase order, management considers the costs of quality only to

the extent that these costs affect ordering costs or carrying costs.

Given these assumptions, EOQ analysis ignores purchasing costs, stockout costs and quality

costs. To determine EOQ, we minimise the relevant ordering and carrying costs (those ordering

and carrying costs that are affected by the quantity of stock ordered):

Total relevant costs = Total relevant ordering costs + Total relevant carrying costs

Exhibit 21.7 shows a graph analysis of the total annual relevant costs of ordering (DP/Q) and

carrying stock ($QC/2$) under various order sizes (Q) and illustrates the trade-off between the two

types of costs. The larger the order quantity, the higher the annual relevant carrying costs, but

the lower the annual relevant ordering costs. *The total annual relevant costs are at a minimum*

where total relevant ordering costs and total relevant carrying costs are equal (in the Headphone

Galore example, each equals €2 600).

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Example 21.4

Headphone Galore sells soundproof headphones to its customers; it also rents out premium headphones.

It purchases each package of soundproof headphones from Sontek at €14 a package. Sontek pays all

incoming freight. No incoming inspection is necessary, as Sontek has a superb reputation for delivering

quality merchandise. Annual demand is 13 000 soundproof headphones at a rate of 250 per week. Head-

phone Galore requires a 15% annual return on investment. The purchase-order lead time is two weeks.

The following cost data are available:

Relevant ordering costs per purchase order

€200.00

Relevant carrying costs per package per year:

Required annual return on investment, 15% × €14

€2.10

Relevant insurance, materials handling, breakage, etc., per year

3.10

5.20

What is the economic order quantity of soundproof headphones?

The formula underlying the EOQ model is:

=

DP

EOQ

2

C

where:

EOQ = Economic order quantity

D = Demand in units for a specified time period (1 year in this example)

P = Relevant ordering costs per purchase order

C = Relevant carrying costs of 1 unit in stock for the time period used for D (1 year in this example).

The formula indicates that EOQ increases with demand and ordering costs and decreases with carrying costs.

We can use this formula to determine the EOQ for Headphone Galore as follows:

EOQ =

2 × 13 000 × €200 = 1000 000 = 1 000 packages

€5.20

Therefore, Headphone Galore should order 1000 tape packages each time to minimise total ordering and

carrying costs.

The total annual relevant costs (TRC) for any order quantity Q can be calculated using the following formula:

TRC = Total annual relevant ordering costs + Total annual relevant carrying costs

Number of

Relevant

Average

Annual relevant

= purchase orders × ordering costs per +

stock × carrying costs of

per year

purchase order

in units

1 unit for a year

$= D \times P + \frac{Q}{2} \times C$

$= DP + \frac{QC}{2}$

(Note that in this formula, Q can be any order quantity, not just the EOQ.)

When Q 1000 units,

$TRC = 13\,000 \times €200 + \frac{1000}{2} \times 5.20 = €2600 + €2600 = €5200$

The number of deliveries each time period (in our example, 1 year) is:

$D \div 13\,000 = 13$ deliveries

EOQ

1000

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Exhibit 21.7

Ordering costs and carrying costs for Headphone Galore

10 000

Annual total

relevant costs

Annual relevant

8000

ordering costs

€)

6000

5200

4000

Total relevant costs (

Annual relevant

2000

carrying costs

650 EOQ = 1000 1300

1950

2600

Order quantity (units)

When to order, assuming certainty

The second major decision in dealing with cost of goods for sale is when to order. The reorder

point is the quantity level of the stock on hand that triggers a new order. The reorder point is

simplest to calculate when both demand and lead time are certain:

Reorder point = Number of units sold per unit of time × Purchase-order lead time

Consider our Headphone Galore example. We choose a week as the unit of time:

Economic order quantity

1000 packages

Number of units sold per week

250 packages

Purchase-order lead time

2 weeks

Thus,

Reorder point = Number of units sold per unit of time × Purchase-order lead time

= 250 × 2

= 500 packages

So, Headphone Galore will order 1000 packages of tapes each time its stock falls to 500

packages.

The graph in Exhibit 21.8 presents the behaviour of the stock level of headphone packages,

assuming demand occurs uniformly throughout each week. If the purchase-order lead time is

two weeks, a new order will be placed when the stock level reaches 500 packages so that the 1000

packages ordered are received at the time stock reaches zero.

This handy formula does not apply when the receipt of the order fails to increase stock to the

reorder-point quantity (for example, when the lead time is three weeks and the order is a one-week

supply). In these cases, orders will overlap.

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Exhibit 21.8

Stock level of tape packages for Headphone Galore

1000

500

Reorder

Reorder

point

point

Stock in units

Weeks 1

2

3

4

5

6

7

8

Lead time

Lead time

2 weeks

2 weeks

Note: This exhibit assumes that demand and purchase-order lead time are certain:

Demand = 250 tape packages per week

Purchase-order lead time = 2 weeks

Safety stock

So far, we have assumed that demand and purchase-order lead time are certain. When retailers are

uncertain about the demand, the lead time or the quantity that suppliers can provide, they often

hold safety stock. Safety stock is stock held at all times regardless of stock ordered using EOQ.

It is used as a buffer against unexpected increases in demand or lead time and unavailability of

stock from suppliers. In our Headphone Galore example, expected demand is 250 packages per

week, but the company's managers feel that a maximum demand of 400 packages per week may

occur. If Headphone Galore's managers decide that the costs of stockout are prohibitive, they

may decide to hold safety stock of 300 packages. This amount is the maximum excess demand

of 150 packages per week for the two weeks of purchase-order lead time. The computation of

safety stock hinges on demand forecasts. Managers will have some notion – usually based on

experience – of the range of weekly demand.

A frequency distribution based on prior daily or weekly levels of demand provides data for

computing the associated costs of maintaining safety stock. Assume that one of seven different

levels of demand will occur over the two-week purchase-order lead time at Headphone Galore:

Units

Total demand for 2 weeks

200

300

400

500

600

700

800

Probability (sums to 1.00)

0.06

0.09

0.20

0.30

0.20

0.09

0.06

We see that 500 is the most likely level of demand for two weeks because it is assigned the

highest probability of occurrence. We also see that there is a 0.35 probability that demand will

be either 600, 700 or 800 packages (0.20 + 0.09 + 0.06 = 0.35).

If a customer calls Headphone Galore to buy headphones and the store has none in stock, it

can ‘rush’ them to the customer at a cost to Headphone Galore of €4 per package. The relevant

stockout costs in this case are €4 per package. The optimal safety stock level is the quantity of

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safety stock that minimises the sum of the relevant annual stockout and carrying costs. Recall that

the relevant carrying costs for Headphone Galore are €5.20 per unit per year.

Exhibit 21.9 presents the total annual relevant stockout and carrying costs when the reorder

point is 500 units. We need only consider safety stock levels of 0, 100, 200 and 300 units, since

demand will exceed the 500 units of stock available at reordering by 0 if demand is 500, by 100

if demand is 600, by 200 if demand is 700 and by 300 if demand is 800. The total annual relevant

stockout and carrying costs would be minimised at €1352, when a safety stock of 200 packages

is maintained. Think of the 200 units of safety stock as extra stock that Headphone Galore

maintains. For example, Headphone Galore ’s total stock of earphones at the time of reordering

its EOQ of 1000 units would be 700 units (the reorder point of 500 units plus the safety stock of

200 units).

Exhibit 21.9

Computation of safety stock for Headphone Galore when reorder point is 500 units

Demand

Relevant No. of

Expected

Relevant

Total

Safety realisations

stockout orders

stockout

carrying

relevant

stock resulting in Stockout in Probability

costs†

per

costs§

costs#

costs

level in stockouts

units* (3) = of stockout

(5) =

year‡

(7) =

(8) =

(9) =

units (1)

(2)

(2) − 500 − (1)

(4)

(3) × €4

(6)

(4) × (5) × (6) (12) × €5.20 (72) + (8)

0

600

100

0.20

€400

13

€1040

700

200

0.09

800

13

936

800

300

0.06

1200

13

936

€2912

€0

€2912

100

700

100

0.09

400

13

€468

800

200

0.06

800

13

624

€1092

€520

€1612

200

800

100

0.06

400

13

€312

€1040

€1352

300

–

–

–

–

–

€0||

€1560

€1560

* Realised demand – stock available during lead time (excluding safety stock), 500 units – safety stock.

† Stockout units × relevant stockout costs of €4.00 per unit.

‡ Annual demand 13 000 ÷ 1000 EOQ = 13 orders per year.

§ Probability of stockout × relevant stockout costs × number of orders per year.

Safety stock × annual relevant carrying costs of €5.20 per unit (assumes that safety stock is on hand at all times and that there is no overstocking caused by decreases in expected usage).

|| At a safety stock level of 300 units, no stockouts will occur and hence expected stockout costs = €0.

Challenges in estimating stock-related costs and their effects

Considerations in obtaining estimates of relevant costs

Obtaining accurate estimates of the cost parameters used in the EOQ decision model is a chal-

lenging task. For example, the relevant annual carrying costs of stock consist of *incremental or*

outlay costs plus the *opportunity cost of capital.*

What are the relevant incremental costs of carrying stock? Only those costs that vary with the

quantity of stock held – for example, insurance, property taxes, costs of obsolescence and costs

of breakage. Consider the salaries paid to clerks, storekeepers and materials handlers. These costs

are irrelevant if they are unaffected by changes in stock levels. Suppose, however, that as stocks

decrease, these salary costs also decrease as the clerks, storekeepers and materials handlers are

transferred to other activities or laid off. In this case, the salaries paid to these persons are relevant

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incremental costs of carrying stock. Similarly, the costs of storage space owned that cannot be

used for other profitable purposes as stocks decrease are irrelevant. But if the space has other

profitable uses, or if rental cost is tied to the amount of space occupied, storage costs are relevant

incremental costs of carrying stock.

What is the relevant opportunity cost of capital? It is the return forgone by investing capital

in stock rather than elsewhere. It is calculated as the required rate of return multiplied by those

costs per unit that vary with the number of units purchased and that are incurred at the time

the units are received. (Examples of these costs per unit are purchase price, incoming freight and

incoming inspection.) Opportunity costs are not calculated on investments, say, in buildings, if

these investments are unaffected by changes in stock levels. In the case of stockouts, calculating

the relevant opportunity costs requires an estimate of the lost contribution margin on that sale

as well as on future sales hurt by customer ill-will resulting from the stockout.

Our discussion suggests that predicting relevant costs requires care and is difficult. Managers

understand that their projections will seldom be flawless. This leads to the question: What is the

cost of an incorrect prediction when actual relevant costs are different from the relevant predicted

costs used for decision making?

Cost of a prediction error

Continuing our example, suppose Headphone Galore ’s relevant ordering costs per purchase order

are €242 instead of the predicted €200. We can calculate the cost of this prediction error with a

three-step approach.

Step 1: Calculate the monetary outcome from the best action that could have been taken,

given the actual amount of the cost input The appropriate inputs are D = 13 000 units,

P = €242 and C = €5.20. The economic order quantity size is:

2

EOQ

DP

=

C

$2 \times 13\,000 \times €242$

$EOQ =$

$= 1\,210\,000$

€5.20

= 1100 packages

The total annual relevant costs when $EOQ = 1100$ is:

DP

QC

TRC

$TRC =$

DP

+

QC

=

+

Q Q 2 2

13

×

×

=

13 000

000

×

€ €242

242 + 11000

11000

×

€5€5

.2 .2

0 0

=

+

1000

1000

2 2

= =€ €286

286 + +€ €2860

2860

= =€ €3146

3146

Step 2: Calculate the monetary outcome from the best action based on the incorrect amount

of the predicted cost input The planned action when the relevant ordering costs per purchase

order are predicted to be €200 is to purchase 1000 packages in each order. The total annual rel-

evant costs using this order quantity when D = 13 000 units, P = €242 and C = €5.20 are:

TRC = 13 000 × €242 + 1000 × €5.20

1000

2

= €314.60 + €2600

= €2914.60

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Just-in-time purchasing

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Step 3: Calculate the difference between the monetary outcomes from steps 1 and 2

Monetary outcome

Step 1

€3146

Step 2

2914.60

Difference

(€231.40)

The cost of the prediction error is €231.40. Note that the total annual relevant costs curve in

Exhibit 21.8 is relatively flat over the range of order quantities from 650 to 1300. An important

feature of the EOQ model is that the *total relevant costs are rarely sensitive to minor variations*

in cost predictions. The square root in the EOQ model reduces the sensitivity of the decision to

errors in predicting its inputs.

Just-in-time purchasing

As described earlier in the chapter, organisations are giving increased attention to *just-in-time*

(JIT) purchasing – the purchase of goods or materials such that a delivery immediately precedes

demand or use. JIT purchasing requires organisations to restructure their relationship with sup-

pliers and place smaller and more frequent purchase orders. We next explore the relationship

between EOQ decision models and JIT purchasing.

Companies moving towards JIT purchasing argue that the full costs of carrying stocks (includ-

ing stock storage space, spoilage and opportunity costs not recorded in the accounting system)

have been dramatically underestimated in the past. At the same time, building close partnerships

with suppliers and using electronic commerce systems for order-related activities significantly

reduce ordering costs.

EOQ implications of JIT purchasing

Exhibit 21.10 analyses the sensitivity of Headphone Galore ’s EOQ to illustrate the economics

of smaller and more frequent purchase orders. The analysis presented in Exhibit 21.10 sup-

ports JIT purchasing – that is, having a smaller EOQ and placing orders more frequently – as

relevant carrying costs increase and relevant ordering costs per purchase order decrease. One

factor driving down ordering costs is the use of electronic links, such as the Internet, to place

purchase orders. The cost of placing some orders on the Internet is estimated to be less than

one-tenth – sometimes less than one-hundredth – of the cost of placing those orders by tele-

phone, facsimile or post.

Exhibit 21.10

Sensitivity of EOQ to variations in relevant ordering and carrying

costs for Headphone Galore*

Relevant ordering costs per purchase order

Relevant carrying costs

per package per year

€200

€150

€100

€30

€5.20

EOQ = 1000

EOQ = 866

EOQ = 707

EOQ = 387

€7.00

862

746

609

334

€10.00

721

624

510

279

€15.00

589

510

416

228

* Assuming annual demand is always 13 000 packages.

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Relevant benefits and relevant costs of JIT purchasing

The JIT purchasing model is not guided solely by the EOQ model. As discussed earlier, the EOQ

model is designed to emphasise only the trade-off between carrying and ordering costs. Stock

management extends beyond ordering and carrying costs to include purchasing costs, stockout

costs and quality costs. The quality of materials and goods and timely deliveries are important

motivations for using JIT purchasing and stockout costs are an important concern. We add these

features as we move from the EOQ decision model to the JIT purchasing model.

Let us revisit the Headphone Galore example and consider the following information. Head-

phone Galore has recently established an internet business-to-business purchase-order link with

Sontek. Headphone Galore triggers a purchase order for earpieces by a single computer entry.

Payments are made electronically for batches of deliveries rather than for each individual delivery.

These changes make ordering costs negligible. Headphone Galore is negotiating for Sontek to

deliver 100 packages of headphones 130 times each year (five times every two weeks) instead of

delivering 1000 packages 13 times each year as calculated in Exhibit 21.7. Sontek is willing to make

these frequent deliveries, but it will tack on a small additional amount of €0.02 to the price per

package. Headphone Galore's required return on investment remains 15%. Assume that relevant

annual carrying costs of insurance, materials handling, breakage and so on remain at €3.10 per

package per year.

Suppose that Headphone Galore incurs no stockout costs under its current purchasing policy

because demand and purchase-order lead times over each four-week period are certain. Head-

phone Galore's major concern is that lower stock levels from implementing JIT purchasing will

lead to more stockouts because demand variations and delays in supplying tapes are more likely

to occur in the short intervals between supplies under JIT purchasing. Sontek assures Headphone

Galore that its new manufacturing processes enable it to respond rapidly to changing demand

patterns. Consequently, stockouts may not be a serious problem. Headphone Galore expects to

incur stockout costs on 50 packages each year under a JIT purchasing policy. In the event of a

stockout, Headphone Galore will have to rush-order packages at a cost of €4 per package. Should

Headphone Galore implement JIT purchasing?

Exhibit 21.11 compares (1) the incremental costs Headphone Galore incurs when it purchases

headphones from Sontek under its current purchasing policy, with (2) the incremental costs Head-

phone Galore would incur if Sontek supplied headphones under a JIT policy. The difference in the

two incremental costs is the relevant savings of JIT purchasing. In other methods of comparing

the two purchasing policies, the analysis would include only the relevant costs – those costs that

differ between the two alternatives. Exhibit 21.11 shows a net cost savings of €1879.85 per year

from shifting to a JIT purchasing policy.

Supplier evaluation and relevant costs of quality and timely deliveries

As we saw earlier, costs of quality and timely deliveries are particularly crucial in JIT purchas-

ing environments. Defective materials and late deliveries often bring the whole plant to a halt,

resulting in forgone contribution margin on lost sales. Companies that implement JIT purchasing

choose their suppliers carefully and pay special attention to developing long-run supplier partner-

ships. Some suppliers are very cooperative with a business's attempts to adopt JIT purchasing. For

example, Convent, which is one of the market leaders in Germany for savoury snack products,

makes more frequent deliveries to retail outlets than does many of its competitors. The company's

corporate strategy emphasises service to retailers and consistency, freshness and quality of the

delivered product. Through a highly customised service, Convent offers its customers the possi-

bility to maximise return on shelf-space – a major service strength.

When evaluating suppliers, companies have to pay special attention to quality costs of goods

or materials (for example, incoming materials inspection costs, returns, scrap costs and rework

costs); costs of late deliveries (expediting costs, idle time on machines and forgone contribution

margin on lost sales); and costs of early deliveries (carrying costs).

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Exhibit 21.11

Annual relevant costs of current purchasing policy and JIT purchasing policy for Headphone Galore

Incremental costs under current purchasing policy	Incremental costs under JIT purchasing policy	Relevant item	Relevant item policy
Purchasing costs			
€14 per unit × 13 000 units per year			
€182 000.00			
	€14.02 per unit × 13 000 units per year		
	€182 260.00		
Required return on investment			
15% per year × €14 cost per unit × 500* units			

1 050.00

of average stock per year

15% per year × €14.02 cost per unit × 50†

105.15

units of average stock per year

Outlay carrying costs

(insurance, materials handling, breakage,

and so on)

€3.10 per unit per year × 500* units of

1 550.00

average stock per year

€3.10 per unit per year × 50† units of

155.00

average stock per year

Stockout costs

No stockouts

0

€4 per unit × 50 units per year

200.00

Total annual relevant costs

€184 600.00

€182 720.15

Annual difference in favour of JIT purchasing

€1 879.85

* Order quantity ÷ 2 = 1000 ÷ 2 = 500.

† Order quantity ÷ 2 = 100 ÷ 2 = 50.

What are the relevant costs when choosing suppliers? Consider again our Headphone Galore

example. The Denton Corporation also supplies headphones. It offers to supply all of Headphone

Galore's headphone needs at a price of €13.60 per package (less than Sontek's price of €14.02)

under the same JIT delivery terms that Sontek offers. Denton proposes an internet purchase-order

link identical to Sontek's that would make Headphone Galore's ordering costs negligible. Head-

phone Galore's relevant outlay carrying costs of insurance, materials handling, breakage and so

on, per package per year, is €3.10 if it purchases headphones from Sontek and €3.00 if it purchases

from Denton. Should Headphone Galore buy from Denton? Not before considering the relevant

costs of quality and also the relevant costs of failing to deliver on time.

Headphone Galore has used Sontek in the past and knows that Sontek fully deserves its repu-

tation for delivering quality merchandise on time. Headphone Galore does not, for example, find

it necessary to inspect the headphone packages that Sontek supplies. Denton, however, does not

enjoy so sterling a reputation for quality. Headphone Galore anticipates the following negative

aspects of using Denton:

● Headphone Galore would incur additional inspection costs of €0.05 per package.

● Average stockouts of 360 packages each year would occur, largely resulting from late deliveries.

Denton cannot rush-order tape packages to Headphone Galore on short notice. Headphone

Galore anticipates lost contribution margin per unit of €8 from stockouts.

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● Customers would probably return 2% of all packages sold owing to poor quality of the tapes.

Headphone Galore estimates its additional costs to handle each returned package are €25.

Exhibit 21.12 presents the relevant costs of purchasing from Sontek and from Denton. Even though

Denton is offering a lower price per package, the total relevant costs of purchasing goods from

Sontek are lower by €4361.85 per year. Selling high-quality merchandise also has non-financial and

qualitative benefits. For example, offering Sontek's high-quality headphones enhances Headphone

Galore's reputation and increases customer goodwill, which may lead to higher future profitability.

Exhibit 21.12

Annual relevant costs of purchasing from Sontek and Denton

Incremental

Incremental

costs of

costs of

purchasing from

purchasing

Relevant item

Sontek

from Denton

Purchasing costs

€14.02 per unit × 13 000 units per year

€182 260.00

€13.60 per unit × 13 000 units per year

€176 800.00

Inspection costs

No inspection necessary

0

€0.05 per unit × 13 000 units

650.00

Required return on investment

15% per year × €14.02 × 50* units of average stock

105.15

per year

15% per year × €13.60 × 50* units of average stock

102.00

per year

Outlay carrying costs

(insurance, materials handling, breakage, and so on)

€3.10 per unit per year × 50* units of average stock

155.00

per year

€3.00 per unit per year × 50* units of average stock

150.00

per year

Stockout costs

€4 per unit × 50 units per year

200.00

€8 per unit multi 360 units per year

2 880.00

Customer returns costs

No customer returns

0

€25 per unit returned × 2% × 13 000 units returned

6 500.00

Total annual relevant costs

€182 720.15

€187 082.00

Annual difference in favour of Sontek

€4 361.85

* Order quantity ÷ 2 = 100 ÷ 2 = 50.

Stock costs and their management in manufacturing organisations

Managers in companies with manufacturing facilities face the challenging task of producing

high-quality products at competitive cost levels. Numerous systems have been developed to help

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Stock costs and their management in manufacturing organisations

managers plan and implement production and stock activities. Earlier, we described the two most

basic types of system:

● *A just-in-time (JIT) production system,* a 'demand-pull' system under which products are

manufactured only to satisfy a specific customer order.

● *A materials requirements planning (MRP) system,* a 'push-through' system that manufactures

finished goods for stock on the basis of demand forecasts.

Companies implementing JIT production systems manage stocks by eliminating them. When

stocks are present, the management accountant plays several important roles. First, the manage-

ment accountant must maintain accurate and timely information pertaining to materials, work-

in-progress and finished goods stocks. A second role of the management accountant consists of

providing estimates of the costs of setting up each production run at a plant, the costs of down-

time and the costs of holding stock. Costs of setting up the machine are analogous to ordering

costs in the EOQ model. When the costs of setting up machines or sections of the production line

are high (for example, as with a blast furnace in an integrated steel mill), processing larger batches

of materials and incurring larger stock-carrying costs is the optimal approach because it reduces

the number of times the machine must be set up. When set-up costs are small, processing smaller

batches is optimal because it reduces carrying costs. Similarly, when the costs of downtime are

high, there can be sizeable benefits from maintaining continuous production.

JIT production, quality and relevant costs

Early advocates of JIT production emphasised the benefits of lower carrying costs of stock. *An*

important benefit of lower stocks, however, is the heightened emphasis on eliminating the root

causes of rework, scrap and waste and on reducing the manufacturing lead time of their prod-

ucts. In computing the relevant benefits and relevant costs of reducing stocks in JIT production

systems, the cost analyst must consider all benefits.

Consider the Hudson Corporation, a manufacturer of brass fittings. Hudson is considering

implementing a JIT production system. Suppose that to implement JIT production, Hudson must

incur €100 000 in annual tooling costs to reduce set-up times. Suppose further that JIT will reduce

average stock by €500 000. Also, relevant costs of insurance, space, materials handling and set-up

will decline by €30 000 per year. The company's required rate of return on stock investments is

10% per year. Should Hudson implement JIT? On the basis of the numbers provided, we would

be tempted to say no. Why? Because annual relevant cost savings in carrying costs amount to

€80 000 [(10% of €500 000) + €30 000], which is less than the additional annual tooling costs

of €100 000.

Our analysis, however, has not considered other benefits of lower stocks in JIT production.

For example, Hudson estimates that implementing JIT will reduce rework on 500 units each

year, resulting in savings of €50 per unit. Also, better quality and faster delivery will allow Hud-

son to charge €2 more per unit on the 20 000 units that it sells each year. The annual relevant

quality and delivery benefits from JIT and lower stock levels equal €65 000 (rework savings,

€50 × 500 + additional contribution margin,€2 × 20 000). Total annual relevant benefits and

cost savings equal €145 000 (80 000 + €65 000) which exceeds annual JIT implementation costs

of €100 000. Therefore, Hudson should implement a JIT production system.

Performance measures and control in JIT production

To manage and reduce stocks, the management accountant must also design performance meas-

ures to evaluate and control JIT production. Examples of information the management account-

ant may use include:

● personal observation by production line workers and team leaders

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● financial performance measures (such as stock turnover ratios) and variances based on standard

materials costs and conversion costs

● non-financial performance measures of time, stock and quality, such as manufacturing lead

time, units produced per hour and days stock on hand

Total set-up time for machines

●

Total manufacturing time

Number of units requiring rework or scrap

●

Total number of units started and completed

Personal observation and non-financial performance measures are the dominant methods of

control. Why? Because they are the most timely, intuitive and easy-to-comprehend measures of

plant performance. Rapid, meaningful feedback is critical because the lack of buffer stocks in a

demand-pull system creates added urgency to detect and solve problems quickly.

Theory of constraints

We consider now problems which arise when products are made from multiple parts and pro-

cessed on different machines. With multiple parts and multiple machines, dependencies arise

among operations; some operations cannot be started until parts from a previous operation are

available. Some operations are bottlenecks; others are not.

The theory of constraints (TOC) describes methods to maximise operating profit when faced

with some bottleneck and some non-bottleneck operations. It defines three measurements:

1 Throughput contribution, equal to sales revenue minus direct materials costs.

2 Investments (stock), equal to the sum of materials costs of direct materials stock, work-in-

progress stock and finished goods stock; R&D costs; and costs of equipment and buildings.

3 Operating costs, equal to all operating costs (other than direct materials) incurred to earn

throughput contribution. Operating costs include salaries and wages, rent, utilities and

depreciation.

The objective of TOC is to increase throughput contribution while decreasing investments

and operating costs. *The theory of constraints considers short-run time horizons and assumes*

other current operating costs to be fixed costs. The key steps in managing bottleneck resources

are as follows:

● Step 1. Recognise that the bottleneck resource determines throughput contribution of the plant

as a whole.

● Step 2. Search and find the bottleneck resource by identifying resources with large quantities

of stock waiting to be worked on.

● Step 3. Keep the bottleneck operation busy and subordinate all non-bottleneck resources to the

bottleneck resource. That is, the needs of the bottleneck resource determine the production

schedule of non-bottleneck resources.

Step 3 represents a key notion: to maximise overall contribution margin, the plant must

maximise contribution margin (in this case, throughput contribution) of the constrained or

bottleneck resource. For this reason, step 3 suggests that the bottleneck machine always be kept

running, not waiting for jobs. To achieve this, companies often maintain a small buffer stock

of jobs waiting for the bottleneck machine. The bottleneck machine sets the pace for all non-

bottleneck machines. That is, the output at the non-bottleneck operations are tied or linked

to the needs of the bottleneck machine. For example, workers at non-bottleneck machines are

not motivated to improve their productivity if the additional output cannot be processed by

the bottleneck machine. Producing more non-bottleneck output only creates excess stock; it

does not increase throughput contribution.

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● Step 4. Take actions to increase bottleneck efficiency and capacity – the objective is to increase

throughput contribution minus the incremental costs of taking such actions. The management

accountant plays a key role in step 4 by calculating throughput contribution, identifying rel-

evant and irrelevant costs and doing a cost–benefit analysis of alternative actions to increase

bottleneck efficiency and capacity.

We illustrate step 4 using the example of Hussermann-Plattenvertriebs AG. Hussermann-

Plattenvertriebs manufactures car doors in two operations: stamping and pressing. Additional

information is as follows:

Stamping

Pressing

Capacity per hour

20 units

15 units

Annual capacity (6000 hours of capacity available

120 000 units

90 000 units

in each of stamping and pressing)

Annual production

90 000 units

90 000 units

Fixed operating costs (excluding direct materials)

€720 000

€1 080 000

Fixed operating costs per unit produced

(€720 000 ÷ 90 000; €1 080 000 ÷ 90 000)

€8 per unit

€12 per unit

Each door sells for €100 and has direct materials costs of €40. Variable costs in other functions

of the value chain – R&D, design of products and processes, marketing, distribution and customer

service – are negligible. Hussermann-Plattenvertriebs' output is constrained by the capacity of

90 000 units at the pressing operation. What can Hussermann-Plattenvertriebs do to relieve the

bottleneck constraint at the pressing operation?

1 *Eliminate idle time* (time when the pressing machine is neither being set-up to process

products nor actually processing products) at the bottleneck operation. Hussermann-

Plattenvertriebs is considering permanently positioning two workers at the pressing operation.

Their sole responsibility would be to unload finished units as soon as one batch of units

is processed and to set up the machine to process the next batch. Suppose the annual cost

of this action is €48 000 and the effect of this action is to increase bottleneck output by

1000 units per year. Should Hussermann-Plattenvertriebs incur the additional costs? Yes,

because Hussermann-Plattenvertriebs' relevant throughput contribution increases by

€60 000 [1000 units × (selling price, €100 – direct materials costs, €40)], which exceeds

the additional cost of €48 000. All other costs are irrelevant.

2 *Process only those parts or products that increase sales and throughput contribution,* not parts

or products that remain in finished goods or spare parts stock. Manufacturing products that

sit in stock does not increase throughput contribution.

3 *Shift products that do not have to be made on the bottleneck machine to non-bottleneck*

machines or to outside facilities. Suppose Kontrol, AG, an outside contractor, offers to press

1500 doors at €15 per door from direct materials that Hussermann-Plattenvertriebs supplies.

Kontrol's quoted price is greater than Hussermann-Plattenvertriebs' own operating costs in the

Pressing Department of €12 per door. Should Hussermann-Plattenvertriebs accept the offer?

Yes, because pressing is the bottleneck operation. Getting additional doors pressed from out-

side increases throughput contribution by €90 000 [€100 – €40) × 1500 doors], while relevant

costs increase by €22 500 (€15 × 1500). The fact that Hussermann-Plattenvertriebs' unit cost

is less than Kontrol's quoted price is irrelevant.

Suppose Ahrens AG, another outside contractor, offers to stamp 2000 doors from direct mate-

rials that Hussermann-Plattenvertriebs supplies at €6 per door. Ahrens' price is lower than

Hussermann-Plattenvertriebs' operating cost of €8 per door in the Stamping Department.

Should Hussermann-Plattenvertriebs accept the offer? Since other operating costs are fixed

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costs, Hussermann-Plattenvertriebs will not save any costs by subcontracting the stamping

operations. Total costs will be greater by €12 000 (€6 × 2000) under the subcontracting alter-

native. Stamping more doors will not increase throughput contribution, which is constrained

by pressing capacity. Hussermann-Plattenvertriebs should not accept Ahrens' offer.

4 *Reduce set-up time and processing time at bottleneck operations* (for example, by simplifying the

design or reducing the number of parts in the product). Suppose Hussermann-Plattenvertriebs

can reduce set-up time at the pressing operation by incurring additional costs of €55 000 a year.

Suppose further that reducing set-up time enables Hussermann-Plattenvertriebs to press 2500

more doors a year. Should Hussermann-Plattenvertriebs incur the costs to reduce set-up time?

Yes, because throughput contribution increases by €150 000[(€100 – €40) × 2500], which

exceeds the additional costs incurred of €55 000. Will Hussermann-Plattenvertriebs find it

worthwhile to incur costs to reduce machining time at the stamping operation? No. Other

operating costs will increase, but throughput contribution will remain unaffected. Throughput

contribution increases only by increasing bottleneck output; increasing non-bottleneck output

has no effect.

5 *Improve the quality of parts or products manufactured at the bottleneck operation.* Poor

quality is often more costly at a bottleneck operation than it is at a non-bottleneck operation.

The cost of poor quality at a non-bottleneck operation is the cost of materials wasted. If

Hussermann-Plattenvertriebs produces 1000 defective doors at the stamping operation, the cost

of poor quality is €40 000 (direct materials cost per unit, €40 × 1000 doors). No throughput

contribution is forgone because stamping has excess capacity. Despite the defective production,

stamping can produce and transfer 90 000 doors to the pressing operation. At a bottleneck

operation, the cost of poor quality is the cost of materials wasted plus the opportunity cost

of lost throughput contribution. Bottleneck capacity not wasted in producing defective units

could be used to generate additional sales and throughput contribution. If Hussermann-

Plattenvertriebs produces 1000 defective units at the pressing operation, the cost of poor quality

is €100 000: direct materials cost of €40 000 (direct materials cost per unit, €40 × 1000 units)

plus forgone throughput contribution of €60 000 [(€100 – €40) × 1000 doors].

The high costs of poor quality at the bottleneck operation mean that bottleneck time should

not be wasted processing units that are defective. That is, inspection should be done before

processing parts at the bottleneck to ensure that only good-quality units are transferred to the

bottleneck operation. Also, quality-improvement programmes should focus on ensuring that

bottlenecks produce minimal defects.

The theory of constraints emphasises the management of bottlenecks as the key to improving

the performance of the system as a whole. It focuses on the short-run maximisation of through-

put contribution – revenues minus materials costs. It is less useful for the long-run management

of costs because it does not model the behaviour of costs or identify individual activities and

cost drivers. By contrast, activity-based costing (ABC) systems take a longer-term perspective by

attempting to eliminate non-value-added activities and to reduce the costs of performing value-

added activities. The theory of constraints is in this respect complementary to ABC systems

(Holmes, 1995).

Balanced scorecards and time-based measures

We want to assess the impact of tracking changes in time-based measures, evaluate and learn

whether these changes affect financial performance, and modify decisions and plans to achieve

corporate goals. We use the structure of the balanced scorecard perspectives – financial, customer,

internal business processes, and learning and growth – which we discussed in Chapter 20 to

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Summary

summarise how financial and non-financial measures of time relate to one another, reduce delays,

and increase the output of bottleneck operations.

Financial measures:

Revenue gains or price increases from fewer delays

Carrying cost of inventories

Customer measures:

Customer-response time (the time it takes to fulfil a customer order)

On-time performance (delivering a product or service by the scheduled time)

Internal-business-process measures:

Average manufacturing time for key products

Manufacturing cycle efficiency for key processes

Defective units produced at bottleneck operations

Average reduction in set-up time and processing time at bottleneck operations

Learning-and-growth measures:

Employee satisfaction

Number of employees trained to manage bottlenecks

To see the cause-and-effect linkages across these balanced scorecard perspectives, consider the

example of Brexit Gems, a designer and manufacturer of equipment for the jewellery industry.

A key financial measure is to achieve a higher profit margin on a specific product line. In the

customer-measure category, the company sets a goal of a 2-day turnaround time on all orders

for the product. To achieve this goal, an internal business-process measure requires a bottleneck

machine to be operated 22 hours per day, 6 days a week. Finally, in the learning-and-growth

measures category, the company trains new employees to carry out non-bottleneck operations

to free experienced employees to operate the bottleneck machine. Brexit Gems's emphasis on

time-related measures in its balanced scorecard has allowed the company to substantially increase

manufacturing throughput and decrease customer-response times, leading to higher revenues

and increased profits. Managers use both financial and non-financial measures to manage the

performance of their firms along the time dimension. Non-financial measures help managers

evaluate how well they have done on goals such as improving manufacturing cycle times and

customer-response times. Revenue and cost measures help managers evaluate the financial

effects of increases or decreases in non-financial measures, such as manufacturing cycle time and

customer-response times.

Summary

The following points are linked to the chapter's learning objectives.

1 Just-in-time production systems take a 'demand-pull' approach in which each component on a production line

is produced immediately as needed by the next step in the production line to directly satisfy customer orders.

2 The five major features of a JIT production system are (a) organising production in manufacturing cells, (b)

employing and training multiskilled workers, (c) emphasising total quality management, (d) reducing manufac-

turing lead time and set-up time, and (e) building strong supplier relationships.

3 Journal entries in a backflush-costing system are not made sequentially to match the flow of a product in a plant.

Rather, some or all journal entries relating to the cycle from purchase of direct materials to the sale of finished

goods are delayed.

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4 The economic order quantity (EOQ) decision model calculates the optimal quantity of stock to order. The larger

the order quantity, the higher the annual carrying costs and the lower the annual ordering costs. The EOQ model

includes those transactions routinely recorded in the accounting system and opportunity costs not routinely

recorded.

5 The reorder point is the quantity level of stock that triggers a new order. It equals the sales per unit of time mul-

tiplied by the purchase-order lead time. Safety stock is the buffer stock held as a cushion against unexpected

unavailability of stock from suppliers.

6 Just-in-time (JIT) purchasing is the purchase of goods or materials such that delivery immediately precedes

demand or use. EOQ models support smaller and more frequent purchase orders (as in JIT purchasing) as rele-

vant carrying costs increase and relevant ordering costs per order decrease.

7 A relevant cost–benefit analysis of JIT purchasing includes relevant costs of purchasing, carrying stock, ordering

and stockout, quality-related costs of inspection and customer returns and lost contribution margins due to late

deliveries. The relevant benefits and relevant costs of JIT production include relevant costs of set-up and carrying

stock, better quality and faster delivery.

8 The three main measurements in the theory of constraints are *throughput contribution* (equal to sales minus

direct materials costs); *investments or stock* (equal to the sum of materials costs of direct materials stock, work-in-

progress stock and finished goods stock, R&D costs and costs of equipment and buildings); and *operating costs*

(equal to all operating costs other than direct materials costs incurred to earn throughput contribution).

9 The four steps in managing bottlenecks are (a) to recognise that the bottleneck operation determines throughput

contribution, (b) to search for and find the bottleneck, (c) to keep the bottleneck busy and subordinate all

non-bottleneck operations to the bottleneck operation and (d) to increase bottleneck efficiency and capacity.

10 The balanced scorecard can be used to track changes in time-based measures, evaluate and learn whether these

changes affect financial performance, and modify decisions.

References and further reading

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CHAPTER 21

Assessment material

Review questions

21.1 Distinguish a demand-pull from a push-through system.

21.2 List five major features of JIT production systems.

21.3 Describe how JIT systems affect product costing.

21.4 Companies adopting backflush costing often meet three conditions. Describe these three

conditions.

21.5 Outline how three different versions of backflush costing can differ.

21.6 What assumptions are made when using the simplest version of the economic order quantity

(EOQ) decision model?

21.7 Give examples of costs included in annual carrying costs of stock when using the EOQ decision

model.

21.8 Give two reasons why waiting lines and delays occur.

21.9 ‘Companies should always make and sell all products whose selling prices exceed variable costs.’

Do you agree? Explain.

21.10 Describe the three main measures used in the theory of constraints.

Exercises

Basic level

***21.11 Backflush costing and JIT production** (20 minutes)

Papadopoulou SA manufactures electrical meters. For August, there were no opening stocks of

direct (raw) materials and no opening and closing work in progress. Papadopoulou uses a JIT pro-

duction system and backflush costing with two trigger points for making entries in the accounting

system:

a Purchase of direct materials debited to Stock: Raw and In-Progress Control

b Completion of good finished units of product debited to Finished Goods Control at standard

costs.

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Papadopoulou's August standard costs per unit are direct materials, €25; conversion costs, €20.

The following data apply to August manufacturing:

Direct (raw) materials purchased

€550 000

Conversion costs incurred

€440 000

Number of finished units

21 000

manufactured

Number of finished units sold

20 000

Required

1 Prepare summary journal entries for August (without disposing of under- or overallocated

conversion costs). Assume no direct materials variances.

2 Post the entries in requirement 1 to the following T-accounts if applicable: Stock Control,

Conversion Costs Control, Conversion Costs Allocated and Cost of Goods Sold.

21.12 Backflush, second trigger is sale (20 minutes)

Assume the same facts as in Exercise 21.11. Assume that the second trigger point for Papadopoulou

is the sale – rather than the production – of finished units. Also, the Stock Control account is con-

fined solely to direct materials, whether these materials are in a storeroom, in work in progress or in

finished goods. No conversion costs are ‘inventoried’. They are allocated at standard cost to the units

sold. Any under- or overallocated conversion costs are written off monthly to Cost of Goods Sold.

Required

1 Prepare summary journal entries for August, including the disposition of under- or over-

allocated conversion costs. Assume no direct materials variances.

2 Post the entries in requirement 1 to the following T-accounts if applicable: Stock Control,

Conversion Costs Control, Conversion Costs Allocated and Cost of Goods Sold.

21.13 Backflush, one trigger point (20 minutes)

Assume the same facts as in Exercise 21.11. Now assume that there is only one trigger point, the com-

pletion of good finished units of product, which are debited to Finished Goods Control at standard

costs. Any under- or overallocated conversion costs are written off monthly to cost of goods sold.

Required

1 Prepare summary journal entries for August, including the disposition of under- or overallo-

cated conversion costs. Assume no direct materials variances.

2 Post the entries in requirement 1 to the following T-accounts if applicable: Stock Control,

Conversion Costs Control, Conversion Costs Allocated and Cost of Goods Sold.

21.14 EOQ for a retailer (15 minutes)

Kari-Klær AS buys and sells fabrics to a wide range of industrial and consumer users. One of

the products it carries is denim cloth, used in the manufacture of jeans and carrying bags. The

supplier for the denim cloth pays all incoming freight. No incoming inspection of the denim is

necessary because the supplier has a track record of delivering high-quality merchandise. The

purchasing officer of Kari-Klær has collected the following information:

Annual demand for denim cloth

20 000 metres

Ordering costs per purchase order

€160

Carrying costs per year

20% of purchase cost

Safety stock requirements

None

Cost of denim cloth

€8 per metre

The purchasing lead time is two weeks. Kari-Klær is open 250 days a year (50 weeks for 5 days

a week).

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Required

1 Calculate the EOQ for denim cloth.

2 Calculate the number of orders that will be placed each year.

3 Calculate the reorder point for denim cloth.

21.15 EOQ for manufacturer (20 minutes)

Keep-Kool makes air conditioners. It purchases 12 000 units of a particular type of compressor

part, CU29, each year at a cost of £50 per unit. Keep-Kool requires a 12% annual return on

investment. In addition, relevant carrying costs (for insurance, materials handling, breakage and

so on) are £2 per unit per year. Relevant costs per purchase order are £120.

Required

1 Calculate Keep-Kool's EOQ for CU29.

2 Calculate Keep-Kool's total ordering and carrying costs using EOQ.

3 Assume that demand is uniform throughout the year and is known with certainty. The pur-

chasing lead time is half a month. Calculate Keep-Kool's reorder point for CU29.

21.16 Choosing suppliers for JIT purchasing (30 minutes)

Arjun Manraj runs a print shop. Manraj requires 100 000 boxes of printing paper each year. He

wants his suppliers to deliver the boxes on a JIT basis in order quantities of 400 boxes. Papyrus

Ltd currently supplies the paper to Manraj. Papyrus charges £100 per box and has a superb repu-

tation for quality and timely delivery. Manraj reports the following revenue and cost information

for a typical print job:

Sales

£100 000

Costs of printing paper (£ 100 per box × 400 boxes)

40 000

Other direct materials (ink, etc.)

2 000

Variable printing costs (other than materials)

3 000

Fixed printing costs

25 000

Variable marketing and distribution overhead

1 000

Fixed marketing and distribution overhead

12 000

Suffolk Leaves Ltd has approached Manraj with a proposal to supply all 100 000 boxes to Manraj

at a price of £95 a box. The savings in purchase costs are substantial and Manraj is tempted to

accept Suffolk Leaves's offer, but before doing so, Manraj decides to check on Suffolk Leaves's

reputation for quality and timely delivery. The information Manraj gathers is not all positive.

Manraj estimates that late deliveries from Suffolk Leaves would lead to his incurring overtime and

subcontracting costs of £30 000 per job on ten jobs during the coming year. Manraj also recog-

nises that Suffolk Leaves's paper quality is not uniformly high and ink sometimes smudges after

printing. Manraj expects that smudging would occur on five jobs during the year. Manraj would

then have to buy paper in the open market at £110 per box and rerun the job. Manraj does not

expect both delivery problems and quality problems to occur on the same jobs. Manraj requires

a rate of return of 15% per year on investments in stock.

Required

1 Calculate changes costs if he purchases paper from (a) Papyrus and (b) Suffolk Leaves. Which

supplier should Manraj choose only on the basis of the financial numbers given in the problem?

2 What other factors should Manraj consider before choosing a supplier?

21.17 Stock management, ethics (CMA, adapted) (20 minutes)

Range-Tout SARL builds and distributes industrial storage racks using a just-in-time system and

maintaining minimal stocks. Range-Tout's earnings increased sharply in 2021 and earnings-based

bonuses were paid to the management staff for the first time in several years. Nathalie Carotte,

Range-Tout's president, wants earnings to continue growing, even to the point that the 2022

bonuses would be double those of 2021.

Albert Capus, Range-Tout's vice-president of finance, met with Boris Carême of Génie du

Bois SA, a primary vendor of Range-Tout's manufacturing supplies and equipment. Capus

asked Carême to invoice all of Range-Tout's 2022 purchases (€2 million in equipment and

€3 million in supplies) as equipment. The reason Capus gave for his request was that Range-

Tout's president had imposed stringent budget constraints on operating costs but not on capital

expenditures. Carême agreed to do as Capus asked. Range-Tout expenses all supplies purchases

immediately. It depreciates equipment on a straight-line basis over 10 years, assuming a zero

disposal price.

While analysing the second-quarter financial statements, Jules Ballès, Range-Tout's financial

controller, noticed that only equipment and no supplies had been purchased from Génie du Bois.

Ballès, who reported to Capus, immediately brought this matter to Capus's attention. Capus told

Ballès of President Carotte's high expectations and of the arrangement made with Boris Carême

of Génie du Bois. Ballès requested that he be allowed to correct the accounts and urged that the

arrangement with Génie du Bois be discontinued. Capus refused and told Ballès not to become

involved in the Génie du Bois arrangement.

After thinking about the matter for a while, Ballès arranged to meet with Nathalie Carotte and

he disclosed the arrangement Capus had made with Génie du Bois.

Required

1 Calculate the effect on Range-Tout's 2022 operating profit of showing supplies purchased in

2022 as equipment purchases. Do you agree with Jules Ballès, Range-Tout's financial controller,

that the supplies purchased from Génie du Bois SA were accounted for improperly? Explain

your answer.

2 Refer to the discussion of professional ethics in the appendix to Chapter 1. Explain why the

use of the alternative accounting method to manipulate reported earnings is unethical.

3 Without prejudice to your answers to requirements 1 and 2, assume that Albert Capus's

arrangement with Génie du Bois SA is not ethical in a professional sense. Discuss whether

Ballès's actions were appropriate.

21.18 Theory of constraints, throughput contribution, relevant costs (15 minutes)

Salamanca SA manufactures filing cabinets in two operations: machining and finishing. Addi-

tional information is as follows.

Machining

Finishing

Annual capacity

100 000 units

80 000 units

Annual production

80 000 units

80 000 units

Fixed operating costs

€640 000

€400 000

(excluding direct materials)

Fixed operating costs per unit produced

(€640 000 ÷ 80 000;

€400 000 ÷ 80 000)

€8 per unit

€5 per unit

Each cabinet sells for €72 and has direct materials costs of €32 incurred at the start of the machin-

ing operation. Salamanca has no other variable costs. Salamanca can sell whatever output it

produces. The following requirements refer only to the preceding data; there is no connection

between the situations.

Required

1 Salamanca is considering using some modern jigs and tools in the finishing operation that

would increase annual finishing output by 1000 units. The annual cost of these jigs and tools

is €30 000. Should Salamanca acquire these tools?

2 The production manager of the Machining Department has submitted a proposal to do faster

set-ups that would increase the annual capacity of the Machining Department by 10 000 units

and cost €5000 per year. Should Salamanca implement the change?

21.19 Theory of constraints, throughput contribution, relevant costs (15 minutes)

Refer to the information in Exercise 21.18 in answering the following requirements; there is no

connection between the situations.

Required

1 An outside contractor offers to do the finishing operation for 12 000 units at €10 per unit,

double the €5 per unit that it costs Salamanca to do the finishing in-house. Should Salamanca

accept the subcontractor's offer?

2 The Hunt Corporation offers to machine 4000 units at €4 per unit, half the €8 per unit that it

costs Salamanca to do the machining in-house. Should Salamanca accept the subcontractor's

offer?

***21.20 Theory of constraints, throughput contribution, quality** (15 minutes)

Refer to the information in Exercise 21.18 in answering the following requirements; there is no

connection between the situations.

Required

1 Salamanca produces 2000 defective units at the machining operation. What is the cost to

Salamanca of the defective items produced? Explain your answer briefly.

2 Salamanca produces 2000 defective units at the finishing operation. What is the cost to

Salamanca of the defective items produced? Explain your answer briefly.

Intermediate level

21.21 Backflush journal entries and JIT production (15–20 minutes)

Krügsmann AG has a plant that manufactures transistor radios. The production time is only a

few minutes per unit. The company uses a just-in-time production system and a backflush-costing

system with two trigger points for journal entries:

● Purchase of direct (raw) materials

● Completion of good finished units of product.

There are no opening stocks. The following data pertain to April manufacturing:

Direct (raw) materials purchased

€8 800 000

Direct (raw) materials used

8 500 000

Conversion costs incurred

4 220 000

Allocation of conversion costs

4 000 000

Costs transferred to finished goods

12 500 000

Cost of goods sold

11 900 000

Required

1 Prepare summary journal entries for April (without disposing of under- or overallocated con-

version costs). Assume no direct materials variances.

2 Post the entries in requirement 1 to the following T-accounts if applicable: Stock Control,

Conversion Costs Control, Conversion Costs Allocated and Cost of Goods Sold.

3 Under an ideal JIT production system, how would the amounts in your journal entries differ

from those in requirement 1?

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21.22 JIT purchasing, choosing suppliers (20–25 minutes)

Grano BV and Henco BV manufacture fairly similar remote-controlled toy cars. Sido BV, a retailer

of children's toys, expects to buy and sell 4000 of these cars each year. Both Grano and Henco can

supply all of Sido's needs and Sido prefers to use only one supplier for these cars. An electronic

link will make ordering costs negligible for either supplier. Sido wants 80 cars delivered 50 times

each year. Sido obtains the following additional information.

	Grano	**Henco**
Purchase price of the car	€50	€49
Relevant incremental carrying costs of insurance, materials handling, breakage, etc., per car per year	€11	€10
Expected number of stockouts per year resulting		

from late deliveries

20 cars

150 cars

Stockout costs per car

€25

€26

Expected number of cars sold that will be returned

owing to quality and other problems

40 cars

140 cars

Additional costs to Sido of handling each returned car

€21

€21

Inspection costs per delivery

€20

€28

Sido requires a rate of return of 15% per year on investments in stock.

Required

1 Which supplier should Sido choose? Show all calculations.

2 What other factors should Sido consider before choosing a supplier?

21.23 JIT production, relevant benefits, relevant costs (20 minutes)

Turun Telelaitos Oy manufactures cordless telephones. Turun Telelaitos is planning to implement

a JIT production system, which requires annual tooling costs of €150 000. Turun Telelaitos esti-

mates that the following annual benefits would arise from JIT production.

a Average stock will decline by €700 000, from €900 000 to €200 000.

b Insurance, space, materials handling and set-up costs, which currently total €200 000, would

decline by 30%.

c The emphasis on quality inherent in JIT systems would reduce rework costs by 20%. Turun

Telelaitos currently incurs €350 000 on rework.

d Better quality would enable Turun Telelaitos to raise the prices of its products by €3 per unit.

Turun Telelaitos sells 30 000 units each year.

Turun Telelaitos's required rate of return on stock investment is 12% per year.

Required

1 Calculate the net benefit or cost to Turun Telelaitos from implementing a JIT production

system.

2 What other non-financial and qualitative factors should Turun Telelaitos consider before decid-

ing on whether it should implement a JIT system?

21.24 Just-in-time systems, ethics (30 minutes)

Anna de Noailles, the plant manager at Electro-Sons, calls Pauline Eluard, the plant controller,

into her office. She had just finished reviewing Eluard's report on the financial benefits from

implementing JIT. The report described the following annual benefits and costs.

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	First year after **implementation**	**Subsequent years**
Annual expected benefits from:		
Lower investment in stocks	€290 000	€350 000
Reductions in set-up costs		

110 000

150 000

Reduction in costs of waste, spoilage and rework

200 000

250 000

Operating profit from higher sales as a result of

180 000

300 000

responding faster to customers

Annual expected costs of implementing JIT

950 000

750 000

‘We have been working on getting organised for JIT for almost a year now. Some of the financial

benefits you have calculated seem optimistic to me. I don’t think we are quite there yet, but if you

continue to use the financial numbers you have, we would be forced to implement JIT sooner than

we should. Please look over the numbers and see what you can do. I think some of the numbers

are rather soft anyway. I also understand that plant profitability might take a hit in the year JIT

is first implemented. I retire next year and I don't want to go out with a losing record.' Eluard is

quite certain that her numbers are correct. She is also aware that Noailles would lose most of her

performance bonuses if plant earnings decrease next year. It does not seem fair to her that Noailles

should be penalised in the short term for what is in the long-run interest of the company.

Required

1 On the basis of Eluard's report, calculate the effect of JIT implementation on plant profita-

bility in the first year after implementation and in subsequent years. On the basis of Eluard's

report, should Electro-Sons implement JIT?

2 Is Noailles correct in characterising some of the financial benefits as 'soft'? Which items do you

think she is referring to? If the benefits you identify as 'soft' are not realised, should Electro-

Sons implement JIT?

3 Is Noailles being unfairly penalised if she implements JIT? What should Noailles do? What

should Eluard do?

21.25 Effect of different order quantities on ordering costs and carrying costs, EOQ (30 minutes)

Rève Andalou retails a broad line of Spanish merchandise at its Mont-St-Michel store. It sells

26 000 Juanita linen bedroom packages (two sheets and two pillow cases) each year. Rève Andalou

pays Juanita, SA, €104 per package. Its ordering costs per purchase order are €72. The carrying

costs per package are €10.40 per year.

Simone Voirbeau, manager of the Mont-St-Michel store, seeks your advice on how ordering costs

and carrying costs vary with different order quantities. Juanita, SA, guarantees the €104 purchase

cost per package for the 26 000 units budgeted to be purchased in the coming year.

Required

1 Calculate the annual ordering costs, the annual carrying costs and their sum for purchase-order

quantities of 300, 500, 600, 700 and 900, using the formulae described in this chapter. What is

the economic order quantity? Comment on your results.

2 Assume that Juanita SA introduces a computerised ordering network for its customers. Simone

Voirbeau estimates that Rève Andalou's ordering costs will be reduced to €40 per purchase

order. How will this reduction in ordering costs affect the EOQ for Rève Andalou on their linen

bedroom packages?

21.26 JIT production, operating efficiency (30 minutes)

Mannklein AG is a major manufacturer of metal-cutting machines. It has plants in Frankfurt and

Stuttgart. The managers of these two plants have different manufacturing philosophies.

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Liisa Kurunmäki, the recently appointed manager of the Frankfurt plant, is a convert to JIT

production and had fully implemented JIT by January 2022.

Thomas Ahrens, manager of the Stuttgart plant, has adopted a wait-and-see approach to JIT.

He commented to Kurunmäki : ‘In my time, I have forgotten more manufacturing acronyms than

you have read about in your five-year career. In two years’ time, JIT will join the manufacturing

buzzword scrapheap.’ Ahrens continues with his ‘well-honed’ traditional approach to manufac-

turing at the Stuttgart plant.

Summary operating data for the two plants in 2022 are as follows:

January–

April–

July–

October–

March

June

September December

Manufacturing lead time (days)

Frankfurt

9.2

8.7

7.4

6.2

Stuttgart

8.3

8.2

8.4

8.1

Total set-up time for machines

Total production time

Frankfurt

52.1%

49.6%

43.8%

39.2%

Stuttgart

47.6

48.1

46.7

47.5

Number of units requiring rework

Total number of units started and completed

Frankfurt

64.7%

59.6%

52.1%

35.6%

Stuttgart

53.8

56.2

51.6

52.7

Required

1 What are the key features of JIT production?

2 Compare the operating performance of the Frankfurt and Stuttgart plants in 2022. Comment

on any differences you observe.

3 Kurunmäki is concerned about the level of detail on the job-cost records for the cutting

machines manufactured at the Frankfurt plant during 2022. What reasons might lead Kurun-

mäki to simplify the job-cost records?

***21.27 Backflushing** (35–40 minutes)

The following conversation occurred between Nicos Stavrou, plant manager at Sarantis Engineer-

ing, and Thanasis Bakogiorgos, plant controller. Sarantis manufactures automotive component

parts such as gears and crankshafts for automobile manufacturers. Stavrou has been very enthu-

siastic about implementing JIT and about simplifying and streamlining the production and other

business processes.

Stavrou: Thanasis, I would like to substantially simplify our accounting in the new JIT environ-

ment. Can't we just record one accounting entry at the time we ship products to our customers? I

don't want our staff to be spending time tracking stock from one stage to the next, when we have

as little stock as we do.

Bakogiorgos: Nicos, I think you are right about simplifying the accounting, but we still have a fair

amount of raw material and finished goods stock that varies from period to period depending on

the demand for specific products. Doing away with all stock accounting may be a problem.

Stavrou: Well, you know my desire to simplify, simplify, simplify. I know that there are some costs

of oversimplifying, but I believe that, in the long run, simplification pays big dividends. Why don't

you and your staff study the issues involved and I will put it on the agenda for our next senior

plant management meeting?

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Required

1 What backflush-costing method would you recommend that Bakogiorgos adopt? Remember

Stavrou's desire to simplify the accounting as much as possible. Develop support for your

recommendation.

2 Think about the three examples of backflush costing described in this chapter. These exam-

ples differ with respect to the number and types of trigger point used. Suppose your goal of

implementing backflush costing is to simplify the accounting, but only if it closely matches the

sequential tracking approach. Which backflush-costing method would you propose if:

a Sarantis had no raw materials or work-in-progress stocks but did have finished goods stock?

b Sarantis had no work-in-progress or finished goods stocks but did have raw material stock?

c Sarantis had no raw material, work-in-progress or finished goods stocks?

3 Backflush costing has its critics. In an article in the magazine *Management Accounting,* entitled

'Beware the new accounting myths', R. Calvasina, E. Calvasina and G. Calvasina state:

The periodic (backflush) system has never been reflective of the reporting needs of a manufac-

turing system. In the highly standardised operating environments of the present JIT era, the

appropriate system to be used is a perpetual accounting system based on an up-to-date, realistic

set of standard costs. For management accountants to backflush on an actual cost basis is to

return to the days of the outdoor privy.

Comment on this statement.

21.28 Stock issues (From ACCA Financial Information for Management, Part 1, June 2005) (25 minutes)

Jane plc purchases its requirements for component RB at a price of £80 per unit. Its annual usage

of component RB is 8760 units. The annual holding cost of one unit of component RB is 5% of

its purchase price and the cost of placing an order is £12.50.

Required

1 Calculate the economic order quantity (to the nearest unit) for component RB.

2 Assuming that usage of component RB is constant throughout the year (365 days) and that

the lead time from placing an order to its receipt is 21 days, calculate the stock level (in units)

at which an order should be placed.

3 a Explain the terms ‘stockout’ and ‘buffer stock’.

b Briefly describe the circumstances in which Jane plc should consider having a buffer stock

of component RB.

***21.29 Theory of constraints, throughput contribution, relevant costs** (20 minutes)

Autronic AG manufactures electronic testing equipment. Autronic also installs the equipment at

the customer's site and ensures that it functions smoothly. Additional information on the Man-

ufacturing and Installation Departments is as follows (capacities are expressed in terms of the

number of units of equipment):

Equipment

manufactured

Equipment installed

Annual capacity

400 units per year

300 units per year

Eq uipment

300 units per year

300 units per year

manufactured and

installed

Autronic manufactures only 300 units per year because the Installation Department has only

enough capacity to install 300 units. The equipment sells for €40 000 per unit (installed) and has

direct materials costs of €15 000. All costs other than direct materials costs are fixed. The follow-

ing requirements refer only to the preceding data; there is no connection between the situations.

Required

1 Autronic's engineers have found a way to reduce equipment manufacturing time. The new

method would cost an additional €50 per unit and would allow Autronic to manufacture 20

additional units a year. Should Autronic implement the new method?

2 Autronic's designers have proposed a change in the direct materials that would increase direct

materials costs by €2000 per unit. This change would enable Autronic to install 320 units of

equipment each year. If Autronic makes the change, it will implement the new design on all

equipment sold. Should Autronic use the new design?

3 A new installation technique has been developed that will enable Autronic's engineers to install

10 additional units of equipment a year. The new method will increase installation costs by

€50 000 each year. Should Autronic implement the new technique?

4 Autronic is considering how to motivate workers to improve their productivity (output per

hour). One proposal is to evaluate and compensate workers in the Manufacturing and Instal-

lation Departments on the basis of their productivities. Do you think the new proposal is a

good idea? Explain briefly.

21.30 Theory of constraints, throughput contribution, quality, relevant costs (30–40 minutes)

Lappalainen Oy manufactures pharmaceutical products in two departments: Mixing and Tablet

Making. Additional information on the two departments follows. Each tablet contains 0.5 gram

of direct materials.

Mixing

Tablet Making

Capacity per hour

150 grams

200 tablets

Monthly capacity (2000 hours available in each of

300 000 grams

400 000 tablets

Mixing and Tablet Making)

Monthly production

200 000 grams

390 000 tablets

Fixed operating costs (excluding direct materials)

€16 000

€39 000

Fixed operating costs per tablet

(€16 000 ÷ 200 000; €39 000 ÷ 390 000)

€0.08 per gram

€0.10 per tablet

The Mixing Department makes 200 000 grams of direct materials mixture (enough to make 400

000 tablets) because the Tablet-Making Department has only enough capacity to process 400 000

tablets. All direct materials costs are incurred in the Mixing Department. Lappalainen incurs €156

000 in direct materials costs. The Tablet-Making Department manufactures only 390 000 tablets

from the 200 000 grams of mixture processed; 2.5% of the direct materials mixture is lost in the

tablet-making process. Each tablet sells for €1. All costs other than direct materials costs are fixed

costs. The following requirements refer only to the preceding data; there is no connection between

the situations.

Required

1 An outside contractor makes the following offer: if Lappalainen will supply the contractor

with 10 000 grams of mixture, the contractor will manufacture 19500 tablets for Lappalainen

(allowing for the normal 2.5% loss during the tablet-making process) at €0.12 per tablet.

Should Lappalainen accept the contractor's offer?

2 Another firm offers to prepare 20 000 grams of mixture per month from direct materials Lap-

palainen supplies. The company will charge €0.07 per gram of mixture. Should Lappalainen

accept the company's offer?

3 Lappalainen's engineers have devised a method that would improve quality in the tabletmak-

ing operation. They estimate that the 10 000 tablets currently being lost would be saved. The

modification would cost €7000 a month. Should Lappalainen implement the new method?

4 Suppose that Lappalainen also loses 10 000 grams of mixture in its mixing operation. These

losses can be reduced to zero if the company is willing to spend €9000 per month on quality

improvement methods. Should Lappalainen adopt the quality-improvement method?

5 What are the benefits of improving quality at the mixing operation compared with the benefits

of improving quality at the tablet-making operation?

21.31 Sloan Moving Ltd transports household goods from one city to another within the UK. It meas-

ures quality of service in terms of (1) time required to transport goods, (2) on-time delivery

(within 2 days of agreed-upon delivery date), and (3) number of lost or damaged items. Sloan is

considering investing in a new scheduling-and tracking system costing £160 000 per year, which

should help it to improve performance for items (2) and (3). The following information describes

Sloan’s current performance and the expected performance if the new system is implemented:

Current

Expected

On-time delivery performance

85%

95%

Variable cost per carton lost or damaged

£60

£60

Nu mber of cartons lost or

damaged per year

3000

1000

Sloan expects each percentage point increase in on-time performance to increase revenue by

£20 000 per year. Sloan’s contribution margin percentage is 45%.

Required

1 Should Sloan acquire the new system? Show your calculations.

2 Sloan is very confident about the cost savings from fewer lost or damaged cartons as a result of

introducing the new system but unsure about the increase in revenues. Calculate the minimum

amount of increase in revenues needed to make it worthwhile for Sloan to invest in the new

system.

Advanced level

***21.32 EOQ, cost of prediction error** (30–45 minutes)

Ronald van Hooijdonk is the owner of a truck repair shop. He uses an EOQ model for each of

his truck parts. He initially predicts the annual demand for heavy-duty tyres to be 2000. Each

tyre has a purchase price of €50. The incremental ordering costs per purchase order are €40. The

incremental carrying costs per year are €4 per unit plus 10% of the supplier's purchase price.

Required

1 Calculate the EOQ for heavy-duty tyres, along with the sum of annual relevant ordering costs

and carrying costs.

2 Suppose van Hooijdonk is correct in all his predictions except the purchase price. (He ignored

a new law that abolished tariff duties on imported heavy-duty tyres, which led to lower prices

from foreign competitors.) If he had predicted events correctly, he would have foreseen that

the purchase price would drop to €30 at the beginning of the year and then remain unchanged

throughout the year. What is the cost of the prediction error?

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CHAPTER 22

Emerging issues: digitalisation

and sustainability

A pervasive theme of this book is that accounting usage within

organisations is affected by many interacting factors including managerial

Learning objectives

behaviour, technological changes, competitive forces and wider

stakeholder concerns with enterprise reporting issues. Just as we find

After studying this chapter, you

that firms tend to calculate and use different costs for different purposes,

should be able to:

so different organisations need to design their management accounting

-

Understand why digitalisation

systems in different ways. In the first four parts of the book, we covered

is changing data and affecting

approaches to management accounting which tie in with enterprises’ management accounting

operational processes and we saw in Chapters 20 and 21 that particular product group and business unit strategies can be aligned with specific

- Consider ways in which digital management accounting approaches. We turn now to two key emerging technologies such as artificial issues affecting the management accounting function. Many managers intelligence, machine learning, today have become aware that the digital transformation of enterprises blockchain and the Internet of and sustainability issues impact the accounting information needs of Things require some firms to decision makers. We discuss here these two themes and how they are operate differently from traditional influencing management accounting information and work. industrial enterprises
- Explain what leads digitally

advanced firms to have different accounting information needs

- Be familiar with the digitalised enterprise control loop
- Understand sustainability issues and basic principles of environmental management accounting
- Understand that management accountants should always consider the enterprise context before engaging in change and must prioritise expertise and communication skillsets.

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Digitalisation is changing data

Digitalisation is changing data

Most organisations have invested in internet technologies and resources to extend their consumer

reach and enhance their operational processes. These technologies are quickly reshaping exist-

ing markets, creating new economic spaces and altering the face of consumerism and business

practices. Further, it has become clear that the rising use of user-driven online services and novel

digital technologies has a significant impact on the management of organisational activities and

corporate pursuits. Consequently, management accounting practitioners are forced to rethink

how their work can adapt to the ongoing changes affecting enterprises. Most firms recognise that

strategic, technological and cost management issues are commingled and cannot be thought of in

simple linear terms where strategy determines the technology to be used which in turn, tells us the

right form of accounting to produce. Similarly, a technique like activity-based costing allows us

to think more clearly about organisational processes that drive costs in industrial companies but

new digital technologies have changed many financial relationships we have traditionally taken

for granted. As an example, in some firms, costs to service consumers are not entirely related to

how revenue are generated. This has altered price-setting strategies as well as how costs are to be

managed. Quality costing is also being rethought in some organisations, where the relationships

between voluntary and non-voluntary quality costs have become more complex with consumers

playing a greater role in designing products before consuming those products. So the environment

in which management accountants operate are becoming more complex and demanding altered

approaches to their work.

Advances in digital technologies and data analysis combined with the plummeting cost of

information production and retrieval and the falling cost of hardware are making it easier for

data about consumer actions and desires to be considered. Long ago, firms in competitive mar-

kets determined the products they would produce and sell and customers would influence market

prices by shopping around. But today, customers can impact both prices and play a role in the

actual design of products. Many digital businesses enable consumers to be ‘price makers’ and

‘product makers’. Social websites such as Zomato, Tik Tok, YouTube and Wikipedia allow con-

sumers to create the products they consume. Some firms encourage the co-innovation of physical

products, where consumers and producers come together as ‘prosumers’ (Phade, 2018). In these

contexts, management accountants must carefully engage with other organisational functions to

seek new ways of adding value, insight and business intelligence.

Digital technologies and innovations will continue to deeply impact the world of management

accounting in large part due to the growth of data (Bhimani and Willcocks, 2014). More than

90% of the data in the world was generated only over the last two years. The proliferation of

mobile devices, applications and operating systems continues to alter how we work, what we

work on, where we work and what we work with. As noted in Chapter 1, some major technologies

producing data include mobile technologies, social media, cloud computing and the Internet of

Things (IoT).

So why is data so important? It’s because data impacts action and lives. Data that is collected

and processed effectively can help organisations. The right choices can assist a firm to reduce costs

and enhance revenues. As we have seen in earlier chapters, data helps the performance of individ-

uals and processes to be tracked. Very significantly, data assists enterprises in identifying effective

strategies. These are naturally all tasks associated with the work of management accountants.

But of specific significance is that data forms are changing and therefore so must the expertise of

management accountants.

Take for instance the data produced by IoTs. The physical world now embeds information

collection capacity via such sensors where everything is becoming connected to everything else

and ultimately everyone. IoTs can be thought of as the billions of physical devices around the

world that are now connected to the Internet, all collecting and sharing data. Connecting things by

adding ID tags that are part of IoT sensors proffers digital intelligence to devices enabling them to

communicate real-time data without involving humans. As an AICPA/CGMA report (2020) notes,

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IoT allows: '. . . objects to communicate or to relay data for remote monitoring. This data can be

monetised by providing advisory or maintenance services. It can also be used to trigger automatic

spare-part orders or to adjust machines to improve efficiency or prevent problems. In effect, this

allows machines to get work done without human intervention.' IoT also moves the world toward

the merging of the digital and the physical. This presents the accountant with opportunities to

integrate different sources and forms of data into their practices.

Most of this data that organisations collect, store, create and manage today is unstructured,

and the deployment of this data, which was near impossible in the recent past, now provides

companies with new forms of business intelligence, more informed decision making and greater

speed of service. The rise of 'big data' is altering the premise on which accounting information

provision is based. New possibilities are emerging continuously for organisations to alter the

speed of their operations, the flexibility of their decision making, their strategic positioning and

how they use accounting information to achieve their objectives. And there are many ways in

which data processing alters the dynamics of information costs. As such, the cloud has enabled

enterprises to store, access and share resources at lower costs and with much greater ease, econ-

omy and flexibility. These are all factors the accountant must be familiar with.

It is of note that what firms and consumers do that trigger economic transactions has always

shaped what executives want from accounting information systems. But now it is not just eco-

nomic transactions which managers want to know about. There is a shift taking place in infor-

mation design structures with enterprises now placing value on data that had previously not been

thought of as having decision-making relevance. It is the case that for instance, a customer making

online searches and collecting product information, leaves a trail of information disclosures about

choice and actions prior to the purchase being made (or not being made). This ‘data exhaust’, if

effectively captured and analysed, can help organisations to understand how customers search,

how they reach a purchase point (or change their mind about making a purchase) and what path

dependencies exist in purchase decisions. Bing as a search engine, learns from every search pro-

cess carried out by users and generates greater search value as the magnitude of prior searches

grows. Rakuten gathers information from online customer behaviour irrespective of whether a

purchase is made. EBay monitors buyer and seller activities even if no bidding transactions are

carried out. Such information gathered in massive amounts has portentive value. The data can

be converted into insights that are *predictive.* For instance, the marketing strategy adopted can

be customised around the actions exhibited by potential customers at an aggregate level. Data

that are non-economic and not financially recorded as transactions and that arise from data

exhaust, offer the many possibilities for extending management accounting systems output and

assist decision makers in ways not harnessed in the past. As such, management accountants can

directly play into making an enterprise more competitive by virtue of the data it is able to process

and derive insights from.

In addition to assessing and delineating insights and trends from the analysis of exhaust data,

the use of artificial intelligence (AI) technologies is altering the value of data further. In particular,

machine learning (ML), with a machine's ability to continuously improve its own performance

without human intervention, is adding to what can be gleaned from information processing.

Information flows within and across machines enables action that bypasses the need for human

input. Consumers ordinarily search for information before making choices. But AI systems enable

the right information to find the right consumer. Consequently, vast amounts of data portend

patterns in people's search behaviours and offer possibilities for delivering more relevant infor-

mation specific to the needs of those who can act on it. As more information is delivered to those

who need it, more actions result from the information which in turn produce more data of further

relevance. Individuals' use of digital devices enable AI technologies to become increasingly more

refined, producing greater consumer benefits from a more customised experience.

As explained above, a new paradigm of business has thus emerged where the information takes

itself to the consumer before the consumer searches for it. The effects of AI are being extended

into manufacturing, retailing, transportation, finance, health care, law, advertising, insurance,

entertainment, education, and virtually every other industry transforming their core processes

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and business models. Some experts believe that ‘over the next decade, AI won’t replace managers,

but managers who use AI will replace those who don’t’ (Brynjolfsson and McAfee, 2017).

In what other ways will the work of management accountants alter? We discussed Porter’s

framework for thinking about strategy in Chapter 20. In relation to the digitalisation of business

models, Porter considers that many companies which have invested heavily in internet-based

business processes have ignored strategy at their peril. He believes that such companies have

undermined the structure of their industries, hastened competitive convergence and reduced the

likelihood that they or anyone else will gain a competitive advantage. However, Porter’s arguments

which have been useful to many industrial economy firms may not always find direct applica-

tion in digitally transformed enterprises. The internet and digital technologies which underlie

new business models have brought new challenges to linking corporate strategy to management

controls. Digitally advanced companies need to think about pricing issues, cost-volume-profit

parameters, quality and throughput factors and cost management concerns in a new light.

As digital technologies see advances, analytical methods as inputs to decision making will find

refinement and drive new roles for cost management and financial control. More widely sourced

data is already altering corporate strategy and operational action bringing them closer together.

Developing the ability to apply data analysis techniques in response to the digital transformation

of organisations has become an essential part of management accounting.

Digital technologies are changing accounting

It has been predicted that accountants and auditors face a 94% risk of job loss or change due

to automation, data intelligence and technological advances (Brook, 2018). In fact, 29% of all

automation in business is currently taking place within accountancy (Quiros, 2021). Traditionally,

accounting has assisted managers with decisions that help achieve targeted financial returns and

effective cost management. Executives ask, through the eyes of accounting information, certain

key questions such as:

- Is the business creating value?
- Is it creating as much value as it set out to?
- Is it using the fewest resources to generate the most value possible?

Accounting's role in this respect is unlikely to alter for most companies for some time. Even

enterprises that make extensive use of digital technologies have to address the above ques-

tions. However, at present, the ongoing pace of technological change is triggering important

disruptions in business models and some accounting information requirements are, as a con-

sequence, altering. In this chapter, when we refer to digitally advanced companies, we mean

those which adopt a range of digital technologies, including cloud, online channels, big data/

analytics, Internet of Things, P2P models, blockchain structures, artificial intelligence and

machine learning and diffuse them across their organisational structure to support mission

critical applications and processes (Bhimani, 2021). This is because the financial circuitry of

digitally advanced companies differs from that of conventional industrial era enterprises and

necessitates additional new accounting and control requirements to ensure that decisions and

enterprise control needs are met.

What is the impact of digitalisation on accounting work? The landscape of accountancy is

rapidly shifting. Generally, it is widely held that some human element will always be essential to

management accounting even as AI takes hold of more tasks undertaken by the finance function

in enterprises. Computers take less and less time to unravel patterns from large volumes of data

processed but actioning many decisions requires skills that machines do not yet exhibit. Some refer

to these as soft skills including communication, emotional empathy, teamwork and leadership

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dimensions. The World Economic Forum's *Jobs of the Future 2020* report suggests the rising

importance of skills such as critical thinking, active learning, resilience, stress tolerance and

flexibility. Three effects in play as explained above are:

1 Data is both *structured and unstructured* so moving from just a focus on past economic trans-

actions toward *predictive* analytics is essential.

2 More decisions are made by *machines.*

3 Information systems and products are increasingly *integrated.*

The impact of these changes is affecting accounting work. Ordinarily the accountant is focused

on converting raw historical economic data into financial information thought to be useful to

decision makers. But unstructured real time data also holds decision-making power and can

no longer be ignored by accountants. Moreover, as machines engage in more decision making,

there is a lesser need for financial information to be converted from data into information read-

able by humans. This is because specific formatting is not required by machines which process

raw data sets into ready actionable decisions. Moreover, as both humans and machines make

decisions that create more data, machines learn faster from the generated data compared to

humans and their capacity to make decisions evolves faster (see Exhibit 22.1). The work of

accountants is thus set to change with differing data sets and skillsets becoming more valuable

than others (Bhimani, 2021).

The application of management accounting techniques we have considered in earlier chapters

in the book still applies but some alterations will be essential for most organisations. Firms that

make heavy use of digital technologies require specific financial and non-financial metrics to help

them manage the business and to monitor activities and they usually need also to communicate

information to their lenders and investors which differs from traditional financial information pro-

vision. Investors will want to see economic and operational targets being met, especially by early

digitalised market players to obtain some level of assurance that the enterprise is performing well

across a range of variables. In digitally advanced companies, financial and non-financial infor-

mation of the right type drive value creation. But what factors differentiate these firms leading

them to find more traditional accounting information and practices insufficient or appropriate?

We discuss three below and then explain the form of accounting that is more appropriate for

such enterprises.

Exhibit 22.1

Who makes executive decisions?

Data

Machine

analysis

Executive

decisions

Machine

action

Financial

insight

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Experimentation

At the heart of technological change lies disruption which is driven by experimentation. Where

a firm utilises advanced automation technologies that are not used by anyone else in the market,

the firm will face no competition and, because of this, it will have to create its own future in real

time to explore ways in which its viability and growth can be ensured. This necessitates contin-

uous experimentation. Once a disruptive company starts to operate successfully and grows in a

previously non-existent market, competitors will want to enter that market. And once this hap-

pens, such a firm and its new competitors will all have to react quickly to competitive challenges

while remaining proactive and innovative. Experimentation with the product, the market, the

selling platform, the user experience, and so on, becomes a must for digitally advanced firms in

the absence or presence of competition. Ongoing needs for specific financial and non-financial

information provide assurance to the extent possible that these enterprises offer value and remain

effective, on track and innovative.

Digitally advanced firms are not like traditional organisations where resources are evaluated

in terms of what is needed to serve a market segment for a product which has a known value. No

such certainty exists in fast-evolving technology environments, where there is constant evolution

of the product-market fit. A firm may need to test out a new website feature, it may want to

explore building relationships with influencers, it may search out altered product angles, it may

put on trial a differential pricing scheme, it may try out a novel mobile-responsive template, it

may implement an altered organic tactic to increase online traffic, and so on. Such experimen-

tation can have only minor business impacts or may trigger a grand new strategic redirection.

From a management accounting information perspective, a digitally advanced firm will need to

try out continuously alterations to stay alive and grow and will have to work out specific ways

of tracking its activities so it can identify what actions to take and when to take them. The key is

that altered accounting information becomes a requirement to assist the enterprise to manoeuvre

in a particular manner via close tracking and monitoring of its ongoing experimental activities.

Unleashing spare resources

A digitally advanced company may be founded on a business premise whereby if a customer can

create value then the firm gets a proportion of the value created. Consider business platforms

such as Airbnb and Uber where the intent is to enable users in need of a service or product to

come together with suppliers who have unused capacity so that all parties see a benefit. Digi-

tally advanced firms modelled on the idea of sharing existing resources specifically target new

sources of value creation that rest on utilising existing supplies. It is likely there will be existing

conventional suppliers of the products but the digitally advanced company will have to consider

how spare capacity can be added into the market which will intensify competition and attract

consumers at new price points that are usually lower. In the transportation industry for instance,

conventional suppliers, such as taxis, trains, and other pre-existing services exist where invest-

ments of new resources have had to be made to bring to action their business plan. A digitally

advanced enterprise entering this space will unleash pre-existing supply sources attracting spare

capacity into the market that had been unavailable to public users. All that is required for this is

a digital platform that is supported by the right technology and enterprise infrastructure. The

increased supply of services that is made available will force traditional providers to share revenues

emanating from what customers have been willing to spend with the new firm.

Naturally, competitive forces ensure that where supply of a good increases, this will drive

prices down across the whole industry. More supply with lower prices tends to attract not just

existing customers, but also new ones into the market given the lower price points. So the digitally

advanced firm will alter not just market pricing and the nature of the product, but will also widen

the base of customers. As a consequence, some of the profits that existed under the conventional

set up will now go to the new suppliers with spare capacity and some will go to the consumers

who access lower prices for servicing their needs. Also, additional profits will arise from the

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expanded customer base – much of which will benefit the new firm because of its lower prices.

Understanding the financial mechanics of the new business model and the nature of the market

changes that result requires accounting information that captures the essence of the economic

shifts, whereby unused capacity is put to work via digitised platforms. The financial basis of the

new model differs fundamentally from traditional service providers who had to invest into asset

structures (vehicles for transportation) rather than bringing new service providers to the market.

In such ‘sharing economy’ contexts, relying on conventional accounting information that is not

reflective of the business premise would prove narrow and inadequate to assist in effective decision

making.

Networks are not linear

Many traditional industrial firms are viable because they produce large quantities of the product

or service with value created by virtue of the economies of scale that are captured. Such firms can

sell products at low prices by focusing on the supply side. So, for instance, they buy in bulk which

pushes down their material costs and they also invest in faster and more flexible technologies

which increases efficiency and throughput. As costs go down and efficiency rises, such firms grow

in profit and size. But, many digitally advanced firms are especially reliant on creating demand

rather than using supply strategies in a market with many buyers. They use digitised technological

innovations to create and expand networks (Bhimani, 2022). The growth of networks can become

self-reinforcing as users get value out of more connections. So as connections grow, users sponsor

more connections because a larger user base in the network increases demand for the product.

This then fuels further network expansion and subsequent demand. Consider for instance, the

value of Facebook to a user, which comes from the large user base. Every time an additional user

signs up, the existing members benefit. Accounting indicators in such firms need to be able to

track the value growth of their product offering where users lend more and more value to the

product as the network grows. Additionally, some networks can connect with other networks and

this accelerates the pace of value creation (Instagram can be connected to Twitter and LinkedIn).

If business transactions grow because networks interconnect and, as a result, value is created

then accounting systems need to be able to reflect this. And very importantly, where networks

can expand in many directions they defy linear pathways. Traditional accounting information

systems which rest on a supply focus and which only capture linear paths of value creation are

inadequate for network-based platforms.

The digitalised enterprise control loop

All organisations will have managers who identify targets to pursue and put those plans into

action. Once a point is reached, where the impact of these actions can be assessed, variances and

deviations from expectations can be investigated. Such an analysis provides new insights and

learning and new plans can be drawn to guide future action. A formal process to do this usually

includes the following steps:

● planning activities

● acting on targets set

● monitoring outcomes

● changing and refining new action plans

● keeping stakeholders and in particular investors informed.

These steps apply to all enterprises. However, a digitally advanced firm needs to have a mechanism

for analysing new information from the external business world and from its own operations. It

must know what could and should change the business model as it evolves. Digitally advanced

Exhibit 22.2

The digitally advanced enterprise control loop

ACTION

HYPOTHESIS

PURSUITS

IMPACT

firms, as explained, need to keep tweaking their activities as new information is received and

they must alter their activities incrementally, or even change their entire business model when

accounting feedback suggests a need for the strategic trajectory to alter. Unlike conventional

industrial firms, digitally advanced firms operate in a void, in that they do not typically have

access to extensive historical trends of financial operations or precedents or benchmarks. So,

such enterprises must seek information from the market and external sources and continuously

assess the implications of and for their own activities. The digitalised enterprise control loop is an

approach that lets developed or emerging digitally advanced firms visualise their financial and

non-financial information needs and allows continuous alteration to broad strategic direction as

well as operational activities (see Exhibit 22.2).

Exhibit 22.2 shows three essential steps for the financial control of a digitally advanced firm.

It indicates that the enterprise needs to consider its pursuits or objectives based on some broad

business strategy and hypothesis about the ability of the digital business model to service certain

customer needs. Once the specific operational pursuits that are aligned with the broad hypothesis

are established, the firm must then take action to service and impact its intended market, given

the operational parameters set by the pursuits. Here, financial and non-financial information is

required to assess and communicate performance impact and achievements. In digitally advanced

firms, an ongoing need exists for an assessment of the pursuits' impact. It may be that the pursuits

need minor recalibration and fine-tuning to allow further operational experimentation, or there

may in fact be sufficient impact information indicative of having to alter the model's strategic

hypothesis entirely (Bhimani, 2022). This approach offers a path of analysis for financial and

non-financial monitoring with a continuous information loop to point to whether minor experi-

mentation within the core business premise should be pursued or whether a total reorientation in an

entirely different direction in the light of the real time control information obtained is warranted.

Management accounting and sustainability

Today's managers need to consider sustainability issues in their decisions which requires support

from accounting. The intent is to raise awareness of the firm's desired and undesired environ-

mental, social and economic impacts. A wide variety of terms encapsulate the many concerns

that are emerging. One term used is corporate sustainability management accounting which points

to the organisation of the collection, analysis and communication of environmental, social and

economic information for internal use by an enterprise's managers (Schalteggers et al., 2022). The

focus of sustainability attention should span not just the business organisation but also contribute

to sustainability transformations of markets at a broader level and addressing the grand sustain-

ability problems of societies. Clearly, the role of management accountants in the provision of

useful information that can feed into these wider corporate responsibilities is expanding. These

developments are increasing and changing the sustainability information needs of managers and

what can be expected of management accountants.

The need for organisations to develop a more public 'social conscience' especially for the envi-

ronment is not new. Environmental accounting and management concerns have been the subject

of corporate action and have had the attention of wider stakeholders for over three decades. In the

1990s, the Organisation for Economic Co-operation and Development (OECD) advanced Principles

of Corporate Governance to support economic efficiency, sustainable growth and financial stability.

The underlying principles encompass Transparency, Accountability, Responsibility, Independence

and Fairness (see ‘G20/OECD Principles of Corporate Governance’ at www.oecd.org). Transpar-

ency implies improving disclosure about corporate performance information including a company’s

ability to engage in the voluntary disclosure of environmental issues. Making cost impacts visible,

however, is no easy task.

We have argued in Chapter 1 and throughout this book that management accounting systems

seek to assist managers to evaluate potential organisational actions they may take. Techniques

and strategies in management accounting must therefore keep pace with changes facing managers

in terms of the type of information they require. This includes the important issue of costing the

environment from an organisational perspective. Environmental management accounting (EMA)

is another term that is gaining importance in this respect. EMA aims to support managers by

informing them about environmental impacts of an organisation beyond its boundaries and about

environmental issues that influence the organisation. EMA can help identifying environmental

problems caused, environmental improvements made and how they relate to the financial perfor-

mance of enterprises (Burrit et al., 2021).

EMA enables environmental costs to be identified, measured and allocated appropriately to

a process or to products and make it easier for managers to control and put into effect cost

savings. For example, the cost to process and clean-up toxic waste associated with products can

be allocated directly to those products. The application of environmental management accounting

can lead to profit increases via information on production costs which can be controlled. Not

accounting for the costs of environmental damage can be extremely high. We discussed ISO 9000

in Chapter 20 in relation to quality certification which reduces costs for enterprises. Companies

are also using quality management and measurement practices to find cost-effective ways to reduce

the environmental and economic costs of air pollution, waste water, oil spills, and hazardous

waste disposal. ISO 14000, also developed by the International Organization for Standardization,

is a set of standards designed to encourage organisations to develop (1) environmental manage-

ment systems to reduce environmental costs and (2) environmental auditing and performance-

evaluation systems to review and monitor their progress towards their environmental goals.

EMA delves into a wide variety of areas and requires, for any firm, different functions and

departments to interact. Accountants have to engage with other experts and work in teams to

address the challenges of EMA. For example, a management accountant might seek the input

from environmental engineers, natural science-based experts such as meteorologists, logistics and

transportation specialists, information technology. Such cross-disciplinary engagement is essential

for the successful mobilisation of EMA (Burrit et al., 2021). Change is rapid in some companies

and much slower in others. In a survey of 1234 CFOs from across Europe, by Deloitte (2022)

reports that: ‘Sixty-three per cent of the companies which do have a carbon emissions reduction

plan aim to achieve their goal by 2030. A small minority of companies (6%) have achieved their

target already. About 11% are giving themselves almost two decades, till 2040, to meet their target,

and a few (3%) have set a time frame of 2050 or later. Seventeen per cent of firms have not yet

set a specific time frame for their carbon reduction’. In the face of such variety across industries

and companies, it is clear that the management accountant has to interface with other managers

across different roles in a manner that promotes learning about environmental factors as well as

cost issues and business strategic concerns.

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Exhibit 22.3 presents the broad social, economic and political forces that interact and which

lend EMA a strategic, decision-making and accounting outlook that goes beyond the scope

achieved by more traditional accounting approaches to considering environmental issues. It

shows how non-governmental organisations, the public and governments, spurred by industrial

accidents and incidents, interact to force corporate reaction and awareness. Developments in

management accounting provide industry with sophisticated tools to respond appropriately.

Coupled with these is the rising demand for better financial reporting and disclosure of envi-

ronmental liabilities and costs, and for information on how these are linked with internal

decision processes, see Soonawalla (2006). Also influencing both management accounts and

financial reporting, and the corporate world in general, are enhanced corporate governance

mechanisms and ethical guidelines. In addition, the emergence of voluntary corporate social

responsibility reporting guidelines and management systems, such as the ISO series, permits

management to go beyond compliance with government regulations and accounting rules.

Exhibit 22.3

A framework for understanding the social, economic, political and scientific

forces influencing EMA

Better

Commercial accidents/incidents

Standard costing

disclosure

Academic

Financial

More instructive

Public pressure

progress

reporting

statements

Better

Corporate

Government

Industrial

transparency

watchdogs NGOs

ordinance

modernisation

Corporate reaction

Corporate governance

Audit bureau

Strategic

management

accounting

Ethical guidelines

EMA within a

conformance-performance

continuum

Discretionary

ISO 14000

Progress in

reporting guidelines

management systems

physical sciences

Source: Adapted from Soonawalla, K. (2006) ‘Environmental management accounting’, in A. Bhimani (ed.) *Contemporary Issues in Management Accounting* (Oxford: Oxford University Press), pp. 381–6.

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Finally, advances in the sciences have driven the evolution of eco-efficient production processes,

better measurement mechanisms and the use of renewable energy sources. All these together

create a setting for EMA to evolve a distinct identity and to function as a compliance, perfor-

mance and enhancement frame of operation. A key input into EMA is strategic management

accounting information (discussed in Chapters 20 and 21), as illustrated in Exhibit 22.3.

Companies are increasingly recognising that they must continually earn the right to operate in

the communities and countries in which they do business. Failure to perform adequately not just

on environmental, but also on social outcomes puts at risk a company's ability to deliver future

value to shareholders. Citizens and governments are becoming much more active in pushing com-

panies to live up to and to report on what they see as their environmental and social obligations.

Many managers are promoting sustainability – the development and implementation of strategies

to achieve:

● long-term financial performance

● social performance, such as minimising employee injuries, improving product safety, and elim-

inating corruption

● environmental performance, such as reducing greenhouse gas emissions and non-recycled waste.

The AICPA/CIMA report (Melancon, 2022) on integrated reporting identifies six 'capitals' as

being relevant:

● *Financial capital* – the pool of funds obtained through financing or generated through opera-

tions or investments

● *Manufactured capital* – manufactured physical objects used in the production of goods or the

provision of services – buildings, equipment, infrastructure

● *Intellectual capital* – knowledge-based intangibles, including intellectual property, such as

patents, copyrights, software and licences

● *Human capital* – the competencies, capabilities, experiences and motivation of people, along

with their ability to lead, manage and innovate to implement the organisation strategy

● *Social and relationship capital* – the institutional and social relationships, including shared

norms, common values and behaviours – intangibles associated with brand and reputation,

and an organisation's social licence to operate

● *Natural capital* – all renewable and non-renewable resources that support the prosperity of the

organisation, including air, water, land, minerals, forests, along with eco-system and biodiver-

sity health.

The capitals are viewed as part of a framework that underpins the concept of value creation,

preservation, or erosion.

Many enterprises want their managers to attain environmental and social objectives beyond

what is legally required, while achieving good financial performance – often called the *triple*

bottom line – as part of a company's social responsibility. Still others believe that there is no con-

flict between achieving social and environmental goals and long-run financial performance. What

still stands for most organisational stakeholders is what was advanced by the World Commission

on Environment and Development (WCED) set up by the UN, 40 years ago. The Brundtland

Report (1987) defines this as follows: ‘Sustainable development is development that meets the

needs of the present without compromising the ability of future generations to meet their own

needs’ (IISD, 2022). Management accountants must adhere to this long-standing premise.

Many managers recognise that good environmental and social performance helps to attract

and inspire outstanding employees, improve employee safety and health, increase productivity,

and lower operating costs. Environmental and social performance also enhances a company’s

reputation with socially conscious customers and investors and boosts its image with govern-

ments and citizens, all contributing to long-run financial performance. Experienced financial

analysts can publish favourable reports about companies with strong environmental and social

performance because of their greater transparency and engagement with multiple stakeholders.

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A distinguishing organisational characteristic of companies that emphasise environmental and

social performance is their long-term orientation. The balanced scorecard discussed in Chapter 20

can incorporate elements of environmental and also social performance of a company. Managers

interested in measuring environmental and social performance can include these factors into their

balanced scorecards to set priorities for initiatives, guide decisions and actions, and fuel discus-

sions around strategies and business models to improve performance. Suppose Chipset Ltd. which

we considered in Chapter 20, decides to emphasise environmental and social goals in its balanced

scorecard. What measures might it add to the balanced scorecard presented in Exhibit 20.1?

Exhibit 22.4 presents these additional environment and social measures. In practice, Chipset, like

all companies that emphasise environmental and social goals, integrates sustainability goals and

measures presented in Exhibit 22.4 with business goals and measures presented in Exhibit 20.1

Exhibit 22.4

Environmental and social balanced scorecard measures for Chipset Ltd for the

year 2023

Target

Actual

Strategic Objectives

Measures

Initiatives

Performance

Performance

Financial Perspective

Reduce waste

Cost savings from reducing

Quality improvement

£400 000

£415 000

energy use and waste

programs

Reduce cost of time

Cost savings from fewer

Train workers in safety

£50 000

£55 000

lost from work injuries

work injuries and illness

methods and hygiene

and illness

Customer Perspective

Enhance reputation for

Percentage of customers

Communicate environmental

90%

92%

sustainability with

giving top two ratings for

and social goals and

customers

environmental and social

performance

performance

Internal-Business-Process Perspective

Reduce greenhouse

Greenhouse gas emissions

Increase energy efficiency

27 grams/£1

25.6 grams/£1

gas emissions

per million dollars of sales

and reduce carbon

million of sales

million of sales

footprint by planting trees

Reduce operational

Hazardous and non-

Increase recycling

130 grams/£1

126 grams/£1

waste not recycled

hazardous waste not

programs and redesign

million of sales

million of sales

recycled per million

products

dollars of sales

Reduce work-related

Days of lost time per

Redesign processes to

0.20 days per

0.18 days per

injuries and illnesses

worker per year due to

improve worker safety

worker per year

worker per year

injury or illness

and hygiene

Learning-and-Growth Perspective

Inspiring employees

Percentage of employees

Training employees

87%

90%

through environmental

giving top two ratings

about environmental

and social goals

for environmental

and social benefits

and social performance

Diversity of employees

Percentage of women and

Develop human resource

40%

42%

minorities in managerial

practices to support

positions

mentoring and coaching

for women and minorities

into a single combined scorecard. Chipset gains the following benefits from measuring environ-

mental and social performance:

1 *Creating shared value.* A major benefit of measuring environmental and social performance

is the opportunity it provides to create shared value – recognising that the competitiveness

of Chipset and its social activities are mutually dependent. Under this view, achieving envi-

ronmental and social objectives is seen as providing strategic advantage to the business. For

example, reducing greenhouse gas emissions motivates Chipset to redesign its product and pro-

cesses to reduce energy consumption. Measuring non-recycled hazardous and non- hazardous

waste prompts Chipset to work with its suppliers to redesign and reduce packaging and toxic

substances in its materials and components. Measuring worker-related injuries and illnesses

motivates Chipset to redesign processes to lessen the number of such incidents. In each of

these initiatives, Chipset achieves environmental and social goals as well as gaining competitive

advantage by reducing costs and pushing itself to innovate and build a social and environmental

value proposition into its business strategy.

2 *Identifying cause-and-effect relationships to evaluate benefits.* Together with developing the

kinds of skills in processes and information systems described in Exhibit 20.1, Chipset's top

management creates a culture that encourages hiring employees from a wide variety of back-

grounds, particularly women and minorities. This furthers the company's social goals, but also

gives it access to top talent from a broad cross-section of society. In addition, the company

trains and mentors employees to create shared value. This training improves internal-business

processes to decrease greenhouse gases, hazardous and non-hazardous waste, and work-related

injuries. These actions, in turn, improve customer measures such as Chipset's reputation for

sustainability with customers and customer satisfaction. The financial benefits are the cost

savings from shared value such as lower energy consumption and waste. If Chipset can measure

growth in revenue or operating income from customers attracted to Chipset's environmental

and social actions with reasonable accuracy, the company might add that measure in its finan-

cial perspective. The scorecard shows that Chipset has achieved all its environmental and social

goals, indicating that its environmental and social actions are translating into financial gains.

These results would encourage Chipset to continue its environmental and social efforts.

3 *Reducing risks.* A final benefit of measuring environmental and social performance is to help

manage downside risk by acting as a good corporate citizen. This means being responsive to

different stakeholders and reducing any adverse environmental or social effects of business

activities. For example, reducing greenhouse gases might ward off fines or more stringent

carbon emission caps under the EU Emissions Trading System and decrease the risk of court

action and negative media attention and stakeholder activism that can damage Chipset's

reputation.

Companies use a variety of measures for environmental and social performance in addition to

those described in the Chipset example:

1 *Financial perspective.* Carbon taxes or fees (in countries that levy a carbon tax for emissions),

cost of preventing and remediating environmental damage (training, clean-up, legal costs, and

costs of consumer boycotts); cost of recycled materials to total cost of materials.

2 *Customer perspective.* Brand image (percentage of survey respondents who rate the company

high on trust).

3 *Internal-business perspective.* Energy consumption (joules per £1000 of sales), water use (mil-

lions of cubic metres); waste water discharge (thousands of cubic metres); individual quantities

of different greenhouse gases, for example, carbon dioxide, nitrous oxide, or sulphur dioxide

(grams per £1 million in sales); number of environmental incidents (such as unexpected dis-

charge of air, water, or solid waste); codes of conduct violations (percentage of total employ-

ees); contributions to community-based non-profit organisations; number of joint ventures

and partnerships between the company and community organisations.

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4 *Learning-and-growth perspective.* Implementation of ISO 14000 environmental management

standards (subjective score); employees trained and certified in codes of conduct (percent-

age of total employees); employees trained in United Nations global compact, for example,

human rights, fair wage, no child labour, corruption and bribery prevention (percentage of

total employees).

Context and communication remain key

Managing costs always involves many enterprise functions and activities. Effective cost man-

agement cannot be purely cost focused. It must entail an assessment of many factors including

operational functions, marketing concerns, design constraints, human resource issues and other

facets of organisational activities. If an organisation wants to manage its costs, it must make cost

information accessible to managers who can understand this information irrespective of their

functional training. This is because it takes more than cost information to manage costs. What is

essential for any firm that contemplates altering its management accounting information is that

the change should increase managerial insight, learning and adaptation. This implies that man-

agement accounting information must prioritise ‘management’ and not ‘accounting’!

Concepts in action

Corporates that prioritise sustainability

Adobe is an IT company which achieved record annual revenues of $15.79 billion and net income of $4.822 billion

in fiscal year 2021. This represented a 23% year-over-year sales growth. Adobe has been regarded by Newsweek as

the greenest company. It follows eco-friendly operations and innovations. Adobe has achieved LEED certifications

for most of its workstations. Leadership in Energy and Environmental (LEED) is the most widely used green building

rating system in the world. LEED certified buildings save money, improve efficiency, lower carbon emissions and create

healthier places for people. They are a critical part of addressing climate change and meeting Environmental, Social,

and Governance (ESG) goals. Investors are increasingly applying ESG non-financial factors as part of their analysis

process to identify material risks and growth opportunities. Adobe has set a 100% renewable energy goal. Its ‘strate-

gic data center’ considers environmental issues within its own platforms as well as those of its partners. Its business

conduct code states its sustainability guiding principles as:

● Creating healthy, collaborative and innovative work environments

● Reducing operational costs and increasing productivity through thoughtful resource conservation and waste

reduction

● Driving profit responsibly

● Fostering a culture of involvement in sustainability through employee education and engagement, and

● Enabling our customers to become more sustainable through the use of our products.

Schneider Electric is a French energy and digital solutions company. In 2021 its revenues were €28.9 billion produc-

ing an income of € 2.13 billion. The company has advocated sustainability for more than two decades and states that

'Sustainability is at the core of our purpose, culture and business as we accelerate our contributions to a sustainable

and inclusive world.' The company believes it will reach net zero biodiversity loss in its operations in 2030 to preserve

natural ecosystems and resources. The company incorporates a broad spectrum of energy-related goals into its sus-

tainability strategy, among them the inclusion of climate action in its pledge to achieve a carbon-neutral footprint

ahead of the 2050 net-zero target; replacing single-use plastic packaging with recycled cardboard; and bridging the

gap between meta and women in its hiring process.

Ørsted is one of the leading multinational energy corporations based in Denmark. It sees itself as the world's most

sustainable energy company providing global green energy solutions, including offshore and onshore wind, solar,

and storage. In 2021, its revenues were €77.7 billion yielding operating profits of €24.3 billion. Ørsted continues to

develop its wind power capabilities both onshore and offshore as it comes to terms with its obligations to provide

businesses with innovative renewable energy solutions and build lasting client relationships, saving them time, money

and reducing their overall climate impact.

These leading companies in relation to suitability aims track measures such as the following:

● Financial metrics like cost/benefit analysis, internal rate of return (IRR), and return on investment (ROI).

● Environmental indicators which can include reduction of electricity usage, change in fuel consumption for com-

pany vehicles, carbon emissions reductions, gallons of water saved, and increased waste diversion.

● Social dimensions that focus on employees and occupants, health & wellbeing, diversity & inclusion, supply chain

management, among others.

● Governance variables that arise from policies on a wide range of issues such as company values and business

resilience plans.

Sources: Newsweek (2014) 'Newsweek ranks Adobe world's greenest IT company', 6 June (https://news.adobe.com/news/news-details/2014/Newsweek-

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Alternative definitions of investment

Additionally, enterprises requiring innovative costing solutions need to be aware that management

and control techniques cannot be generic off-the-peg approaches. A management accounting

system should reflect the local context in which it is to operate, and the specific challenges being

faced. It is the management accountant's responsibility to ensure this occurs. General account-

ing metrics and generic non-financial measures rarely fully grasp salient aspects and details of

organisational processes. Most implementations of management accounting systems in practice

show that their effects differ depending on the situation. In other words, there is a high degree

of specificity in the outcomes. So simply transplanting what may be an effective and successful

management accounting approach in one enterprise into another will rarely produce the intended

effects. This applies both to traditional management accounting techniques and to the newer

approaches described in this book. So, it is a requisite for the management accountant to ponder

the possible organisation-specific outcomes that will emerge from a management accounting

system change.

Aside from contextualising accounting practices, communication and expertise are crucial for

the advancing management accounting solutions. Based on extensive evidence, it is clear that both

technical and softer skills are essential for finance executives in the face of the growth of advanced

technologies, including particularly AI and machine learning. Skills such as communication, lead-

ership, critical thinking, and collaboration, aside from technical knowledge, data analytics and

domain expertise are as critical as ever. Many management accountants will find the need to up

their competencies relating to business analytics as well as their statistical, mathematical and

programming skills so as to effectively use AI and machine learning tools. In some few cases,

certain financial executives will need to further their understanding of the following: statistics

including linear and non-linear methods and spline techniques, data mining, probability as well

as mathematics including linear algebra and optimisation; simple algorithms and their assump-

tions including non-parametric algorithms; resampling methods such as bootstrapping and cross-

validation techniques; an AI/machine learning software package; a language such as Python or R;

databases such as SQL and MySQL; and importantly, develop the ability to differentiate between

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References and further reading

causal and predictive analysis to provide more valuable business information to managers. They

may also need to have some understanding of the capabilities of software, data visualisation, data

warehouse management, basics of coding and related analysis skills

As machines take over repetitive mundane work and as many activities become hybrid

human-robot tasks, both technical and social skills are becoming essential for management

accountants to invest in. The technical skills are important as accountants need to deal directly

with machines or interface with people that do. But social skills are also of growing relevance

particularly as accountants become more involved in providing and interpreting information

relating to business activities as opposed to focusing on financial statements. Social skills that

are increasingly relevant include conflict solving, tolerance of uncertainty, innovation focus and

leadership skills. As always, it is likely that differing contexts will make different demands on

skill sets. What is evident is that the work of accountants is changing, and their expertise must

adapt. In a world of IOT, AI and big data, the capacity to make real time data-based decisions is

crucial (Bhimani, 2021). But also, many avant-garde accountants are seeing themselves as business

translators who can drive innovation and digitalisation initiatives by bridging technical expertise

with business needs. Those that adapt will retain and gain relevance.

Summary

The following points are linked to the chapter's learning objectives.

1 Digital innovations are transforming all organisations and affecting their management accounting processes.

2 Digital technologies such as artificial intelligence, machine learning, blockchain and the Internet of Things require

some firms to operate differently from traditional industrial enterprises. Big data analysis is one key outcome

affecting management accounting.

3 Digitally advanced firms have different accounting information needs.

4 The digital enterprise control loop alters the way such firms plan and control their activities and guides the form

of management accounting information necessary.

5 Sustainability and environment management accounting practices help firms achieve their social, environmental

and sustainability activities.

6 Management accountants should privilege the local context and the application of technical and soft skillsets.

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CHAPTER 22

Assessment material

Review questions

22.1 What impact is digitisation having on firms?

22.2 How is data affected by digitisation?

22.3 What are some key technologies producing data?

22.4 What differentiates a digitally advanced firm from a traditional industrial one?

22.5 What is the digitally advanced enterprise control loop?

22.6 Describe dimensions of the strategic scorecard?

22.7 What does the strategic scorecard force board members to do?

22.8 What are the OECD’s corporate governance principles?

22.9 What does environmental management accounting capture?

22.10 What must management accounting system designers be careful to do?

Exercises

Basic level

***22.11 Balanced scorecard, environmental, and social performance** (30 minutes)

Gardini Chocolates makes custom-labelled, high-quality, specialty candy bars for special events

and advertising purposes. The company employs several chocolatiers who were trained in

Germany. The company offers many varieties of chocolate, including milk, semi-sweet, white,

and dark chocolate. It also offers a variety of ingredients, such as coffee, berries, and fresh mint.

The real appeal for the company's product, however, is its custom labelling. Customers can order

labels for special occasions (for example, wedding invitation labels) or business purposes (for

example, business card labels). The company's balanced scorecard for 2022 follows. For brevity,

the initiatives taken under each objective are omitted.

Target

Actual

Objectives

Measures

performance performance

Financial perspective

Increase shareholder value

Operating-income changes $1 000 000

$1 500 000

from price recovery

Operating-income changes $200 000

$250 000

from growth

Target

Actual

Objectives

Measures

performance performance

Cost savings due to

$40 000

$50 000

reduced packaging size

Customer perspective

Increase market share

Market share of overall

8%

7.8%

candy bar market

Increase the number of new product

Number of new product

5

7

offerings

offerings

Increase customer acquisitions due to Percentage of new

35%

40%

sustainability efforts

customers surveyed who

required recycled paper

options

Internal-business-process perspective

Reduce time to customer

Average design time

3 days

3 days

Increase quality

Internal quality rating

7 points

8 points

(10-point scale)

Increase use of recycled materials

Recycled materials used

30%

32%

as a percentage of total

materials used

Learning-and-growth perspective

Increase number of professional

Number of chocolatiers

5

6

chocolatiers

Increase number of women and

Percentage of women

40%

38%

minorities in the workforce

and minorities in the

workforce

Required:

1 Was Gardini successful in implementing its strategy in 2022? Explain your answer.

2 Would you have included some measure of customer satisfaction in the customer perspective?

Are these objectives critical to Gardini for implementing its strategy? Why or why not? Explain

briefly.

3 Explain why Gardini did not achieve its target market share in the candy bar market but still

exceeded its financial targets. Is ‘market share of overall candy bar market’ a good measure of

market share for Gardini? Explain briefly.

4 Do you agree with Gardini’s decision not to include measures of changes in operating income

from productivity improvements under the financial perspective of the balanced scorecard?

Explain briefly.

5 Why did Gardini include balanced scorecard standards relating to environmental and social

performance? Is the company meeting its performance objectives in these areas?

Intermediate level

22.12 Balanced scorecard, social performance (30 minutes)

Comtex Company provides cable and internet services in the Greater Boston area. There are many

competitors that provide similar services. Comtex believes that the key to financial success is to

offer a quality service at the lowest cost. Comtex currently spends a significant amount of hours

on installation and post-installation support. This is one area that the company has targeted for

cost reduction. Comtex's balanced scorecard for 2022 follows.

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Target

Actual

Objectives

Measures

performance

performance

Financial perspective

Increase shareholder value

Op erating-income

$2 400 400

$800 000

changes from

productivity

Op erating-income

$520 000

$250 000

changes from growth

In crease in revenue

$50 000

$24 000

from new customer

acquisition

Customer perspective

Increase customer satisfaction

Po sitive customer survey

70%

65%

responses

Increase customer acquisition

Ne w customers acquired

475

350

through company

sponsored community

events

Internal-business-process perspective

Develop innovative services

Re search and

5%

6%

development costs as a

percentage of revenue

Increase installation efficiency

In stallation time per

5 hours

4.5 hours

customer

Increase community involvement

Nu mber of new programs

12

15

with community

organisations

Decrease workplace injuries

Nu mber of employees

<3

7

injured in the

workplace

Learning-and-growth perspective

Increase employee competence

Nu mber of annual

10

11

training-hours per

employee

Increase leadership skills

Nu mber of leadership

2

1

workshops offered

Increase employee safety awareness

Pe rcent of employees

100%

95%

who have completed

safety certification

training

Required

1 Was Comtex successful in implementing its strategy in 2022? Explain.

2 Do you agree with Comtex’s decision to include measures of developing innovative services

(research and development costs) in the internal-business-process perspective of the balanced

scorecard? Explain briefly.

3 Is there a cause-and-effect linkage between the measures in the internal-business-process

perspective and the customer perspective? That is, would you add other measures to the

internal-business-process perspective or the customer perspective? Why or why not? Explain

briefly.

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4 Why do you think Comtex included balanced scorecard measures relating to employee safety

and community engagement? How well is the company doing on these measures?

Advanced level

22.13 Balanced scorecard, environmental, and social performance (30 minutes)

WrightAir is a no-frills airline that services the Midwest. Its mission is to be the only short-haul,

low-fare, high-frequency, point-to-point carrier in the Midwest. However, there are several large

commercial carriers offering air transportation, and Wright Air knows that it cannot compete

with them based on the services those carriers provide. WrightAir has chosen to reduce costs by

not offering many inflight services, such as food and entertainment options. Instead, the com-

pany is dedicated to providing the highest quality transportation at the lowest fare. Wright Air's

balanced scorecard measures (and actual results) for 2022 follow:

Target

Actual

Objectives

Measures

performance performance

Financial perspective

Increase shareholder value

Op erating-income

$7 200 000

$8 400 000

changes from

productivity

Op erating-income

$2 700 000

$3 600 000

changes from price

recovery

Op erating-income

$3 000 000

$3 960 000

changes from

growth

Co st savings due to

$900 000

$1 080 000

reduction in jet fuel

consumption

Customer perspective

Increase the number of on-time

FA A on-time arrival

1st in

2nd in industry

arrivals

ranking

industry

Improve brand image

Pe rcentage of customer

100%

96%

survey respondents

with greater than

90% approval rating

on company’s

sustainability efforts

Internal-business-process perspective

Reduce turnaround time

On-ground time

<25 minutes

30 minutes

Reduce CO

10

9

2 emissions

Nu mber of engineering

changes that

decreased CO2

emissions

Learning-and-growth perspective

Align ground crews

% of ground crew

70%

68%

stockholders

Ac quire new energy management tool Ac hieve ISO 50001

Acquire

Acquire

and technology

certification in

certification certification

energy management by Dec. 31

by Dec. 31

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Required:

1 What is WrightAir's strategy? Was WrightAir successful in implementing its strategy in 2022?

Explain your answer.

2 For WrightAir, draw a map describing the cause-and-effect relationships among the strategic

objectives described in the balanced scorecard. Identify what you believe are any (a) strong ties,

(b) focal points, (c) trigger points, and (d) distinctive objectives. Comment on your structural

analysis of the strategy map.

3 Based on the strategy identified in requirement 1 above, what role does the price-recovery

component play in explaining the success of WrightAir?

4 Would you have included customer-service measures in the customer perspective? Why or why

not? Explain briefly.

5 Would you have included some measure of employee satisfaction and employee training in the

learning-and-growth perspective? Would you consider this objective critical to WrightAir for

implementing its strategy? Why or why not? Explain briefly.

6 Why do you think Wright Air has introduced environmental measures in its balanced score-

card? Is the company meeting its performance objectives in this area?

22.14 Downsizing (CMA, adapted) (60 minutes)

Mayfair Limited currently subsidises cafeteria services for its 200 employees. Mayfair is in the

process of reviewing the cafeteria services as cost-cutting measures are needed throughout the

organisation to keep the prices of its products competitive. Two alternatives are being evaluated:

downsize the cafeteria staff and offer a reduced menu, or contract with an outside supplier.

The current cafeteria operation has four employees with a combined base annual salary of

€110 000 plus additional employee benefits at 25% of salary. The cafeteria operates 250 days

each year, and the costs for utilities and equipment maintenance average €30 000 annually. The

daily sales include 100 starters at €4.00 each, 80 sandwiches or salads at an average price of €3.00

each, plus an additional €200 for beverages and desserts. The cost of all cafeteria supplies is 60%

of revenues.

The plan for downsizing the current operation envisions retaining two of the current employees

whose combined base annual salaries total €65 000. A starter menu would no longer be offered,

and prices of the remaining items would be increased slightly. Under this arrangement, Mayfair

expects daily sales of 150 sandwiches or salads at a higher average price of €3.60. The additional

revenue for beverages and desserts is expected to increase to €230 each day. Because of the elimina-

tion of the starter, the cost of all cafeteria supplies is expected to decline to 50% of revenues. All

other conditions of operation would remain the same. Mayfair is willing to continue to subsidise

this reduced operation but will not spend more than 20% of the current subsidy.

A proposal has been received from Wilco Foods, an outside supplier who is willing to supply caf-

eteria services. Wilco has proposed to pay Mayfair €1000 per month for use of the cafeteria and

utilities. Mayfair would be expected to cover equipment repair costs. In addition, Wilco would pay

Mayfair 4% all revenues received above the breakeven point. This payment would be made at the

end of the year. All other costs incurred by Wilco to supply the cafeteria services are variable and

equal 75% of revenues. Wilco plans to charge €5.00 for a starter course, and the average price for

the sandwich or salad would be €4.00. All other daily sales are expected to average €300. Wilco

expects daily sales of 66 starters and 94 sandwiches or salads.

Required

1 Determine whether the plan for downsizing the current cafeteria operation would be acceptable

to Mayfair Limited. Show your calculations.

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2 Is the Wilco Foods proposal more advantageous to Mayfair Limited than the downsizing plan?

Show your calculations.

22.15 From the Chartered Institute of Management Accountants, Intermediate Level,

Management Accounting – Performance Management, November 2003 (45 minutes)

E plc provides a computer upgrading, servicing and repair facility to a variety of business and

personal computer users.

The management team has managed the business to date by using a standard costing and budget-

ary control system. However, the team has recently been discussing the possible use of alternative

performance measurement systems, such as the ‘balanced scorecard’.

Another issue which concerns the management of E plc is the quality of the service provided for

clients. The operations manager has suggested that the company should introduce total quality

management (TQM) but the management team is unsure how to do this and of the likely costs

and benefits of its introduction.

Required

1 Explain the concept of the balanced scorecard and how it may be used by E plc to improve

performance measurement.

2 a Briefly explain total quality management in the context of E plc.

b Discuss the likely costs and benefits that would arise if E plc introduced a TQM policy.

PART V

Case study problems

Case 501

High-Tech Limited

Jenice Prather-Kinsey, University of Missouri-Columbia

This case demonstrates the importance of strategy and cost allocation in the IT manufacturing

environment. The case requires the development of a relevant balanced scorecard for the busi-

ness together with the construction of an appropriate ABC model.

Background

High-Tech (H-T) is a computer manufacturer founded in Yorkshire, England, in 1901. H-T

originated as a commercial scale, cheese and meat slicing, punch card, tabulating and time record-

ing conglomerate. The company began with 1300 employees and with sales in England, Scotland

and Wales. The company had a difficult time managing its diversified products in numerous loca-

tions. H-T undertook several strategies to overcome its faltering operations. First, H-T increased

sales by implementing healthy sales incentives, grooming its salesmen in dark suits, promoting

company pride and loyalty in its employees and beefing up customer services. Second, H-T focused

on selling tabulating machines, and expanded sales to the USA, Asia, Australia and South America.

These strategies helped H-T overcome its sinking operations. While other companies were

folding during the Great Depression, H-T continued to grow and began providing employee

benefits such as life insurance and paid vacations. Just-in-time inventory control would not have

been useful to H-T during the Depression. Because H-T had large inventories on hand, it was

able to undertake large government contracts during the 1930s. H-T had become so large in the

computer industry that it was constantly being sued, but unsuccessfully, for monopoly violations.

During World War II, H-T continued to grow through government contracts. H-T used some of

its profits to finance orphans and widows of war casualties. This goodwill act helped to foster

employee loyalty and demonstrated good community citizenship?

Technological development escalated beginning in the 1950s. H-T first developed a 5-ton

50-foot by 8-foot calculator. This calculator was replaced with vacuum tubes and later with

a mainframe transistor that was faster and smaller than the vacuum tube. By 1957, H-T had a

spinning disk storage system that could assess and process accounting data on as many as 50

disks and introduced the FORTRAN computer language. H-T was so large that it supplied 90%

of Europe's computers, had £80 billion in sales and 270 000 employees. Between 1970 and 1980,

H-T became the leading manufacturer of mainframe computers, hardware, software and services.

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By the 1980s, H-T was manufacturing floppy disks, bank automatic teller machines, and PCs for

small businesses, schools and home use.

H-T now has manufacturing plants located in Yorkshire, England, and Essonnes, France. In

Yorkshire, H-T manufactures low-end servers and personal computer systems while in Essonnes

it manufactures logic and memory chips. H-T is now vertically integrated and produces, services

and sells products exclusively in the computer industry. More recently, H-T has experienced a

downturn in earnings resulting from a very competitive computer industry.

Systems information

H-T's corporate strategy is to get multi-year cooperative agreements with SAP adopters to

increase H-T's share of the computer hardware market. H-T uses a normal costing system where

manufacturing overhead is applied and estimated annually and quarterly and all other costs are

recorded at actual using a stand-alone weighted-average accounting information and inventory

system. Stand-alone implies that the cost accounting system is not integrated with financial

accounting, finance or logistics ledgers. They hope to install SAP, an electronic resource planning

system, but that has not happened yet. Because cost accounting is stand-alone, at the end of each

quarter considerable accounting effort is spent integrating cost data with financial accounting

and logistics data. Each production location (Yorkshire and Essonnes) is managed separately and

within each location there is decentralisation of functions. The cost accountants focus solely on

budgeting, recording and analysing costs (Exhibits 501.1 and 501.2).

Exhibit 501.1

High-Tech Corporation: Income statement at 31 December

(£ millions except per-share amounts)

2011

2010

Revenues:

Hardware sales

36 500

35 700

Services revenues

15 000

12 000

Software sales

13 000

13 000

Maintenance revenues

7 000

7 000

Rentals and financing income

1 600

1 500

Total revenues

73 100

69 200

Cost of sales:

Hardware sales

24 000

22 000

Services expenses

12 000

10 000

Software expenses

4 000

4 400

Maintenance expenses

3 600

3 600

Rentals and financing expenses

1 600

1 500

Total cost of sales

45 200

41 500

Gross profit

27 900

27 700

Selling expense

15 000

15 200

R & D expense

4 000

4 000

Operating Income

8 900

8 500

Other income

9 000

8 000

Other expenses

710

720

Earnings before income taxes

17 190

15 780

Income tax expense

3 100

3 600

Net income

14 090

12 180

Dividends paid

22

60

Net income to common stockholders

14 068

12 120

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Exhibit 501.2

High-Tech Corporation: Balance sheet at 31 December (£ millions except

per-share amounts)

2011

2010

2011

2010

Current assets:

Current liabilities:

Cash and cash equivalents

7 680

7 260 Taxes payable

3 000

2 600

Marketable securities

500

450 Short-term payables

13 000

11 500

Notes and accounts receivable

16 500

16 400 Accounts payable

5 000

4 500

Sales lease receivables

5 700

6 000 Compensation and benefits

3 000

3 000

Other receivables

900

1 000 Deferred income

3 700

3 500

Inventories

6 000

6 000 Other liabilities

6 600

6 500

Prepaid expenses

3 500 3 200 Total current liabilities

34 300

31 600

Total current assets

40 780

40 310

Long-term liabilities

10 000

10 000

Property, plant and equipment

41 200

44 000 Other debt

14 000

14 300

Less: Accumulated depreciation

−25 000 −27 000 Deferred income taxes payable

1 600

1 800

Net property, plant and equipment

16 200

17 000 Total liabilities

59 900

57 700

Software – net

2 000

2 500 Stockholders’ equity

Investments and miscellaneous acct

22 500

20 600 Preferred stock

353

353

Common stock

8 500

8 400

s

Total assets

81 480 80 410 Retained earnings

10 327

10 657

Translation adjustment

2 400

3 300

Total stockholders’ equity

21 580

22 710

roblem

Total liabilities and

stockholders’ equity

81 480

80 410

tudy p

Case s

Yorkshire, England

RT V

The product development cycle for low-end servers and personal computer systems is three

PA

months. This means that faster and cheaper computers are developed at least three to four times

a year. The computer industry experiences a 2–3% decline in raw material costs and selling

prices each quarter. Therefore, product costs are changing constantly. While head count is high

at Yorkshire, this cost is stable and represents only about 5% of product cost. Seventy per cent of

product cost is materials and 25% is manufacturing overhead. Traditionally, for manufacturing

overhead in production, direct labour £s have been the allocation base.

Yorkshire tries to trace most of its costs directly to the product. Labour and materials are

traced directly to the product through bar codes. Each material input component is bar-coded and

traced directly to the unit to which it is attached. As materials move through assembly, assemblers

indicate which unit of output they are assembling through bar codes. For each product produced,

a diskette includes the serial number assigned to the finished server, the assembler ID number and

the identification number of parts used to make the server.

Since the market fixes the price of labour and materials, H-T hopes to increase profit margins

by reducing manufacturing overhead costs. H-T believes that it can reduce costs by reducing

throughput time. Throughput is defined as follows:

Parts

Finished

Dealers

End users

procurement

goods

1 week

15 days

3 weeks

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PART V Case study problems

H-T's strongest competitors reduce throughput time by eliminating the dealer. Their compet-

itors sell directly to the final or end customer. However, the dealers provide a level of immediate

service to end customers at the end customer's location that is not provided by its competitors.

Competitors' customers have to call an 0800 (freephone) number and sometimes wait 30 minutes

on the phone before a technician can answer their question. Many customers who have software

installation problems must see a computer specialist at their own cost, or for other problems

they may have to return their equipment to the vendor and wait 2–3 weeks before the computer

is replaced or repaired. Therefore, H-T must weigh the benefits of selling through dealers to its

end customers against reducing throughput time by eliminating dealers.

Lead time from dealer order to receipt of goods by the dealer is usually 3–4 weeks. Dealers

generally hold five-week inventory levels to avoid stockout costs and to compensate for goods that

may be damaged during shipment. If not sold immediately, dealers have unsold obsolete inventory

on hand. In the past, H-T has provided rebates to dealers for obsolete inventory. This way, dealers

can offer obsolete inventory at discounted prices to their customers. H-T is concerned that this

policy sends the wrong message to dealers. That is, if dealers do not move their inventory fast,

the dealer does not lose because H-T will discount the merchandise. Therefore, dealers are not

motivated to buy from H-T in small quantities or to sell their inventories quickly. H-T wants

dealers to more accurately estimate their sales so that they do not end up with large quantities of

obsolete inventory on hand. H-T's competitors not only reduce dealer costs by not having dealers,

but also reduce costs related to storing outdated inventory at the dealer's location.

H-T records procurement parts costs when invoiced. So if it invoices a purchase in March, it

uses February costs because March costs are not known at the time of invoicing. At the end of

March, when H-T knows the actual cost of March purchases, it records the under- or overapplied

materials/parts cost as the difference between actual and recorded parts cost.

Variances are investigated at the top end of the organisation, outside of the cost accounting

department. Some variance is tolerated/expected due to the rapidly decreasing parts cost in the

computer industry. Similarly, when dealers are billed for computers purchased, they are billed at

the previous month's price and the invoice price is adjusted the following month to reflect the

actual selling price. That is, H-T does not know the cost of producing the computers and therefore

the selling price of the computers until a month later when their vendors invoice raw materials.

This is when H-T knows the actual cost of parts procurement. Sizing or the comparison of ledger

to physical inventory is done annually.

Shipment of almost all of H-T's products (servers, PCs and mainframes) is out of Yorkshire. In

addition to the production area, Yorkshire has 450 000 square feet of warehousing space. Inven-

tory is in the warehouse for an average of 10–15 days before shipping. H-T uses activity-based

costing (ABC) to allocate annual warehousing and shipping costs to each product as follows (in

£ millions):

Hours

scanning

Hours

Indirect

Square foot

outbound

information

head count

floor space

freight

systems

Activities

(£)

(£)

(£)

(£)

Receiving (from mfg)

50

15.5

Sh ipping parts to

120

12.0

shipping lane

Storage

700.5

10.5

Transportation-out

185

30

10.0

Annual allocation of expenses to products is then conducted as follows:

Desktop

Server

Monitor

Laptops

Options

Receiving

Head count

1000

500

600

1200

400

Info. systems (hours)

600

120

100

800

60

Shipping parts to lane

Head count

800

100

100

800

20

Info. systems (hours)

80

10

60

80

15

Storage

Floor space

1000

2000

600

800

400

Info. systems (hours)

100

100

100

100

100

Trans-out

Head count

70

120

50

80

20

Info. systems (hours)

20

15

10

20

5

Scanning hours

10

5

5

10

2

For some parts, transportation-out is the highest cost (servers). For example, servers have

high transportation-out costs because they are heavy. For other products, order filling is the

highest cost (desktops). For example, desktops absorb high order-filling costs because desktops

are composed of multiple individual parts. The desktops may have 10–15 pieces to a box so it

s

takes more time to fill a desktop order than a server order, which is composed of one or two

parts.

roblem

Essonnes, France

tudy p

In Essonnes, France, H-T manufactures logic and memory chips from a silicon wafer. The silicon

wafers are sliced from a silicon cylinder. The silicon cylinders are £400 each. Each working day

Case s

H-T manufactures approximately 1200 wafers.

In Essonnes, production takes place 24 hours a day, 7 days a week and 52 weeks a year.

RT V

The only days off are 1 May because the French law of 1936 requires it and 25 December.

PA

However, accounting executives' working hours are generally 8.30 a.m. to 6.00 p.m., five

days a week.

H-T purchases silicon cylinders for £400 each. Approximately 125 wafers can be sliced

from each cylinder. During slicing, there is a loss of 20% of the silicon cylinder. It has quality

assurance contracts with its vendors to assure the quality and on-time delivery of its pro-

duction parts (silicon cylinders). After an order is received, H-T slices the silicon cylinders

into wafers.

From each wafer H-T can usually get a total of 100 logic chips and 400 memory chips of which

5% of the good output is loss. The loss is detected at the end of production. To minimise costs,

H-T is currently focusing on increasing the yield from each cylinder and wafer.

After end-of-line, the chips go to production control where they are distributed to their inter-

nal customers at a transfer price of 10% above total production cost. H-T spends considerable

effort in developing and implementing its budget. H-T prepares five-year strategic plans from

which flow yearly budgets and quarterly budgets. The annual budgets begin with actual data that

is negotiated with production managers to produce annual and quarterly budgets. Budgeting

involves a cross-functional team to ensure optimal corporate goal congruence (as opposed to

unit-focused goals that may be suboptimal to the corporation as a whole). Senior management

has weekly technical meetings with production regarding yield, lead time, and quality of shipped

output. Each quarter (three months), H-T compares actual with monthly budgets. Usage of the

service department centres during 2011 follows.

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2011 JOINT PROCESSING COST CENTRE

H-T's actual usage for the year

Information

Quality

systems

assurance

(computer-

Utilities

Maintenance

(no. people on

Suppliers

hours)

(square km) (labour-hours)

prod. line)

Us ers of joint processing

service departments

Utilities

500

70 000

100

Maintenance

1200

1000

60 000

100

Memory chip

500

2000

12 000

500

Logic chip

500

1000

60 000

800

The budgeted charge-out rate for information systems is £10 000 per hour, for utilities is £20 000

per square kilometre, for maintenance is £80 per labour-hour and for quality assurance is £52 000

per person. Information systems include the salaries of personnel, accounting and budgeting costs

and costs associated with the mainframe central processing unit. Utilities include building repairs,

electricity, water, fuel, property taxes and building depreciation. Maintenance involves servicing

the machinery used in production and computers and mainframe systems used throughout H-T.

Quality assurance represents those personnel who measure quality and who conduct surveys on

supplier, employee and customer satisfaction. Full absorption costing is used to determine prod-

uct costs. (For the French definition of full absorption costing, see Bescos and Mendoza (1995).)

H-T wants to assign costs so that managers maximise the quality of output and reduce the

percentage of spoiled chips from each cylinder and wafer (yield). Currently H-T uses a traditional

normal costing system and allocates all processing costs to the good chips only. H-T also wants

a cost system that accurately allocates overhead costs to chips.

To monitor quality, H-T continuously queries its suppliers, employees and customers. Employee

satisfaction is important because it believes the more satisfied the employee, the more likely the

employee will seek to achieve quality output efficiently. In France, the employees are very concerned

about job stability as a result of the downsizing that has taken place. H-T has reduced the number

of buildings occupied by 60%, the number of employees by 40% and has increased production

100% over the past five years as a result of increased technology in its production facilities. Thus,

employees are working harder to achieve corporate goals in a competitive environment. Customer

surveys include questions about on-time delivery. H-T strives to have a 98–99% on-time delivery rate.

Source: Adapted from Prather-Kinsey, J. (2001) 'High-Tech Limited', *Cases from Management Accounting Practice*, Volume 16

(Montvale, New Jersey: Institute of Management Accounting Practice).

Questions

Implementing and monitoring strategy

H-T is in the process of designing a balanced scorecard for the company overall and a tableau

de bord for its plant in Yorkshire. Management's overall corporate goal is to get multi-year

cooperative agreements with SAP adopters to increase H-T's share of the computer hard-

ware market.

1 Develop a value chain for H-T Corporation and for its operations in Yorkshire. Your value-chain

models should be illustrated similar to your textbook. Explain functions in the value chain

with examples. For instance, define in your own words, research and development costs

(R&D) and indicate what projects might be undertaken in R&D. Just because you have the

R&D element in the corporate value chain does not imply that you have an R&D element

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in the Yorkshire value chain. Therefore, the corporate value chain may look different from

or similar to Yorkshire's value chain. You must explain why the chains are similar or dissimilar

between the corporate office and the Yorkshire plant site.

2 A balanced scorecard is usually used to depict corporate strategy. A tableau de bord is a

reflection of the balanced scorecard but represents a division's responsibility in achieving

corporate strategy. For example, a balanced scorecard includes a 5% increase in operating

profits as one of its goals. However, a cost centre will usually focus on the cost element of

operating profit. Therefore the cost centre's tableau de bord will have cost goals rather than

revenue or profit goals. Develop a balanced scorecard for H-T Corporation similar to that

of Kaplan and Norton, but be creative in developing your illustration. You must provide

objective measures for each of the four perspectives of the balanced scorecard. Explain how

your balanced scorecard monitors how well the corporation is meeting its objective(s).

3 Develop a tableau de bord for H-T's operations in Yorkshire. The tableau de bord should be

consistent with the corporate balanced scorecard goals. You should contrast the difference

of Kaplan's balanced scorecard as you illustrated in question 2 above with the tableau de

bord for Yorkshire.

4 Prior to the summary of your paper, you should recommend whether H-T should use the

balanced scorecard only or the tableau de bord for Yorkshire as well as the balanced score-

card for corporate headquarters.

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Are standard and activity-based costing appropriate for H-T?

H-T is contemplating using activity-based costing (ABC). Answer the following questions about

roblem

the Yorkshire location.

5 Would you recommend that H-T consider using activity-based-costing throughout the York-

tudy p

shire plant site? (H-T is currently using ABC in the warehousing area only.)

6 What costing system is H-T using in the production area: actual, normal or standard? What

Case s

costing system would you recommend that H-T use and why?

7 Develop a model for H-T to use if it considers adopting ABC at the Yorkshire plant's pro-

RT V

duction department. Your model should include identification of activities and cost drivers

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for which standards should be developed. To defend the cost drivers used, relate them to

the tableau de bord and corporate strategy targets that you developed in the assignment

'Implementing and Monitoring Strategy'.

Allocating costs in a multicultural company

Answer the following questions about the Essonnes plant site.

8 Recommend a method that H-T should use in allocating its joint production costs. Explain

how this method would be useful in monitoring company strategy.

9 Use your recommended joint cost allocation method to allocate joint production costs.

Provide an illustration of the computations used to allocate joint production costs.

10 What method did you use to allocate service department costs to the production depart-

ments? Explain why you recommend your selected service department cost allocation

method.

11 How much will H-T charge its internal customers (transfer price) for:

a Memory chips

b Logic chips?

12 H-T is hesitant about implementing standard costing because the manufacturing system

is very complicated and because many products share the same manufacturing machines

and/or assembly production lines. Assuming that H-T uses normal costing and is considering

ABC and standard costing, explain personnel issues.

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PART V Case study problems

Case 502

Tanner Pharmaceuticals and the price of a new drug

Andrew Inkpen

This case explores issues of pharmaceutical drug prices in the light of competitive strategy.

Jack Stevens savoured his morning newspaper ritual before starting work as CEO of Dominion

Health. In September 2024, this ritual had become less enjoyable. Stevens was the lead inde-

pendent board member for Tanner Pharmaceuticals Inc. (Tanner), a major US pharmaceutical

company. Tanner's most profitable product was a vaccine for the nulux virus with the brand

name Zorstat. Tanner was the first company to launch a successful nulux vaccine. Unfortunately,

accolades for Tanner were turning into brickbats. Tuesday's *New York Times* had the headline,

'Painted as Zorstat villain, Tanner's chief says she's no such thing'. *The Wall Street Journal wrote,*

'Tanner faces scrutiny over Zorstat price increases: criticisms mount after drugmaker raises cost

of Nulux vaccine by 550% since 2020'. On Wednesday, the *New York Times* had an op-ed feature

titled ‘Stop immoral price gouging for life-saving Zorstat’. At a press conference that included

questions about Zorstat, the White House press secretary said, ‘Pharmaceutical companies often

do real damage to their reputation by being greedy and jacking up prices in a way that victimizes

vulnerable people’. On Thursday, Democratic presidential nominee Kanye West called the price

increase ‘outrageous’; Tanner’s stock ended the day down by 6.2%.

In two days, Stevens would attend the annual meeting of Tanner independent directors. The

Zorstat pricing controversy was on the agenda. Stevens would have to take and defend a position

on Tanner’s drug-pricing strategy. Inevitably, there would be a heated discussion on Zorstat and

whether management was effectively driving shareholder value with drug-pricing decisions.

The pharmaceutical industry

The main goal of the pharmaceutical industry is to provide drugs that prevent infections, main-

tain health, and cure diseases. This industry directly affects the global population, so a number

of international regulatory bodies monitor things like drug safety, patents, quality, and pricing.

The industry includes several distinct sectors: patented drugs, generic (off patent) drugs, over-the-

counter (OTC) products, and active pharmaceutical ingredients (APIs), which are the chemicals

used to manufacture drugs.

Pharmaceutical companies focused on R&D and patented drugs, such as Pfizer and Novartis,

were consistently among the most profitable companies in the world. The cost of bringing a new

drug to market was estimated at $2.6 billion.1 New drug inventions were protected by patents.

The upstream activities in the pharmaceutical industry value chain were similar to those of

other industries in the manufacturing sector. In the United States, the pharmaceutical industry

had only two drug distribution channels: prescriptions from doctors, and OTC. The US Food

and Drug Administration regulated both channels. Because pharmaceutical drugs directly affect

millions of people's health, strict regulations and oversight existed to ensure safety and quality

at each step in the value chain.

Total global pharmaceutical sales were expected to grow in line with overall health care spend-

ing and global economic growth. The main factors driving health care demand included ageing

populations, the rise of chronic disease, and the increase in innovative and expensive treatments

for disease such as cancer and Hepatitis C.

Source: Thunderbird School of Global Management case No. TB0477 by Andrew Inkpen.

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Drug prices

The prices of patented drugs varied from country to country and depended on various factors,

such as the regulatory environment, the drug distribution systems, the degree to which buyers

are public or private, and the nature of health care and insurance systems. The United States and

Norway, a country with a much higher GDP per capita than the United States, found that US prices

were higher than Norwegian prices for 93% of 40 top-branded drugs available in both countries.2

In many countries, including Norway, a government health care system negotiated drug prices

and in some cases opted not to buy certain drugs if there were questions about their efficacy. In

the United States, governments were not involved in drug-pricing decisions. The pharmaceutical

companies defended their US pricing practices as necessary to recover the costs of drug develop-

ment and testing. Companies argued that if the United States had pricing controls similar to those

in Europe and Canada, R&D spending would be cut and fewer new drugs would be developed.

Tanner Pharmaceuticals Inc

Tanner was founded in 1961 in Morristown New Jersey as a pharmaceutical products distrib-

utor. In 1956 the company began manufacturing OTC health products such as cough syrup. In

1966 Tanner received approval from the FDA to manufacture its first medicine, Penicillin G. The

company broadened its product line to include other generic antibiotics as well as analgesics,

antihistamines, diuretics, and tranquilisers. These products were sold to other pharmaceutical

s

companies as private label products. In 1984 the company introduced its first branded generic

product. Between 1993 and 1999, the company reduced its private labelling business and increased

the number of branded products. In 2004 the company’s revenue was more than $1.3 billion and

roblem

its stock was added to the S&P500. In 2008 the company acquired Signet Laboratories, a com-

pany focused on vaccines. The Signet deal was Tanner's entry into pharmaceutical R&D and

proprietary drugs.

tudy p

Tanner's mission statement was as follows:

● To provide a continuum of quality healthcare services within our resource capabilities.

Case s

● To serve as a leader in a collaborative effort with the community to provide health education,

RT V

support services and care for all of our citizens.

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In 2017 Tanner was involved in a complex transaction involving the acquisition of the generics

business of UK-based Tysol, the creation of a holding company in the Netherlands, and a large

transfer of Tanner stock to a Dutch foundation called a *stichting.* The transaction, known in the

United States as an inversion, shifted Tanner's tax domicile to the Netherlands and lowered US

corporate income taxes. Exhibit 502.1 shows summary financial information for Tanner.

Zorstat price

In 2015 the nulux virus began spreading to many other countries, including the United States. In

2020 Tanner received FDA approval for a new nulux vaccine, which was branded as Zorstat. The

company launched the product simultaneously in the United States and many other countries.

The controversy over the Zorstat price erupted in 2024 after a review by a drug-pricing ana-

lytics firm. The firm reported that in the past two years Tanner had doubled the price of a single

vaccine dose from $50 to $100, and that since the drug was introduced, the price had risen 550%.

Prices outside the United States were much lower. In Brazil a single dose could be purchased from

a doctor for less than $20. In some countries in Africa, the price was even lower. Exhibit 502.2

shows some excerpts from media articles about pharmaceutical prices.

Tanner CEO Susan Steward, who was paid $21.6 million in 2023, defended the US price

increases in an interview. She blamed high patient costs on insurers and drug-benefit managers

who make money by negotiating bigger discounts off increasing list prices. She also said, ‘You

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Exhibit 502.1

Tanner financial data

Income Statement

2023

2022

2021

2020

2019

Total revenue

$9 429.3

$7 719.6

$6 909.1

$6 796.1

$6 129.8

Cost of sales

4 213.2

3 191.6

2 868.8

2 887.8

2 566.4

Gross profit

5 216.1

4 528.0

4 040.3

3 908.3

3 563.4

Operating expenses:

Research and development

671.9

581.8

507.8

401.3

294.7

Selling, general and administrative

2 180.7

1 625.7

1 408.5

1 392.4

1 214.6

Litigation settlements, net

(97.4)

47.9

(14.6)

(3.1)

48.6

Other operating (income) expense

–

(80.0)

3.1

8.3

–

Income from operations

2 460.9

2 352.6

2 135.5

2 109.4

2 005.5

Interest expense

339.4

333.2

313.3

308.7

335.9

Other expense (income) expense

206.1

44.9

74.9

(3.5)

15.0

Income before income taxes and

1 915.4

1 974.5

1 747.3

1 804.2

1 654.6

non-controlling interest

Income tax provision

67.7

41.4

120.8

161.2

115.8

Net income attributable to the

(0.1)

(3.7)

(2.8)

(2.1)

(2.0)

non- controlling interest

Net income attributable to Tanner

$1 847.6

$1 929.4

$1 623.7

$1 640.9

$1 536.8

ordinary shareholders

Selected balance sheet data

Total assets

$22 267.7 $15 820.5 $15 086.6 $11 847.8

$11 530.5

Working capital

2 350.5

1 137.2

1 258.6

1 485.4

804.5

Short-term debt

1.3

330.7

439.8

299.0

128.1

Long-term debt including current

7 294.3

8 104.1

7 543.8

5 395.6

5 130.9

portion of long-term debt

Total equity

9 765.8

3 276.0

2 959.9

3 355.8

3 504.8

can do good and do well, and I think we strike that balance around the globe. I am running a

business. I am a for-profit business. I am not hiding from that.'

Steward indicated that Tanner would expand the number of uninsured patients getting free

Zorstat shots. Stewart also said Tanner would consider a generic version of Zorstat with a lower

list price, an unusual move since Tanner was the only company that could sell the product.

The directors' meeting

Although it was management's responsibility to make pricing decisions, Stevens decided the inde-

pendent board members needed to provide guidance for top management. It looked likely that

Congress would be holding hearings on drug prices. CEO Stewart could get called up to Capitol

Hill next month to explain Zorstat's price.

Lowering Zorstat's US price could help the company's corporate reputation but would lower

Tanner's profitability and lead to cutbacks in several promising research areas. Another factor for

Stevens and the independent board members to consider was the executive compensation plan.

Tanner had put a special incentive plan in place more than two years ago that rewarded executives

if they hit profit targets. The compensation award was potentially worth as much as $82 million

overall to the company's top five executives. Several large shareholders had criticised the plan

when it was made public. Reducing the price of Zorstat could mean sharply lower compensation

for executives. As a member of the Tanner Compensation Committee, Stevens had approved the

incentive plan but was now concerned that perhaps it was driving decisions on drug prices that

were jeopardising Tanner's corporate reputation and long-term performance.

Exhibit 502.2

Excerpts from media articles and op-eds about pharmaceutical prices

New York Times 1

The rapid increase in the price of Zorstat has shocked consumers and lawmakers. Yet it is just one more outrageous instance of pharmaceutical companies raising prices for lifesaving medicines with no justification.

High-level scrutiny from Congress and others could conceivably shame Tanner into lowering prices. But if Congress were concerned about escalating drug prices, it would undertake a much broader look at the industry and possible 18% increase in general inflation.

Los Angeles Times 2

The drug companies are ripping us off, pill by pill, shot by shot. Instead of working to earn reasonable returns by relieving our suffering and saving lives, they now focus on profits above all.

Their main targets are insurance companies.

The pharmaceutical industry has learned to expect such windfall profits because it knows

insurance companies can't say no to unique, patented drugs that have no competitors. The drug

companies defend their pricing practices by stoking fears that curbing exorbitant profits will kill

the golden goose of drug development.

CNBC 3

For several decades, lows and regulations were created to allow intermediaries – the insurers and

distributors – to profit from price increases. But now we need to strike a balance where we not

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only develop rewards for sound financial management, but also ensure there is little reward for

price increases in the absence of a change in unit volume sales or increased product benefit.

We need to reward long-term investment in pipeline and innovation and those who reduce their

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costs without cannibalising innovation, and bring value to patients, doctors, and our economy.

We need to show patients, shareholders, and other stakeholders that we will take action. And we

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need to challenge other who participate in delivering health care – including generic companies,

payers, PBMs, and health-care systems – to do the same.

Case s

1 www.nytimes.com/2016/08/25/opinion/another-drug-pricing-ripoff.html

RT V

2 www.latimes.com/opinion/op-ed/la-oe-stone-solvadi-drug-pricing-20160705-snap-story.html

PA

3 www.cnbc.com/2016/09/16/heres-how-we-break-the-cycle-of-outrageous-drug-price-increases-

commentary.html

Stevens knew that Tanner was not the first US pharmaceutical company subject to criticism

over its pricing practices and would not be the last. Health care costs were a regular source of

debate in the United States, especially during presidential campaigns. Outside the United States,

Tanner was being hailed as a savior for its success with the nulux vaccine, and its pricing practices

generated little controversy.

Notes

1 Tufts Center for the Study of Drug Development (2014) ‘Cost to develop and win marketing approval for a new drug

is $2.6 Billion', Press Release (18 November).

2 J. Whalen (2015) 'Why the U.S. pays more than other countries for drugs', *Wall Street Journal* (1 December).

Question

Do you agree with Tanner's pricing strategy?

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PART V Case study problems

Case 503

Osram

John Shank and Lawrence Carr

This case highlights the trade-off faced by organisations between traditionally used consumables,

and newer, more efficient ones that have a higher initial cost. The case requires the analysis of the

potential savings made by more efficient consumables.

Larry Carter was feeling very optimistic about the new product he wanted to introduce in the

European market, the 'Dulux' Compact Fluorescent Lamp. He had lined up two potential test

market sites, pending a final pricing decision. Larry's problem now was to determine how to price

the Dulux bulbs to provide good value to both end-use customers and Osram's distributors while

also earning as good a profit as possible. His compensation as president of Osram Europe (OEU)

was largely based on the profitability of the business.

Osram EU's parent company, Osram GmbH, is a German-based lighting firm with €1.5 billion

in annual sales. It is part of the German electrical giant Siemens AG (€70 billion in sales). Osram

competes in a €12 billion worldwide lightbulb market with a very strong position in North and

South America. In 1989, Osram started a new subsidiary, Osram Europe (OEU), to try to compete

in the very attractive European market. The European market represents 50% of world lighting

demand, but it is dominated by three major competitors: GE, Sylvania and Philips. OEU grew very

rapidly (25% per year) during its first 10 years, pursuing a niche strategy. OEU, however, was only

participating on the fringe of the market. The three dominant players focused primarily on large

segments in both the consumer and commercial lightbulb markets. Sales for OEU peaked in 1994

and seemed stuck at €60 million in 2001. This was only 4% of the total European commercial

market for 2001, but it was 50% of the speciality segments in which OEU concentrated. Carter felt

it was unlikely he could do better than a 50% market share, so his only realistic hope for further

high growth, which Siemens expected of him, was to tackle new segments.

A new product opportunity

In 2001, during a factory visit in Germany, the OEU management team was introduced to a

patented, innovative light source called Compact Fluorescent Lamps (CFL). Similar in size to an

incandescent bulb, CFL bulbs emit the same 'colour' of light (colour temperature 2800 Kelvin).

The big differences with CFL are that they last about ten times as long and consume only about

one-fifth of the energy. For example, an 18 W CFL bulb provides the light of a 100 W incandescent

bulb while consuming only 18% of the energy and lasting 10 000 hours, versus about 1000 hours.

Of course, this kind of performance comes at a price. The normal incandescent 100 W bulb costs

about 18 cents to manufacture and sells retail for about €1.20. The CFL 18 W bulb costs well over

€2.00 to manufacture. The retail selling price is yet to be determined. Typically, bulb prices did not

vary with wattage. The ten-times life and 80% energy savings factors were thought to more than

justify a substantially higher price that would more than compensate for the significantly higher

manufacturing cost. ‘Customer value’ for an 18 W CFL bulb, replacing 10 000 hours of use with

a 100 W incandescent bulb (at €0.14 per kWh) is €78.00, as shown below:

Annual cost for the incandescent bulb = €1.20 + Power cost (1000 hr × 100 W)

= 100 kWh × €.14 = €14.00)

= €15.20

Source: Adapted from Shank, J. and Carr, L. (2002) ‘Osram’, IMA *Cases from Management Accounting Practice,* Volume 17

(Montvale, NJ: Institute of Management Accounting Practice).

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10-year present value(10%)of €15.20 per year = €93.40

For the 18 W CFL bulb, 10 years of energy cost has a present value (PV) of €15.40 as shown below:

1000 hours per year × 18 W = 18 kWh × €.14

= €2.50 per year

10-year PV(10%)of €2.50 per year = €15.40

Customer value of the CFL bulb = €93.40 − €15.40 = €78.00

In theory, a consumer should be willing to pay up to €78.00 for the alternative CFL bulb. OEU

management was confident that the CFL product had high potential in the European market.

They were pleased to have a proprietary technology to compete against the big three in larger seg-

ments. The technological superiority would give them immediate credibility with end-users and

distributors. Philips Europe owned the European distribution rights to CFL bulbs manufactured

in the USA through joint venture agreements with Siemens. OEU could pay Philips a royalty on

imported CFL bulbs, or manufacture bulbs in the EU to avoid the royalty. Siemens would license

the manufacturing patent to OEU for a nominal fee. Carter was reluctant to commit to EU man-

ufacturing until he was sure of the demand. He wanted to do some test marketing, using bulbs

imported from the USA, to introduce the new product.

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Market segmentation

The European lighting market can be divided into two basic segments: commercial and

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consumer. The latter is the channel for retail sales for home use. The product is ultimately

purchased from supermarkets, drugstores, hardware stores, lighting stores or mass merchan-

tudy p

disers. Mass merchandisers buy bulbs direct from manufacturers. Other outlets use wholesale

distributors.

The commercial segment provides lighting for hotels, factories, hospitals, offices, schools, the-

Case s

atres, scientific laboratories, street and sign lighting, and retail lighting fixture salesrooms. Eighty

per cent of commercial bulbs are bought through wholesale distributors. Because GE, Sylvania

RT V

and Philips are so well established with the major distribution companies, Carter thought his

PA

best bet for introducing CFL was to target segments that do not use distributors. Because OEU is

far too small to deal with the mass merchandisers or the government, Carter decided to explore

two particular niches within the commercial segment: (1) energy-saving converters, which are not

currently large buyers of lightbulbs; and (2) lighting maintenance companies which supply and

maintain bulbs for businesses such as hotels, offices or casinos.

The energy savings converters (ESCO) market

Babson Energy Savers (BES) is a successful ESCO located in London. Its business is energy-

saving remodelling projects, such as heating and air-conditioning systems, low-voltage versus

high- voltage power conversions, and automatic switching controls. A small part of its current

business involves saving building owners energy costs through conversion to fluorescent fixtures.

For example, a fluorescent lamp, which consumes about 32 W of power, provides the equivalent

of 150 W of incandescent light.

The major drawbacks to fluorescent light are the high cost of the bulb, the harsh light and

glare, and the bulky fixtures which are awkward to install and service, and are very unattractive.

CFL bulbs could create a new business opportunity for firms such as BES. CFL's small size and

simple ballasting allow a much wider range of fixture design options than with fluorescent, as

well as the huge energy savings and long-life advantages.

Once the idea was explained to them, the BES engineers shared OEU management's enthu-

siasm for the compact fluorescent lamp. BES felt that, with proper pricing of the CFL lamp, the

cost savings would be very attractive for many of its customers.

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In order to test the new product in this segment, OEU convinced BES to propose using CFL

lighting as part of an overall energy savings project for one of London's old classic hotels, the

Opaque Gardens. OEU would provide financing to the hotel for the cost of retrofitting existing

fixtures (12% annual rate and payments over 15 years) through Siemens' captive finance sub-

sidiary. OEU would guarantee the hotel annual savings in power cost at least double the annual

payment on the retrofitting loan.

The hotel lighting configuration is as follows:

● *Rooms:* 10 floors with 25 rooms per floor. Each room averages 200 occupied days per year.

There are 9 lights in each room (4 table or vanity, 3 overhead and 2 wall) at 100 W each (cost

€1.20 each). Average usage per room rental is a total of 7 hours.

● *Halls:* 10 floors with 24 overhead lights per floor (one 50 W bulb each). Average usage of 24

hours per day.

● Bulb life for the hotel, using incandescent bulbs was 800 hours for room lamps and 1400 hours

for hall lights. Turning bulbs on and off shortens the useful life.

The cost of electricity in London is high, averaging €.14 per kilowatt-hour (kWh). In other parts

of Europe, power costs can be half that rate.

The hotel was currently buying about 1900 bulbs per year:

2250 room bulbs(1250 × 9)at 5-year life per bulb(200 × 7 = 1400 ÷ 9 = 155 vs 800)

= 450 bulbs per year

240 hall bulbs at 6 changes per year (8760 hours ÷ 1400) = 1440 bulbs per year

450 ÷ 1440 = 1890 ≈ 1900 bulbs

Bulbs are changed by the hotel maintenance staff as they burn out. BES cost to retrofit the hotel

light fixtures is as follows:

A typical incandescent or fluorescent overhead fixture costs €7 for material (reflector, bal-

last, igniters and housing modifications) and one half-hour of electrical technician labour

at €18 per hour to retrofit for CFL use. To retrofit a table or vanity fixture costs €2.50 for

material and one quarter-hour of labour. Wall fixtures cost €3 for material and 40 minutes

to retrofit.

BES electrical technicians would do the conversion job. Lighting fixtures typically have a life

of 15 years.

The lighting maintenance contractors (LMC) market

The second niche market that looked attractive to OEU for CFL bulbs was lighting maintenance

contractors (LMCs). This segment bought €144 million in incandescent and fluorescent bulbs

in 2001 and was supplied directly by the big three. The ESCO segment was buying only about

€36 million in fluorescent bulbs in 2001. Even if OEU could double the ESCO market by switching

it to CFL bulbs, the potential was only half that of LMCs.

Farnham Lighting Service (FLS) is based in Farnham, Surrey. FLS contracts with building man-

agers to change the many thousands of lightbulbs that illuminate casino interiors, exterior signs

and car parks. A typical job could have 12 000 to 18 000 bulbs. For the Mayfair casino in London,

the marquee billboard alone has 33 000 bulbs.

FLS charges the casino a set monthly fee based on the number of light sources. The fee includes

labour, equipment usage and the cost of the lightbulbs themselves. Access to the lightbulb can

be very difficult, requiring lifts and other power equipment for changes. This is a key factor in

determining the monthly fee. Normally, longer-life light sources (fluorescent) are chosen for the

least accessible locations. Research showed that burned-out lighting is very unattractive, keeping

customers away from the casinos. The standard practice for lighting service companies is to totally

relamp a section, known as ‘group relamping’, at 80% of the bulbs’ expected life. This virtually

eliminates burned-out lights.

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In order to test the new product in this segment, OEU convinced FLS to propose a conversion

to CFL bulbs for one large customer, the Victoria Casino. The casino has 15 000 incandes-

cent fixtures (50 W and 100 W) with an expected life of 800 or 1400 hours, similar to a hotel,

and 2000 25 W fluorescent fixtures with a rated life of 8000 hours. The casino stays open 24

hours a day. FLS does not relamp the hotel room bulbs, which are changed as they burn out by

the regular maintenance staff. It relamps the hall and casino incandescent bulbs 8 times per

year (8760 hours ÷ 1400 × 0.8) and the fluorescent fixtures approximately 1.4 times per year

(8760 ÷ 8000 × 0.8).With an average labour rate of €20 per hour, an average of 5 minutes to

change each bulb, and equipment rental at about €300 per day, the CFL story is very appealing

to Farnham.

The CFL bulb offers lower power cost to the casino (18 W bulbs vs 100 W, and 9 W vs 25 or

50 W). CFL bulbs offer lower changeover cost to the service company due to longer bulb lives.

The casino would also enjoy less downtime for its 24-hour gambling operation. Sometimes bulbs

could be changed without closing down the gambling, but not always. Downtime means lost

revenue from the gamblers who move to a different casino.

Once they move, players usually do not return immediately the bulb change is complete. The

Victoria Casino, which grosses €250 million a year, once estimated that lost time from lightbulb

changes costs about €100 000 each year in lost revenue at, probably, 75% gross margin.

The changeover requires the purchase of more expensive bulbs and a one-time retrofitting of

all fixtures to accommodate CFL-compatible sockets. The lighting configuration for the Victoria

Casino is as follows:

s

● A 1000-room hotel, with 9 bulbs (100 W) per room and 1000 hall lights (50 W). This is a total

of 10 000 incandescent bulbs.

roblem

● The casino, with 5000 100 W incandescent bulbs and 2000 25 W fluorescent bulbs.

● The casino and the hotel halls were lighted 24 hours a day. The hotel rooms average 200 occu-

tudy p

pied nights per year with 7 hours of bulb usage, combined, per stay.

The one-time retrofitting cost for light fixtures would be:

Case s

3000 wall fixtures @ €30 each

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5000 overhead fixtures @ €35 each

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Power cost is €.12 per kWh in Victoria

FLS uses an eight-person crew at the Victoria Casino. The crew averages 7 working hours on each

8-hour shift. The crew is scheduled to spend about 76 days a year on site. The monthly fee is €20

500 (€246 000 per year), which breaks down as follows:

Bulbs: 48 000 incandescent bulbs at €1.00 each

=

€48 000

2800 fluorescent bulbs at €6.00

=

€16 800

Labour: 50 800 bulb changes at 5 minutes (average) per bulb

= 4234 hours

Paid hours = 76 days × 8 hr × 8 persons = 4864 hours × €20 per hour =

€97 280

Equipment rental (at €300 per crew-day) = €300 × 76

=

€22 800

Subtotal

=

€184 880

Mark-up to cover overhead and profit

=

€61 120

Total

=

€246 000

The CFL bulbs exhibit much smaller variation in bulb life compared with incandescent, whether

bulbs are frequently turned on and off or left burning. FLS could go to ‘group relamping’ at 90%

of the 10 000-hour-rated CFL life with very little chance of burned-out bulbs.

Source: Adapted from Shank, J. and Carr, L. (2002) ‘Osram’, IMA *Cases from Management Accounting Practice*, Volume 17

(Montvale, NJ: Institute of Management Accounting Practice).

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Questions

1 a For the ESCO test market job, what is the present value of CFL bulbs to the hotel over the

15 years life of the fixtures? (This figure will be equivalent to energy savings and labour

saving on bulb replacements, less the cost to retrofit all the fixtures, plus current expendi-

tures for bulb replacement.) This is the maximum price the hotel should be willing to pay

BES for the conversion job.

b What price should OEU charge BES for the CFL bulbs for the Opaque Gardens Hotel job?

c What price should OEU charge the hotel for replacement bulbs?

2 a For the LMC test market, what is the value to FLS in the first year from the Victoria Casino

contract if FLS switched to CFL bulbs? (This figure will be equivalent to the labour and

equipment rental savings from longer bulb life.) This is the maximum amount, which FLS

might pay to OEU for the 8000 new CFL bulbs (5000 18 W bulbs and 3000 9 W bulbs). Of

course, FLS would also know that the casino was achieving large savings which might be

shared with FLS and OEU.

b What is the average annual saving to the Victoria Casino, over the 15-year life of the retro-

fitted fixtures, of switching to CFL bulbs? (This figure will be equivalent to energy savings,

less the retrofit charge, plus the value of reduced casino downtime.) Assume the retrofit

contractor earns a 40% gross margin and Siemens' captive finance subsidiary will finance

the retrofit with a 15-year instalment loan at 12% interest. This is the maximum amount,

which the casino might be willing to pay to FLS for using CFL bulbs. Of course, the casino

would also know that FLS was saving on changeover costs.

c What price should OEU charge FLS for the 8000 replacement bulbs each year?

3 Which of these two markets should OEU pursue? Both?

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APPENDIX A

Solutions to selected exercises

CHAPTER 1

Exercise 1.11

This problem can form the basis of an introductory discussion of the entire field of management accounting.

1 The focus of management accounting is on assisting internal users in their pursuit of better decisions,

whereas the focus of financial accounting is on helping external users seeking to make better decisions.

Management accounting attempts to assist in making most decisions, including pricing, product choices,

investments in equipment, making or buying goods and services, and manager rewards.

2 Generally accepted accounting principles affect both management accounting and financial accounting.

However, an organisation's management accounting system is not governed by generally accepted

accounting principles. For example, if an organisation wants to account for assets on the basis of

replacement costs for internal purposes, no outside agency can prohibit such accounting.

Exercise 1.12

Report statement

Purpose

a

Formulating overall strategies . . .

b

Meeting external regulatory . . .

c

Performance measurement of . . . people

d

Cost planning and cost control

e

Product/customer emphasis decisions

Exercise 1.22

1 Companies with ‘codes of conduct’ frequently have a ‘supplier clause’ that prohibits their employees

from accepting ‘material’ (in some cases, any) gifts from suppliers. The motivations include:

● *Integrity/conflict of interest.* Suppose von Stolzing recommends that a Pogner 1-2-3 product

subsequently be purchased by Beckmesser. This recommendation could be because he felt he owed

them an obligation as his trip to the Marbella conference was fully paid for by Pogner.

● *The appearance of a conflict of interest.* Even if the Pogner 1-2-3 product is the superior one at that

time, other suppliers will probably have a different opinion. They may believe that the way to sell

products to Beckmesser is via ‘fully-paid junkets to resorts’. Those not wanting to do business this

way may downplay future business activities with Beckmesser even though Beckmesser may gain

much from such activities.

Some executives view the meeting as ‘suspect’ from the start given the Costa del Sol location and its ‘rest

and recreation’ tone.

2 The pros of attending the user meeting are as follows:

● Able to learn more about the software products of Pogner.

● Able to interact with other possible purchasers and get their opinions.

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● Able to influence the future product development plans of Pogner in a way that will benefit

Beckmesser. An example is Pogner subsequently developing software modules tailored to food

product companies.

● Saves Beckmesser money. Visiting suppliers and their customers typically costs money whereas Pogner

is paying for the Marbella conference.

The cons of attending are:

● The ethical issues raised in requirement 1.

● Negative morale effects on other Beckmesser employees who do not get to attend the Marbella

conference. These employees may reduce their trust and respect for von Stolzing's judgement, arguing

he has been on a 'supplier-paid vacation'.

The conditions on attending that Beckmesser might impose are:

● A sizeable part of time in Marbella has to be devoted to business rather than recreation.

● The decision on which Beckmesser executive attends is *not* made by the person who attends (this

reduces the appearance of a conflict of interest).

● The person attending (von Stolzing) does not have the final say on a purchase decision (this reduces

the appearance of a conflict of interest).

● Beckmesser executives go only when a new major purchase is being contemplated (to avoid the

conference becoming a regular 'vacation').

A Conference Board publication *Corporate Ethics* asked executives about a comparable situation:

● 76% said Beckmesser and von Stolzing face an ethical consideration in deciding whether to attend.

● 71% said von Stolzing should not attend as the payment of expenses is a 'gift' within the meaning of

a credible corporate ethics policy.

3 Concerning the pros of having a written code, the Conference Board outlines the following reasons why

companies adopt codes of ethics:

● Signals commitment of senior management to ethics.

● Promotes public trust in the credibility of the company and its employees.

● Signals the managerial professionalism of its employees.

● Provides guidance to employees as to how difficult problems are to be handled. If adhered to,

employees will avoid many actions that are, or appear to be, unethical.

● Drafting of the policy (and its redrafting in the light of ambiguities) can assist management in

anticipating and preparing for ethical issues not yet encountered.

The cons of having a written code are:

● Can give the appearance that all issues have been covered. Issues not covered may appear to be

'acceptable' even when they are not.

● Can constrain the entrepreneurial activities of employees. Forces people always to 'behave by the

book'.

● The cost of developing such a code can be 'high' if it consumes a lot of employee time.

CHAPTER 2

Exercise 2.12

1

Fixed costs

Variable costs

Schedule 1

€8000

–

Schedule 2

€2000

€20 per person

Schedule 3

–

€50 per person

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2

50 people

200 people

500 people

Schedule 1

Total costs

€8 000

€8 000

€8 000

Unit costs

160

40

16

Schedule 2

Total costs

€3 000*

€6 000†

€12 000‡

Unit costs

60

30

24

Schedule 3

Total costs

€2 500

€10 000

€25 000

Unit costs

50

50

50

* (€20 × 50) + €2000.

† (€20 × 200) + €2000.

‡ (€20 × 500) + €2000.

Schedule 1 has €8000 fixed costs; as the attendance increases, the unit cost decreases. Schedule 2 has both

a fixed cost component (€2000) and a variable cost component (€20); the spreading of the €2000 amount

over more units as attendance increases causes the unit cost to decrease. Schedule 3 has only a variable

cost component; there is no change in unit cost as attendance increases.

Exercise 2.23

1 Target closing stock of finished goods, 31 Dec. 2023

12 000 units

Forecasted sales for 2023

122 000 units

Total finished goods required in 2023

134 000 units

Opening finished goods, 1 Jan. 2023

9 000 units

Finished goods production required in 2023

125 000 units

2 Revenues (122 000 units sold × €4.80)

€585 600

Cost of units sold:

Opening stock of finished goods, 1 Jan. 2023

€20 970

Cost of goods manufactured

281 250

Cost of goods available for sale

302 220

Closing stock of finished goods, 31 Dec. 2023

27 000

275 220

Gross margin

310 380

Operating costs:

Marketing, distribution and customer-service costs

204 700

Administrative costs

50 000

254 700

Operating profit

€55 680

Supporting computations

Manufacturing costs for 125 000 units

Variable

Fixed

Total

Direct materials costs

€175 000

–

€175 000

Direct manufacturing labour costs

37 500

–

37 500

Plant energy costs

6 250

–

6 250

Indirect manufacturing labour costs

12 500

16 000

28 500

Other indirect manufacturing costs

10 000

24 000

34 000

Cost of goods manufactured

€241 250

€40 000

€281 250

● Direct materials costs = 250 000 kg × €0.70 per kg = €175 000.

● The average unit manufacturing costs in xxx1 are €281 250 ÷ 125 000 units = €2.25.

● Finished goods, 31 Dec. 2022 = 12 000 × €2.25 = €27 000.

Variable marketing, distrib. and customer-service costs, 122 000 × €1.35

€164 700

Fixed marketing, distrib. and customer-service costs

40 000

Fixed administrative costs

50 000

€254 700

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Appendix A Solutions to selected exercises

Exercise 2.24

1 Variable cost per tonne of beach sand mined:

Subcontractor

€80

Government tax

50

Total

€130

Fixed costs per month:

0–100 tonnes of capacity per day = €150 000

101–200 tonnes of capacity per day = €300 000

201–300 tonnes of capacity per day = €450 000

2

975 000

450 000

650 000

300 000

325 000

150 000

Total fixed cost

Total variable cost

2500

5000

7500

100

200

300

Tonnes mined

Tonnes of capacity per day

The concept of relevant range is potentially relevant for both graphs. However, the question does not

place restrictions on the unit variable costs. The relevant ranges for the total fixed costs are from 0 to 100

tonnes; from 101 to 200 tonnes; from 201 to 300 tonnes, and so on. Within these ranges, the fixed costs

do not change in total.

3 **Tonnes mined**

Tonnes mined

Fixed unit

Variable unit

Total unit cost

per day

per month

cost per tonne

cost per tonne

per tonne

(1)

(2) = (1) × 25

(3) = FC ÷ (2)

(4)

(5) = (3) + (4)

a 180

4500

€300 000 ÷ 4500

€130

€196.67

= €66.67

b 220

5500

€450 000 ÷ 5500

€130

€211.82

= €81.82

The unit cost for 220 tonnes mined per day is €211.82, while for 180 tonnes it is only €196.67. This

difference is caused by the fixed cost increment from 101 to 200 tonnes being spread over an increment

of 80 tonnes, while the fixed cost increment from 201 to 300 tonnes is spread only over an increment of

20 tonnes.

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CHAPTER 3

Exercise 3.11

1

Budgeted

Budgeted

Budgeted

Budgeted

fixed

variable

total

fixed

indirect

indirect

indirect

indirect

Budgeted

costs rate

cost rate

cost rate

costs

hours

per hour

per hour

per hour

a Jan.–March

€50 000

20 000

2.50

10

12.50

April–June

50 000

10 000

5.00

10

15.00

July–Sept.

50 000

4 000

12.50

10

22.50

Oct.–Dec.

50 000

6 000

8 .33

10

18.33

b Jan.–Dec.

€200 000

40 000

5.00

10

15.00

2 a All four jobs use 10 hours of professional labour time. The only difference in job costing is the indirect

cost rate. The quarterly-based indirect job cost rates are:

Roquelin:

(10 × €12.50) = €125.00

Leduc:

(6 × €12.50) + (4 × €15.00) = €135.00

Dudet:

(4 × €15.00) + (6 × €22.50) = €195.00

Leclerc:

(5 × €12.50) + (2 × €22.50) + (3 × €18.33) = €162.50

Roquelin

Leduc

Dudet

Leclerc

Revenues, €65 × 10

€650

650

650

650.00

Direct costs, €30 × 10

300

300

300

300.00

Indirect costs

125

135

195

162.50

Total costs

425

435

495

462.50

Operating profit

€225

215

155

187.50

b Using annual-based indirect job cost rates, all four customers will have the same operating profit:

Revenues, €65 × 10

€650

Direct costs, €30 × 10

300

Indirect costs, €15 × 10

150

Total costs

450

Operating profit

€200

3 All four jobs use 10 hours of professional labour time. Using the quarterly-based indirect cost rates,

there are four different operating profit as the work done on them is completed in different quarters. In

contrast, using the annual indirect cost rate all four customers have the same operating profit. All these

different operating profit figures for jobs with the same number of professional labour-hours are due to

the allocation of fixed indirect costs.

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An overview of the Tax-Assistance job-costing system is:

Indirect

Office support

cost pool

Cost

allocation

Professional

base

labour-hours

Indirect costs

Cost object:

job

Direct costs

Direct cost

Professional

labour

Exercise 3.17

1 a

Budgeted indirected cost

Budgeted indirected-cost rate =

= SKr 8 000 000

Budgeted direct labour-hours

1 600 000 hours

= SKR 50 per direct labour-hour

b Actual indirect-cost rate

=

Actual indirect costs

= SKr 6 888 000

Actual direct labour-hour

164 000 hours

= SKr 42 per direct labour-hour

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2

Mora model

Solna model

a Normal costing

Direct costs

Direct materials

SKr 106 450

SKr 127 604

Direct labour

36 276

41 410

142 726

169 014

Indirect costs

Assembly support (SKr 50 × 900; 1010)

45 000

50 500

45 000

50 500

Total costs

SKr 187 726

SKr 219 514

b Actual costing

Direct costs

Direct materials

SKr 106 450

SKr 127 604

Direct labour

36 276

41 410

142 726

169 014

Indirect costs

Assembly support (SKr 42 × 900; 1010)

37 800

42 420

37 800

42 420

Total costs

SKr 180 526

SKr 211 434

3 Normal costing enables Idergard to report a job cost as soon as the job is completed, assuming that both

the direct materials and direct labour costs are known at the time of use/work. Once the 900 direct

labour-hours are known for the Mora model (June 2022), Idergard can calculate the SKr 187 726 cost

figure using normal costing. In contrast, Idergard has to wait until the December 2022 year-end to

calculate the SKr 180 526 cost figure using actual costing.

Indirect

Assembly

cost pool

support

Cost

Direct

allocation

labour-hours

base

Indirect costs

Cost object:

residential home

Direct costs

Direct costs

Direct

Direct

materials

manufact.

labour

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Exercise 3.20

1 Actual indirect cost rate = 190% of professional labour-euros.

Requirement 1

Requirement 2(a) and (b)

General

Indirect

Indirect

support

costs

cost pool

Cost

Professional

Professional labour

allocation

labour costs

or

base

Total direct costs

Cost object:

job for

Indirect costs

Indirect costs

consulting

Direct costs

Direct costs

client

Professional

Professional

Technical

Phone/

Direct cost

labour

labour

specialists

Faxes

Computer

time

Photocopying

2 a Actual indirect cost rate = 135% of professional labour-euros

b Actual indirect cost rate = 87.1% of total direct costs

3

Client 304

Client 308

a Direct costs

€200 000

€200 000

Indirect costs, 190% × €200 000

380 000

380 000

Total costs

€580 000

€580 000

b Direct costs

€260 000

€340 000

Indirect costs, 135% × €200 000

270 000

270 000

Total costs

€530 000

€610 000

c Direct costs

€260 000

€340 000

Indirect costs, 87.1% × direct costs

226 460

296 140

Total costs

€486 460

€636 140

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4

Client 304

Client 308

a Total costs

€580 000

€580 000

Billings, 120% × total costs

696 000

696 000

b Total costs

€530 000

€610 000

Billings, 120% × total costs

636 000

732 000

c Total costs

€486 460

€636 140

Billings, 120% × total costs

583 750

763 370

5 Three guidelines for costing system refinement are:

(i) *Direct cost tracing.* Costing systems (b) and (c) increase the percentage of total costs that are directly

traced to the cost object. Other things being equal, (b) or (c) is preferred to (a).

(ii) *Indirect cost pools.* Costing systems (b) and (c) have the same single indirect cost pool and hence this

guideline does not assist in choosing between them.

(iii) *Cost allocation bases.* Analysis could be made of whether professional labour costs or total direct

costs is the cost driver of the costs in the indirect cost pool. Note that this analysis may lead to more

than one indirect cost pool being selected. That is, costing systems (b) and (c) may be further refined.

CHAPTER 4

Exercise 4.12

1 Work in Progress – Assembly

720 000

Creditors

720 000

To record €720 000 of direct materials purchased and used in production during February

2 Work in Progress – Assembly

760 000

Various accounts

760 000

To record €760 000 of conversion costs for February; examples include energy, manufacturing supplies,

all manufacturing labour, and plant depreciation

3 Work in Progress – Testing

1 368 000

Work in Progress – Assembly

1 368 000

To record 9000 units completed and transferred from Assembly to Testing during February at

€152 × 9000 units = €1 368 000

Postings to the Work in Progress – Assembly account follows.

Work in Progress – Assembly Department

Opening stock, 1 February

0

3 Transferred out to

1 Direct materials

720 000

Work in Progress – Testing

1 368 000

2 Conversion costs

760 000

Closing stock, 28 February

112 000

Exercise 4.14

1 The reported monthly cost per equivalent unit of either direct materials or conversion costs is lower

when the plant manager overestimates the percentage of completion of closing work in progress; the

overestimate increases the denominator and thus decreases the cost per equivalent whole unit. By

reporting a lower cost per equivalent unit, the plant manager increases the likelihood of being in the top

three ranked plants for the benchmarking comparisons.

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A plant manager can manipulate the monthly estimate of percentage of completion by understating

the number of steps yet to be undertaken before a suit becomes a finished good.

2 There are several options available:

a Khrishna shows the letters to the line executive to whom the plant managers report directly (say, the

corporate manager of manufacturing). This approach is appropriate if the letters allege it is the plant

managers who are manipulating the percentage of completion estimates.

b Khrishna herself shows the letters to the plant managers. This approach runs the danger of the plant

managers ignoring or reacting negatively to someone to whom they do not report in a line mode

questioning their behaviour. Much will depend here on how Khrishna raises the issue. Unsigned

letters need not have much credibility unless they contain specific details.

c Khrishna discusses the letters with the appropriate plant accountants without including the plant

manager in the discussion. While the plant accountant has responsibility for preparing the accounting

reports from the plant, the plant accountant in most cases reports directly to the plant manager. If

this reporting relationship exists, Khrishna may create a conflict of interest situation for the plant

accountant. Only if the plant accountant reports directly to the corporate accountant and has a

'dotted-line' reporting responsibility to the plant manager should Khrishna show the letters to the

plant accountant without simultaneously showing them to the plant manager.

3 The plant accountant's ethical responsibilities to Khrishna and to Manchester Suits should be the same.

These include:

● *Competence.* The plant accountant is expected to have the competence to make equivalent unit

computations. This competence does not always extend to making estimates of the percentage of

completion of a product. In Manchester Suits' case, however, the products are probably easy to

understand and observe. Hence, a plant accountant could obtain reasonably reliable evidence on

percentage of completion at a specific plant.

● *Objectivity.* The plant accountant should not allow the possibility of the division being written up

favourably in the company newsletter to influence the way equivalent unit costs are calculated.

4 Khrishna could seek evidence on possible manipulations as follows:

● Instruct plant accountants to report detailed breakdowns on the stages of production and then

conduct end-of-month audits to verify the actual stages completed for closing work in progress.

● Examine trends over time in closing work in progress. Divisions that report low amounts of closing

work in progress relative to total production are not likely to be able to affect greatly equivalent cost

amounts by manipulating percentage of completion estimates. Divisions that show sizeable quantities

of total production in closing work in progress are more likely to be able to manipulate equivalent

cost computations by manipulating percentage of completion estimates.

Exercise 4.16

1 Solution Exhibit 4.16A calculates equivalent units of (a) opening work in progress and (b) work done in

the current period for each cost element. To calculate equivalent units of opening work in progress,

divide the value of opening work in progress by the cost per equivalent unit of opening work in progress.

Similarly, to calculate equivalent units of work done in the current period divide total costs added in the

current period by the cost per equivalent unit of work done in the current period.

Solution Exhibit 4.16A

Step 3: Compute equivalent units under the weighted-average method, thermo-assembly process

of Le Roi du Plastique for June.

Transferred-

Direct

Conversion

in costs

materials

costs

a *Equivalent unit costs of opening work in progress*

Opening work in progress (given)

€90 000

–

€45 000

Divide by cost per equivalent unit

÷€6

–

÷€5

of opening work in progress

Equivalent units of opening work

15 000

–

9 000

in progress

b *Equivalent unit costs of work done in current period only*

Costs added in current period (given)

€58 500

€57 000

€57 200

Divide by cost per equivalent unit of

÷€6.50

÷€3

÷€5.20

work done in current period

Equivalent units of work done in

9 000

19 000

11 000

current period only

Solution Exhibit 4.16B

Steps 1 and 2: Summarise output in physical units and compute equivalent units, thermo-assembly

process of Le Roi du Plastique for June.

(Step 2)

Equivalent units

(Step 1)

Physical

Transferred-

Direct

Conversion

Flow of production

units

in costs

materials

costs

Completed and transferred

out during current period

19 000

19 000

19 000

19 000

Add closing work in progress,

5 000

(5000 × 100%; 5000 × 0%;

5000 × 20%)

5 000

0

1 000

Total accounted for

24 000

24 000

19 000

20 000

Deduct opening work in progress

15 000

(15 000 × 100%; 15 000 × 0%;

15 000 × 60%)

15 000

0

9 000

Transferred in during current period

9 000

Work done in current period only

9 000

19 000

11 000

2 and 3 See Solution Exhibit 4.16B.

Using information about physical units given in the exercise:

Physical units

Physical units in

Physical units

Physical units in

completed and

=

opening work in

+

transferred-in

–

closing work in

transferred out

progress

during period

progress

=

15 000

+

9000

–

5000

=

19 000

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Equivalent units of opening work in progress and equivalent units of work done in current period (rows

4 and 5 of Solution Exhibit 4.16B) have been calculated in Solution Exhibit 4.16A. Equivalent units of

units completed and transferred out for each cost element equal the 19 000 physical units completed and

transferred out. Equivalent units of closing work in progress for each cost element are then given by:

Equivalent units

Equivalent units

Equivalent units

Equivalent units

completed and

in closing work

=

in opening

+ of work done in −

transferred out

in progress

work in progress

current period

during current

period

Equivalent units of transferred-in

=

15 000 + 9000 − 19 000

=

5000 units

cost in closing work in progress

Equivalent units of direct materials in

=

0 + 19 000 − 19 000

=

0 units

closing work in progress

Equivalent units of conversion costs in

=

9000 + 11 000 − 19 000

=

1000 units

closing work in progress

3 a Percentage of completion of opening work-in-progress stock:

Transferred-in costs:

15 000 equivalent units ÷ 15 000 physical units

=

100%

Direct materials:

0 equivalent units ÷ 15 000 physical units

=

0%

Conversion costs:

9000 equivalent units ÷ 15 000 physical units

=

60%

b Percentage of completion of closing work-in-progress stock:

Transferred-in costs:

5000 equivalent units ÷ 5000 physical units

= 100%

Direct materials:

0 equivalent units ÷ 5000 physical units

=

0%

Conversion costs:

1000 equivalent units ÷ 5000 physical units

=

20%

CHAPTER 5

Exercise 5.11

1 Total manufacturing overhead cost pool = €3 600 000 + €2 800 000 = €6 400 000.

Total direct manufacturing labour-hours:

500 cc:

10 000 × 2 = 20 000

1000 cc:

20 000 × 4 = 80 000

100 000 hours

Manufacturing overhead cost per direct

manufacturing labour-hour

=

€64

Manufacturing overhead costs allocated per unit to each brand:

500 cc:

2 × €64

=

€128

1000 cc:

4 × €64

=

€256

2 Machining cost pool = €3 600 000.

Machining hours:

500 cc:

10 000 × 8

=

80 000

1000 cc:

20 000 × 8

=

160 000

240 000 hours

Machining cost per machining hour

= €15

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Each unit would be charged:

500 cc:

8 × €15

= €120

1000 cc:

8 × €15

= €120

General plant overhead cost pool

= €2 800 000

Direct manufacturing labour-hours

(from requirement 1)

= 100 000 hours

General plant overhead costs per direct

manufacturing labour-hour

= €28

Each unit would be charged:

500 cc:

2 × €28

= €56

1000 cc:

4 × €28

= €112

The total manufacturing overhead costs allocated per unit of each brand is:

500 cc:

Machining cost pool

8 × €15 = €120

General plant overhead

cost pool

2 × €28 =

56

€176

1000 cc:

Machining cost pool

8 × €15 = €120

General plant overhead

cost pool

4 × €28 =

112

€232

3 Use of two separate cost pools can provide more refined estimates of unit costs. Different cause-and-

effect relationships may exist for the machining costs and the general plant overhead costs, which can be

captured by the use of two different allocation bases.

The use of separate cost pools can also aid cost management at Azu-Cena as different cost

improvement targets may be appropriate for each manufacturing overhead cost area.

Exercise 5.14

1 The total costs in the single-cost pool are fixed (€1 000 000) and variable (€2 000 000) = €3 000 000.

Alxenor could use one of two allocation bases (budgeted usage or actual usage) given the information

provided.

● Allocation to Iraklion based on budgeted usage: (60/200) × €3 000 000 = €900 000.

● Allocation to Iraklion based on actual usage: (120/240) × €3 000 000 = €1 500 000.

2 Using the dual-rate method (with separate fixed and variable cost pools), several combinations of the

budgeted and actual usage allocation bases are possible:

Fixed cost pool. Total costs of €1 000 000:

● Allocation to Iraklion based on budgeted usage: (60/ 200) × €1 000 000 = €300 000.

● Allocation to Iraklion based on actual usage: (120/240) × €1 000 000 = €500 000.

Variable cost pool. Total costs of €2 000 000:

● Allocation to Iraklion based on budgeted usage: (60/200) × €2 000 000 = €600 000.

● Allocation to Iraklion based on actual usage: (120/240) × €2 000 000 = €1 000 000.

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The combinations possible are:

Combination

Fixed-cost pool

Variable cost pool

Allocation function

I

Budgeted usage

Budgeted usage

= €300 000 + €600 000

= €900 000

II

Budgeted usage

Actual usage

= €300 000 + €1 000 000

= €1 300 000

III

Actual usage

Budgeted usage

= €500 000 + €600 000

= €1 100 000

IV

Actual usage

Actual usage

= €500 000 + €1 000 000

= €1 500 000

Combinations I and IV give the same cost allocations as in requirement 1. Combination II is a frequently

used dual-rate method. The fixed costs are allocated using budgeted usage on the rationale that it better

captures the cost of providing capacity. The variable costs are allocated using actual usage on a cause-

and-effect rationale. Combination III is rarely encountered in practice.

Exercise 5.22

1 The average full cost per unit of the 2000 units of Product Line B produced in 2022 is €27 850 per unit.

Details of the €55.7 million full cost for Product Line B, compared with those for Product Line A, are

(in €millions):

Product Line A

Product Line B

Direct costs

Research and development

€10.0

€5.0

Design

2.0

3.0

Manufacturing/production

15.0

13.0

Marketing

6.0

5.0

Distribution

2.0

3.0

Customer service

5.0

3.0

Total direct costs

40.0

32.0

Indirect costs

Research and development,

6000/8000; 2000/8000 × €20.0

€15.0

€5.0

Design,

8/12; 4/12 × €6.0

4.0

2.0

Manufacturing/production,

70 000/120 000; 50 000/120 000 ×

14.0

10.0

€24.0

Marketing,

25/70; 45/70 × €7.0

2.5

4.5

Distribution,

600/2000; 1400/2000 × €2.0

0.6

1.4

Customer service,

1000/5000; 4000/5000 × €1.0

0.2

0.8

Total indirect costs

36.3

23.7

Full product costs

€76.3

€55.7

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Chapter 5

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2 The summary data are (in €millions):

Product Line A

Product Line B

Upstream

€31.0

€15.0

Manufacturing

29.0

23.0

Downstream

16.3

17.7

€76.3

€55.7

Upstream

Direct

Research and development

€10.0

€5.0

Design

2.0

3.0

12.0

8.0

Indirect

Research and development

15.0

5.0

Design

4.0

2.0

19.0

7.0

Total upstream costs

€31.0

€15.0

Manufacturing

Direct

€15.0

€13.0

Indirect

14.0

10.0

Total manufacturing cost

€29.0

€23.0

Downstream

Direct

Marketing

€6.0

€5.0

Distribution

2.0

3.0

Customer service

5.0

3.0

13.0

11.0

Indirect

Marketing

2.5

4.5

Distribution

0.6

1.4

Customer service

0.2

0.8

3.3

6.7

Total downstream costs

€16.3

€17.7

3 The inventoriable costs are (in €millions):

Product Line B

Direct costs

Design

€3.0

Manufacturing

13.0

Total

16.0

Indirect costs

Design

2.0

Manufacturing

10.0

Total

12.0

Total inventoriable costs

€28.0

The average inventoriable cost per unit of Product Line B is €14 000 per unit.

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4 The reimbursable costs for Product Line A are (in €millions):

Product Line A

Direct costs

Research and development

€10.0

Design

2.0

Manufacturing/production

15.0

Distribution

2.0

Customer service

5.0

Total direct costs

34.0

Indirect costs

Research and development

15.0

Design

4.0

Manufacturing/production

14.0

Distribution

0.6

Customer service

0.2

Total indirect costs

33.8

Full reimbursable cost

€67.8

5 No. The answers to requirements 1 to 4 illustrate how a single accounting system (database) can provide

relevant data for a diverse set of decisions. The data in this single system can be ‘sliced and diced’ in

many ways without requiring multiple systems to be independently set up.

CHAPTER 6

Exercise 6.13

1 a Sales value at split-off point method

Kilograms

Wholesale

Sales

Weighting:

Joint Allocation of selling price value at sales value costs	costs per product per kg split-off at split-off allocated kg
Breasts	
100	
€1.10	
€110	
0.675	
€67.50	

€0.6750

Wings

20

0.40

8

0.049

4.90

0.2450

Thighs

40

0.70

28

0.172

17.20

0.4300

Bones

80

0.20

16

0.098

9.80

0.1225

Feathers

10

0.10

1

0.006

0.60

0.0600

250

€163

1.000

€100.00

Costs of destroyed product

Breasts:

€0.6750 × 20 = €13.50

Wings:

€0.2450 × 10 = 2.45

€15.95

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Chapter 6

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b Physical measures method

Kilograms

Weighting:

Joint

Allocation

of

physical

costs

costs per

product

measures

allocated

kg

Breasts

100

0.400

€40.00

€0.400

Wings

20

0.080

8.00

0.400

Thighs

40

0.160

16.00

0.400

Bones

80

0.320

32.00

0.400

Feathers

10

0.040

4.00

0.400

250

1.000

€100.00

Costs of destroyed product

Breasts:

€0.40 × 20 = €8

Wings:

€0.40 × 10 = 4

€12

Note: Although not required, it is useful to highlight the individual product profitability figures:

Sales value at

Physical measures

split-off method

method

Joint costs

Gross

Joint costs

Gross

Product

Sales value

allocated

income

allocated

income

Breasts

€110

€67.50

€42.50

€40.00

€70.00

Wings

8

4.90

3.10

8.00

0.00

Thighs

28

17.20

10.80

16.00

12.00

Bones

16

9.80

6.20

32.00

(16.00)

Feathers

1

0.60

0.40

4.00

(3.00)

2 The sales value at split-off method captures the benefits-received criterion of cost allocation. The costs

of processing a chicken are allocated to products in proportion to the ability to contribute revenue.

Galinha-Esquina’s decision to process chicken is heavily influenced by the revenues from breasts and

thighs. The bones provide relatively few benefits to Galinha-Esquina despite their high physical volume.

The physical measures method shows profits on breasts and thighs and losses on bones and feathers.

Given that Galinha-Esquina has to process jointly all the chicken products, it does not make sense

intuitively to single out individual products that are being processed simultaneously as making losses

while the overall operations make a profit.

Exercise 6.14

1

By-product accounting method

A

B

C

D

When by-products are recognised

At

At

At

At

in the general ledger

production

production

sale

sale

Where by-product revenues

Reduction

Revenue

Reduction

Revenue

appear in the profit statement

of cost

item

of cost

item

Revenues:

Main product: Pelléas, 8000 × €20.00

€160 000

€160 000

€160 000

€160 000

By-product: Mélisande, 1400 × €2.00

–

2 800

–

2 800

160 000

162 800

160 000

162 800

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By-product accounting method

A

B

C

D

Cost of goods sold:

Total manufacturing costs

120 000

120 000

120 000

120 000

Deduct by-product

revenue, 1400 × €2.00

2 800

–

2 800

–

Net manufacturing costs

117 200

120 000

117 200

120 000

Deduct main product

stock, 2000/10 000 ×

net manufacturing costs

23 440

24 000

23 440

24 000

Deduct by-product

stock, 600 × €2.00

1 200

1 200

–

–

Cost of goods sold

92 560

94 800

93 760

96 000

Gross margin

€67 440

€68 000

€66 240

€66 800

Gross margin percentage

42.15%

41.77%

41.40%

41.03%

2

A

B

C

D

Inventoriable costs (30 September):

Main product – Pelléas

€23 440

€24 000

€23 440

€24 000

By-product – Mélisande

1 200

1 200

0

0

Under methods C and D there is no inventoriable cost shown for the by-product (Mélisande), as

by-products are not recognised in the general ledger until sales are made.

3 Method A or B results in a better matching of costs with revenues than does either Method C or D.

Method B results in more disclosure about individual product revenues than does Method A. Method A

‘buries’ information about by-product revenues as a reduction of cost.

Exercise 6.19

A diagram of the situation is shown in Solution Exhibit 6.19.

1

Sales

Estimated net

price

Final

Separable

realisable

Quantity

per

sales

processing

value at

(kg)

kg

value

costs

split-off

Weighting

Vadstena

20 000

SKr 20

SKr 400 000

SKr 100 000

SKr 300 000

30/56

Vättervik

60 000

6

360 000

200 000

160 000

16/56

Birgitta

100 000

1

100 000

0

100 000

10/56

Totals

SKr 860 000

SKr 300 000

SKr 560 000

Allocation of Skr 420 000 joint costs:

Vadstena

30/56 × SKr 420 000 = SKr 225 000

Vättervik

16/56 × SKr 420 000 =

120 000

Birgitta

10/56 × SKr 420 000 = 75 000

SKr 420 000

Solution Exhibit 6.19

Joint costs

Separable costs

Vadstena:

Processing

100

SKr 100

000 kg at

000

SKr 1 per kg

Vättervik:

Processing

Processing

60

SKr 420

000 kg at

000

SKr 200 000

SKr 6 per kg

Birgitta:

100 000 kg at

SKr 1 per kg

Split-off

point

Separable

Joint costs

processing

Unit

allocated

costs

Total costs

Units

cost

Vadstena

SKr 225 000

SKr 100 000

SKr 325 000

20 000

SKr 16.25

Vättervik

120 000

200 000

320 000

60 000

5.33

Birgitta

75 000

0

75 000

100 000

0.75

Totals

SKr 420 000

SKr 300 000

SKr 720 000

180 000

The closing stock is:

Vadstena

1000 × SKr 16.25 = SKr 16 250

Vättervik

1000 × SKr 5.33 =

5 330

Birgitta

1000 × SKr 0.75 =

750

SKr 22 330

2

Gross-margin

Unit sales price

Unit cost

Gross margin

percentage

Vadstena

SKr 20

SKr 16.25

SKr 3.75

18.75%

Vättervik

6

5.33

0.67

11.17

Birgitta

1

0.75

0.25

25.00

3 Further processing of Vättervik yields incremental profit of SKr 40 000:

Incremental revenue of further

processing Vättervik (SKr 6 − SKr 2) × 60 000

SKr 240 000

Incremental processing costs

200 000

Incremental operating profit from further processing

SKr 40 000

Langholmen-Sverige should process Vättervik further. Note that joint costs are irrelevant to this decision;

they remain the same, whichever alternative (sell at split-off or process further) is selected.

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CHAPTER 7

Exercise 7.12

1 Normal utilisation (givens denoted by §):

Allocated

(Budgeted input

Actual

Same lump sum

Same lump sum

allowed for actual

costs

regardless of

regardless of

output achieved

incurred

output level

output level

× **Budgeted rate)**

70 000 hours§ × €2.00*

€130 000

€120 000§

€120 000§

= €140 000

€10 000 U§

–

€20 000 F§

Spending variance

Never a variance

Production volume

variance

€20 000 F = €120 000 – *X*

X = €140 000

* Budgeted fixed manufacturing overhead rate per unit = €2 per machine-hour, denominator level = 60 000

machine-hours.

2 Practical capacity (givens denoted by §):

Allocated

(Budgeted input

Actual

Same lump sum

Same lump sum

allowed for actual

costs

regardless of

regardless of

output achieved

incurred

output level

output level

× **Budgeted rate)**

70 000 hours§ × €1.20*

€130 000

€120 000§

€120 000§

= €84 000

€10 000 U§

–

€36 000 U§

Spending variance

Never a variance

Production volume

variance

€36 000 U = €120 000 – *X*

X = €84 000

* Budgeted manufacturing overhead rate per unit = €1.20 per machine-hour, denominator level = 100 000

machine-hours.

3 To maximise operating profit, the executive vice-president would favour using normal utilisation rather

than practical capacity. Why? Because normal utilisation is a smaller base than practical capacity,

resulting in any year-end stock having a higher unit cost. Thus, less fixed manufacturing overhead would

become an expense if normal utilisation were used as the denominator level.

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Exercise 7.19

1 Ericsson AB: Income statements for the year (in SEK 000).

Variable costing

Revenues (25 000 × SEK 40)

SEK 1000

Variable costs

Opening stock (1000 × SEK 24)

SEK 24

Variable cost of goods manufactured (29 000 × SEK 24)

696

Cost of goods available for sale

720

Closing stock (5000 × SEK 24)

120

Variable manufacturing cost of goods sold

600

Variable marketing and administrative costs

(25 000 × SEK 1.20)

30

Variable costs

630

Contribution margin

370

Fixed costs

Fixed manufacturing overhead costs

120

Fixed marketing and administrative costs

190

Fixed costs

310

Operating profit

SEK 60

Absorption costing

Revenues (25 000 × SEK 40)

SEK 1000

Cost of goods sold

Opening stock (1000 × SEK 28)

SEK 28

Variable manufacturing costs (29 000 × SEK 24)

696

Fixed manufacturing costs (given)

120

Cost of goods available for sale

844

Closing stock (5000 × SEK 28)

140

Cost of goods sold

704

Gross margin

296

Marketing and administrative costs

Variable marketing and administrative costs

(25 000 × SEK 1.20)

30

Fixed marketing and administrative costs

190

Marketing and administrative costs

220

Operating profit

SEK 76

2 SEK 76 000 − SEK 60 000 = (5000 × SEK 4) − (1000 × SEK 4)

= SEK 20 000 − SEK 4000

= SEK 16 000

The operating profit figures differ because the amount of fixed manufacturing costs in the closing stock

differs from that in the opening stock.

3 *Advantages*

● The fixed costs are reported as period costs (and not allocated to stock), thus increasing the likelihood

of better control of these costs.

● Operating profit is directly influenced by changes in unit sales (and not influenced by build-up of

stock).

● The impact of fixed costs on operating profit is emphasised.

● The income statements are in the same form as is used for cost–volume–profit analysis.

● Product line, territory, etc., contribution margins are emphasised and more readily ascertainable.

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Disadvantages

● Total costs may be overlooked when considering operating problems.

● Distinction between fixed and variable costs is arbitrary for many costs.

● Emphasis on variable costs may cause some managers to ignore fixed costs.

● A new variable-costing system may be too costly to install unless top managers think that operating

decisions will be improved collectively.

Exercise 7.23

1 a Variable costing income statements (in €000):

2022

2023

Together

Revenues

€300

€300

€600

Variable cost of sales

70

70

140

Contribution margin

230

230

460

Fixed manufacturing costs

€140

Fixed marketing and

administrative costs

40

180

180

360

Operating profit

€50

€50

€100

b Absorption statements (in €000):

Alternative 1

Alternative 2

2022

2023

Together

2022

2023

Together

Revenues

€300

€300

€600

€300

€300

€600

Opening stock

–

140

–

–

210

–

Manufacturing costs

280

–

280

420

–

420

Available for sales

280

140

280

420

210

420

Closing stock

140

–

–

210

–

–

Cost of goods sold

140

140

280

210

210

420

Underallocated

overhead

–

140

140

–

140

–

Overallocated

overhead

–

–

–

(140)

–

–

Marketing and

administrative costs

40

40

80

40

40

80

Total costs

180

320

500

110

390

500

Operating profit

€120

€(20)

€100

€190

€(90)

€100

(loss)

Alternative 1. Rate for fixed manufacturing overhead allocation based on 20 000 units:

€140 000 = €7.00 per tonne

20000

Alternative 2. Rate for fixed manufacturing overhead allocation based on 10 000 units:

€140 000 = €14.00 per tonne

10000

2 Audumla Oy has a positive operating profit because some of its costs were variable. They could be

avoided when the plant shut down for the second year. Variable costs can be 'stored' as measures of

assets, while fixed costs cannot. When Audumla paid €70 000 for direct materials, direct manufacturing

labour and variable manufacturing overhead to produce 10 000 additional tonnes of fertiliser during the

first year for sale in the second year, it saved that amount of cost in the second year.

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Chapter 8

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3

Absorption costing

20 000

10 000

Variable costing

unit base*

unit base

Stock, end of 2022

€70 000

€140 000

€210 000

Stock, end of 2023

0

0

0

* Fixed manufacturing overhead rate is €7.00 when denominator level is 20 000 units and is

€14.00 when denominator level is 10 000 units.

4 Reported operating profit is affected by both production *and* sales under absorption costing. Hence,

most managers would prefer absorption costing because their performance in any given reporting

period, at least in the short run, is influenced by how much production is scheduled near the end of a

reporting period.

CHAPTER 8

Exercise 8.11

a TCM = Q (USP − UVC)

= 70 000 (£30 − £20)

= £700 000

TFC = TCM − OP/L

= £700 000 − (£15 000) = £715 000

b

TCM = Q (USP − UVC)

£900 000 = 180 000 (£25 − UVC)

UVC = £20

OP/L = TCM − TFC

= £900 000 − £800 000 = £100 000

c

TCM = Q (USP − UVC)

£300 000 = 150 000 (USP − £10)

USP = £12

OP/L = TCM − TFC

= £300 000 − £220 000 = £80 000

d Q = TCM ÷ (USP − UVC)

= £120 000 ÷ (£20 − £14)

= 20 000

TFC = TCM − OP/L

= £120 000 − £12 000 = £108 000

Exercise 8.22

1 Variable cost percentage is SFr 3.20/SFr 8.00 = 40%. Let R = Revenues needed to obtain target net

profit, then:

R − 0.40 R − SFr 450 000 = SFr 150 000

0.60 R = SFr 450 000 + SFr 150 000

R = SFr 600 000 ÷ 0.60

= SFr 1 000 000

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Appendix A Solutions to selected exercises

Proof:

Revenues

SFr 1 000 000

Variable costs (at 40%)

400 000

Contribution margin

600 000

Fixed costs

450 000

Operating profit

150 000

Income taxes (at 30%)

45 000

Net profit

SFr 105 000

2 a Sales necessary to earn net profit of SFr 105 000:

SFr 100000 = 125 000 sales necessary

SFr 8

b Sales necessary to break even:

Contribution margin = SFr 8.00 − SFr 3.20 = SFr 4.80

SFr 450 000 = 93 750 sales necessary

SFr 4 .80

3 Using the short-cut approach described in the chapter:

Change in net profit = (150 000 − 125 000) × SFr 4.80 × (1 − 0.30)

= SFr 120 000 × 0.7 = SFr 84 000

New net profit = SFr 84 000 + SFr 105 000 = SFr 189 000

Proof:

Revenues, 150 000 × SFr 8.00

SFr 1 200 000

Variable costs at 40%

480 000

Contribution margin

720 000

Fixed costs

450 000

Operating profit

270 000

Income tax at 30%

81 000

Net profit

SFr 189 000

Exercise 8.26

1 Let Q = Number of units of deluxe product to break even.

Q

3

= Number of units of standard product to break even.

Revenues − Variable costs − Fixed costs = Zero operating profit.

€20(Q

3) + €30 Q − €14 Q

(3) − € Q

18

− €1 200 000 = 0

€60 Q + €30 Q − €42 Q − € Q

18

= €1 200 000

€30 Q = €1 200 000

Q = 40 000 units of deluxe

Q

3

= 120 000 units of standard

The breakeven point is 120 000 standard units plus 40 000 deluxe carriers, a total of 160 000 units.

2 Unit contribution margins are: standard: €20 − €14 = €6; deluxe: €30 − €18 = €12.

a If only standard carriers were sold, the breakeven point would be:

€1 200 000/€6 = 200 000 units

b If only deluxe carriers were sold, the breakeven point would be:

€1 200 000/€12 = 100 000 units

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3 Operating profit = 180 000(€6) + 20 000(€12) − €1 200 000

= €1 080 000 + €240 000 − €1 200 000

= €120 000

Let Q = Number of units of deluxe product to break even.

9 Q = Number of units of standard product to break even.

€20(9 Q) + €30 Q − €14(9 Q) − € Q

18

− €1 200 000 = 0

€180 Q + €30 Q − €126 Q − €18 Q = €1 200 000

€66 Q = €1 200 000

Q = 18 182 units of deluxe (rounded)

9 Q = 163 638 units of standard

The breakeven point is 163 638 standard = 18 182 deluxe, a total of 181 820 units.

The lesson of this problem is that changes in sales mix change breakeven points and operating profits.

In this example, the budgeted and actual total sales in number of units were identical, but the proportion

of the product having the higher contribution margin declined. Operating profit suffered, falling from

€300 000 to €120 000. Moreover, the breakeven point rose from 160 000 to 181 820 units.

CHAPTER 9

Exercise 9.11

1 Slope coefficient = €0.30 per machine-hour.

Constant = Total cost − (Slope coefficient × Quantity of cost driver)

= €3900 − (€0.30 × €7000) = €1800

= €3000 − (€0.30 × 4000) = €1800

The cost function based on the two observations is:

Maintenance costs = €1800 + €0.30 × machine-hours

2 The cost function in requirement 1 is an estimate of how costs behave within the relevant range, not at

cost levels outside the relevant range. If there are no months with zero machine-hours represented in the

maintenance account, data in that account cannot be used to estimate the fixed costs at the zero machine-

hours level. Rather, the constant component of the cost function provides the best available starting

point for a straight line that approximates how a cost behaves within the relevant range.

Exercise 9.20

1 It is economically plausible that the correct form of the model of overhead costs includes both number

of academic programmes and number of enrolled students as cost drivers. The findings indicate that

each of the independent variables affects overhead costs. (Each regression has a significant r 2 and t-value

on the independent variable.) Raphaël could choose to divide overhead costs into two cost pools, (i)

those overhead costs that are more closely related to the number of academic programmes and (ii) those

overhead costs more closely related to the number of enrolled students, and rerun the simple regression

analysis on each overhead cost pool. Alternatively, she could run a multiple regression analysis with total

overhead costs as the dependent variable and the number of academic programmes and number of

enrolled students as the two independent variables.

2 Raphaël should use the multiple regression model over the two simple regression models. The multiple

regression model appears economically plausible and the regression model performs very well when estimating

overhead costs. It has an excellent goodness-of-fit and significant *t*-values on both independent variables, and

it meets all the specification assumptions for ordinary least-squares regression (see Solution Exhibit 9.20).

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Solution Exhibit 9.20

Evaluation of cost function for overhead costs

estimated with multiple regression for ESMSE

Number of academic programmes and number

Criterion

of enrolled students as independent variables

1 Economic plausibility

A positive relationship between overhead costs and number of

academic programmes and number of enrolled students is eco-

nomically plausible at ESMSE

2 Goodness-of-fit

r 2 = 0.81

Excellent goodness-of-fit

3

Significance of independent *t*-values of 3.46 on number of academic programmes and 2.03

variable(s)

on number of enrolled students are both significant

4

Specification analysis of

The assumptions of linearity, constant variance, and normality of

estimation assumptions

residuals hold, but inferences drawn from only 12 observations

are not reliable; the Durbin–Watson statistic = 1.84 indicates

that independence of residuals holds

There is some correlation between the two independent variables, but multicollinearity does not appear to

be a problem here. The significance of both independent variables (despite some correlation between them)

suggests that each variable is a driver of overhead cost. Of course, as the chapter describes, even if the

independent variables exhibited multicollinearity, Raphaël should still prefer to use the multiple regression

model over the simple regression models. Omitting any one of the variables will cause the estimated

coefficient of the independent variable included in the model to be biased away from its true value.

3 Possible uses for the multiple regression results include:

● *Planning and budgeting at ESMSE.* The regression analysis indicates the variables (number of

academic programmes and number of enrolled students) that help predict changes in overhead costs.

● *Cost control and performance evaluation.* Raphaël could compare actual performance with budgeted

or expected numbers and seek ways to improve the efficiency of the ESMSE operations, and evaluate

the performance of managers responsible for controlling overhead costs.

● *Cost management.* If cost pressures increase, the ESMSE could save costs by closing down academic

programmes that have few students enrolled.

Exercise 9.21

1 Solution Exhibit 9.21 plots the relationship between machine-hours and power costs.

2 (i)

Machine-hours (*X*)

Pow

er costs (*Y*)

Highest observation of independent variable

400

SEK 500

Lowest observation of independent variable

100

300

300

SEK 200

Slope coefficient = SEK 0.667 per machine-hour

Constant = SEK 500 − (SEK 0.667 × 400) = SEK 233.20

= SEK 300 − (SEK 0.667 × 100) = SEK 233.30

(difference in values is due to rounding errors)

Cost function estimated with high–low approach is:

y = SEK 233.20 + SEK 0.667 X

Solution Exhibit 9.21

Plot of machine-hours versus power cost

500

400

300

200

Power costs (SKr)

100

0 0

100

200

300

400

Machine-hours

(ii) One way of calculating *a* and *b* under the regression approach is to use the equations given in the

chapter appendix.

Period

Machine-hours (*X*)

Power costs (*Y*)

X 2

XY

(1)

(2)

(3)

(4)

(5)

1

200

350

40 000

70 000

2

300

450

90 000

135 000

3

100

300

10 000

30 000

4

400

500

160 000

200 000

Total

1 000

1 600

300 000

435 000

$\sum Y = na + b(\sum X)$

$\sum XY = a(\sum X) + b(\sum X)2$

That is,

1600 = 4 a = 1000 b

R1

435 000 = 1000 a + 300 000 b

R 2

400 000 = 1000 *a* + 250 000 *b*

R = 250(R)

3

1

35 000 = 50 000 *b*

R = R − R

4

2

3

b = SEK 0.70

1600 = 4 *a* + 1000 (0.70)

900 = 4 *a*

a = SEK 225

Cost function estimated with the regression approach is:

y = SEK 225 + SEK 0.70 × machine-hours

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Substituting we get:

a = SEK 225

Another approach is to use a computer software package. Results are:

Variable

Coefficient

Standard error

***t*-value**

Constant

SEK 225

SEK 19.36

11.62

Independent variable: machine-hours

SEK 0.70

SEK 0.07

10.00

r 2 = 0.98; Durbi −

n Watson statistic = 2.20

In this simple illustration, the high–low estimate using only two observations closely approximates

the least-squares regression approach that minimises the sum of squares of the vertical deviations

from the observations to the estimated regression line. The regression equation indicates that variable

power costs are SEK 0.70 per machine-hour against the high–low estimate of SEK 0.667. The fixed

component of power costs within the relevant range equals SEK 225, while the high–low method

estimates this component as SEK 233.20. The high–low method gives good results in this case because

all the data points fall very close to the regression line.

A = SEK 0.70.

3 $\bar{Y} = \sum Y \div 4$ = SEK 1600 ÷ 4 = SEK 400

$\sum(Y - \bar{Y})2$

= (350 − 400)2 + (450 − 400)2 + (300 − 400)2 + (500 − 400)2

= 2500 + 2500 + 10 000 + 10 000 = 25 000

Period

Y

y* = SEK 225 + SEK 0.70 *X

Y* − *y

(*Y*

***y*)2**

–

1

350

365

−15

225

2

450

435

+15

225

3

300

295

+5

25

4

500

505

−5

25

Total

1600

500

2

$r = 0.98$.

An r 2 of 0.98 indicates excellent goodness-of-fit. Only 2% of the variation in power costs is not explained

by machine-hours. Since the relation between machine-hours and power costs is also economically

plausible, Bildt-Östersund can be very confident of using the regression results to set its flexible budget

for power costs. Machine-hours is a cost driver of power costs.

CHAPTER 10

Exercise 10.14

1 Average one-way fare per passenger

€500

Commission at 8% of €500

40

Net cash to Air Calabria per ticket

€460

Average number of passengers per flight

200

Revenues per flight (€460 × 200)

€92 000

Food & beverage cost per flight (€20 × 200)

4 000

Total contribution from passengers

88 000

Fuel costs per flight

14 000

Contribution per flight

74 000

Fixed costs allocated to each flight:

Lease costs

€53 000

Baggage handling

7 000

Flight crew

4 000

64 000

Operating profit per flight

€10 000

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2 If fare is

€480.00

Commission at 8% of €480

38.40

Net cash per ticket

441.60

Food and beverage cost per ticket

20.00

Contribution per passenger

€421.60

Total contribution margin from passengers

(€421.60 × 212)

€89 379.20

All other costs are irrelevant

On the basis of quantitative factors alone, Air Calabria should decrease its fare to €480 because reducing

the fare gives Air Calabria a higher contribution margin from passengers (€89 379.20 versus €88 000).

3 In evaluating whether Air Calabria should charter its plane to Cima-Rosa, we compare the charter

alternative to the solution in requirement (2) because requirement (2) is preferred to requirement (1).

Under requirement (2), Air Calabria gets

€89 379.20

Deduct fuel costs

14 000.00

Total contribution per flight

€75 379.20

Air Calabria gets €75 000 per flight from chartering the plane to Cima-Rosa. On the basis of quantitative

financial factors Air Calabria is better off not chartering the plane and instead lowering its own fares.

Students who compare the €75 000 that Air Calabria earns from chartering its plane to the contribution

from passengers in requirement (1) (€74 000) will conclude that Air Calabria should charter the plane to

Cima-Rosa. Strictly speaking, though, the correct answer must compare the charter fee of €75 000 to the

€75 379.20 passenger contribution in requirement (2) since lowering the fare is certainly an alternative

available to Air Calabria.

Other qualitative factors that Air Calabria should consider in coming to a decision are:

a The lower risk from chartering its plane relative to the uncertainties regarding the number of

passengers it might get on its scheduled flights.

b Chartering to Cima-Rosa means that Air Calabria would not have a regular schedule of flights each

week. This arrangement could cause inconvenience to some of its passengers.

c The stability of the relationship between Air Calabria and Cima-Rosa. If this is not a long-term

arrangement, Air Calabria may lose current market share and not benefit from sustained charter

revenues.

Exercise 10.18

1

750 000 bottles

Time spent on manufacturing bottles =

= 7500 hours

100 bottles per hour

So 10 000 − 7500 = 2500 hours available for toys.

100 000 units

The moulded plastic toy requires

= 2500 hours, so Fri-Flask has enough capacity to

40

accept the toys order. Additional income from accepting the order is:

Revenue DKK 3.00 × 100 000

DKK300 000

Variable costs 2.40 × 100 000

240 000

Contribution margin

60 000

Fixed costs

20 000

Additional income

DKK 40 000

So Fri-Flask should accept the order since it has enough excess capacity to make the 100 000 toys.

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2 Time spent on manufacturing bottles

850 000

=

= 8500 hours

100

So 10 000 − 8500 = 1500 hours available for toys.

From requirement (1) moulded plastic toy requires 2500 hours and generates DKK40 000 in operating

income.

So if the toy order is accepted, 1000 hours (2500 hours required – 1500 hours available) of bottle

making will be forgone, equal to 100 000 bottles (100 bottles/hr × 1000 hrs).

Operating income from accepting

DKK40 000

Forgone contribution margin (100 000 bottles × DKK0.30)

30 000

Increase in operating income

DKK10 000

So Fri-Flask should accept the special order.

3 Without considering the fixed costs of the toy mould, the contribution per machine-hour of the

constrained resource for bottles and the special toy are as follows:

Bottles

Toys

Contribution margin per unit

DKK0.30

DKK0.60

Multiplied by units made in 1 machine-hour

100

40

Contribution margin per machine-hour

DKK30

DKK24

This suggests that Fri-Flask should make as many bottles as it can rather than the special toys because

bottles generate a higher contribution margin per machine-hour.

So if Fri-Flask used the 1500 hours available to it for making toys after using the 8500 hours to make

bottles, it would be able to make 1500 × 40 = 60 000 toys and earn operating income of:

Contribution margin 60 000 × DKK0.60

DKK36 000

Fixed mould costs

20 000

Increase in operating income

DKK16 000

The contribution margin earned covers the fixed costs of the mould, so Fri-Flask should make 850 000

bottles and 60 000 toys.

4 Time spent on manufacturing bottles 900 000

=

= 9000 hours

100

So 10 000 − 9000 = 1000 hours available for toys.

So if the toy order is accepted, then 1500 hours (2500 hours required – 1000 hours available) of bottle

capacity will be forgone = 150 000 bottles

Contribution from accepting toy offer

DKK40 000

Forgone profits on bottles 150 000 × DKK0.30

(45 000)

Increase (decrease) in operating income

DKK(5 000)

So *reject* the special order.

5 As in requirement (3), Fri-Flask should first use the 9000 hours to make bottles and then consider using

the 1000 hours available to it for making toys. It would be able to make 1000 hours × 40 = 40 000 toys

and earn operating income of:

Contribution margin 40 000 × DKK0.60

DKK24 000

Fixed mould costs

20 000

Increase in operating income

DKK 4 000

Fri-Flask should make 900 000 bottles and 40 000 toys.

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6 As in requirements (3) and (5), Fri-Flask should first use 9500 hours to make bottles and then consider

using the 500 hours available to it for making toys. It would be able to make 500 hours × 40 = 20 000

toys and earn operating income of:

Contribution margin 20 000 × DKK0.60

DKK12 000

Fixed mould costs

20 000

Increase (decrease) in operating income

DKK (8 000)

So Fri-Flask should refuse to make any of the plastic toys. If it tried to make the toy product more

profitable by making more toys, it would have to give up the plastic bottles. This trade-off is not

worthwhile because Fri-Flask makes DKK24 per hour from the toys and would lose DKK30 per hour

from the plastic bottles.

7 The subcontracting option is a good option because it nets Fri-Flask DKK0.20 per toy (DKK3.00 –

DKK2.80) without using up any of its limited capacity.

So long as Fri-Flask is manufacturing in-house, it would prefer to first make bottles (contribution of

DKK30 per hour) and then make toys (contribution of DKK24 per hour).

As in requirement (5), Fri-Flask would make 900 000 bottles and be left with 1000 hours available for

toy making. It has two options at this stage (1) use 1000 hours of available in-house capacity to make

40 000 toys and subcontract 60 000 toys outside or (2) subcontract all 100 000 toys from outside.

40 000 toys in-house

100 000 toys

60 000 toys subcontracted

subcontracted

Revenues (irrelevant)

DKK300 000

DKK300 000

Costs

Variable manufacturing costs

(40 000 × DKK2.40)

96 000

Incremental fixed costs of mould

20 000

Subcontract costs (DKK2.80 × 60 000;

168 000

DKK2.80 × 100 000)

280 000

Total costs

284 000

280 000

Operating income

DKK 16 000

DKK 20 000

So Fri-Flask should use 9000 hours of its capacity to make 900 000 bottles, leave 1000 hours capacity idle

and subcontract out all the 100 000 toys.

A short-cut to solving this problem is to calculate when it is worthwhile for Fri-Flask to manufacture

toys in-house rather than subcontracting them. Suppose number of toys manufactured is *X,* the cut-off

point is obtained by solving:

DKK20 000

+

DKK2.40X

=

DKK2.80X

fixed

variable

subcontracting

manufacturing

manufacturing

costs

costs

costs per unit

X = DKK20 000 = 50 000 toys

DKK0.40

This means that if the internal manufacturing capacity is for less than 50 000 toys, it is cheaper to

subcontract, whereas if the internal manufacturing capacity is for more than 50 000 toys, it is better to

manufacture in-house.

In our example, the internal manufacturing capacity is for 40 000 toys, so it is better to subcontract

out entirely.

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CHAPTER 11

Exercise 11.11

1

Direct costs

Direct materials

€150 000

€150 000

Indirect costs

Product support

983 000

983 000

Total costs

€1 133 000

Cost per kilogram of chips = €1.133

2

(a) Retail chips

(b) Institutional chips

Direct costs

Direct materials

€135 000

€15 000

Packaging

180 000

8 000

Indirect costs

315 000

23 000

Cleaning

€0.120 × 900 000

108 000

€0.120 × 100 000

12 000

Cutting

€0.24 × 900 000

216 000

€0.15 × 100 000

15 000

Packaging

€0.48 × 900 000

432 000

€0.12 × 100 000

12 000

756 000

39 000

Total costs

€1 071 000

€62 000

Kilograms produced

900 000

100 000

Cost per kilogram

€1.19

€0.62

Note: The total costs of €1 133 000 (€1 071 000 + €62 000) are the same as those in requirement 1.

3 There is much evidence of product-cost cross-subsidisation.

Retail

Institutional

Current system

€1.133

€1.133

ABC system

€1.190

€0.620

Assuming the ABC numbers are more accurate, retail is undercosted by approximately 5%

(€1.133 ÷ €1.19 = 0.95) while institutional is overcosted by 83% (€1.133 ÷ €0.620 = 1.83).

The current system assumes that each product uses all the activity areas in a homogeneous way. This

is not the case. Institutional sales use far fewer resources in the cutting area and the packaging area. The

percentage of total costs for each cost category is:

Retail

Institutional

Total

Direct costs

Direct materials

90.0%

10.0%

100.0%

Packaging

95.7

4.3

100.0

Indirect costs

Cleaning

90.0

10.0

100.0

Cutting

93.5

6.5

100.0

Packaging

97.3

2.7

100.0

Units produced

90.0%

10.0%

100.0%

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McCarthy Potatoes can use the revised cost information for a variety of purposes:

● *Pricing/product emphasis decisions.* The sizeable drop in the reported cost of institutional potatoes

makes it possible that McCarthy Potatoes was overpricing potato products in this market. It lost the

bid for a large institutional contract with a bid 30% above the winning bid. With its revised product

cost dropping from €1.133 to €0.620, McCarthy Potatoes could have bid much lower and still made

a profit. An increased emphasis on the institutional market appears warranted.

● *Product design decisions.* ABC provides a roadmap as to how to reduce the costs of individual

products. The relative components of costs are:

Retail

Institutional

Direct costs

Direct materials

12.6%

24.2%

Packaging

16.8

12.9

Indirect costs

Cleaning

10.1

19.3

Cutting

20.2

24.2

Packaging

40.3

19.3

Total costs

100.0%

100.0%

Packaging-related costs constitute 57.1% (16.8% + 40.3%) of total costs of the retail product line.

Design efforts that reduce packaging costs can have a big impact on reducing total unit costs for retail.

● *Process improvements.* Each activity area is now highlighted as a separate cost. The three indirect cost

areas are over 60% of total costs for each product, indicating the upside from improvements in the

efficiency of processes in these activity areas.

Exercise 11.12

1

(a) Cleaning activity area

1 000 000 kg × €0.120

€120 000

(b) Cutting

900 000 × €0.24

€216 000

100 000 × €0.15

15 000

€231 000

(c) Packaging

900 000 × €0.480

€432 000

100 000 × €0.120

12 000

€444 000

2 **Cost**

Costs in

Number of

Costs per

pool

pool

driver units

driver unit

(a) Cleaning

€120 000

1 200 000 raw kilograms

€0.10

(b) Cutting

€231 000

3 850 hours*

€60.00

(c) Packaging

€444 000

37 000 hours†

€12.00

* (900 000 ÷ 250) + (100 000 ÷ 400) = 3600 + 250 = 3850.

† (900 000 ÷ 25) + (100 000 ÷ 100) = 36 000 + 1000 = 37 000.

3 McCarthy Potatoes can use information about cost driver rates in several ways:

● Target the high cost rate areas for process improvement. For example, cutting has a €60 per hour rate.

McCarthy Potatoes could seek ways to reduce this by either redesigning processes or employing

lower-cost equipment.

● Benchmarking to signal areas capable of improvement. If McCarthy Potatoes has other potato

processing plants around the globe, it could compare cost driver rates for the same activity at different

plants. It could then seek to transfer knowledge from the most efficient plants to the less efficient

plants.

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● Use cost driver rates as performance targets when evaluating operating managers. For example, the

manager in charge of potato cleaning could be given a target rate of €0.09 per raw kilogram of

potatoes cleaned.

● Developing a flexible budget for McCarthy Potatoes. The effect of different product mixes and

different output levels can be estimated using the cost driver rates.

Exercise 11.18

1

Job order 410

Job order 411

Direct manufacturing costs

Direct materials

SFr 9 700

SFr 59 900

Direct manufacturing labour,

SFr 30 × 25; 375

750

SFr 10 450

11 250

SFr 71 150

Indirect manufacturing costs,

SFr 115 × 25; 375

2 875

43 125

Total manufacturing costs

SFr 13 325

SFr 114 275

Number of units

÷10

÷200

Unit manufacturing cost per job

SFr 1 332.50

SFr 571.375

2

Job order 410

Job order 411

Direct manufacturing costs:

Direct materials

SFr 9 700

SFr 59 900

Direct manufacturing labour,

SFr 30 × 25; 375

750

SFr 10 450

11 250

SFr 71 150

Indirect manufacturing costs:

Materials handling,

SFr 0.40 × 500; 2000

200

800

Lathe work,

SFr 0.20 × 20 000; 60 000

4 000

12 000

Milling,

SFr 20.00 × 150; 1050

3 000

21 000

Grinding,

SFr 0.80 × 500; 2000

400

1 600

Testing,

SFr 15.00 × 10; 200

150

7 750

3 000

38 400

Total manufacturing costs

SFr 18 200

SFr 109 550

Number of units per job

÷10

÷200

Unit manufacturing cost per job

SFr 1 820

SFr 547.75

3

Job order 410

Job order 411

Number of units in job

10

200

Unit cost per job with prior costing system

SFr 1332.50

SFr 571.375

Unit cost per job with activity-based costing

SFr 1820.00

SFr 547.75

Job order 410 has an increase in reported cost of 36.6% [(SFr 1820 − SFr 1332.50) ÷ SFr 1332.50] while

Job order 411 has a decrease in reported cost of 4.1% [(SFr 547.75 − SFr 571.375) ÷ SFr 571.375].

A common finding when activity-based costing is implemented is that low-volume products have

increases in their reported costs while high-volume products have decreases in their reported cost. This

result is also found in requirements 1 and 2 of this problem.

The product cost figures calculated in requirements 1 and 2 differ because:

● the job orders differ in the way they use each of the five activity areas; and

● the activity areas differ in their indirect cost allocation bases (specifically, each area does not use the

direct labour-hours indirect cost allocation base).

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Chapter 11

775

The following table documents how the two job orders differ in the way they use each of the five activity

areas included in indirect manufacturing costs:

Usage based on analysis

Usage assumed with

of activity area

direct labour-hours as

cost drivers

application base

Activity area

Job order 410

Job order 411

Job order 410

Job order 411

Materials handling

20.0%

80.0%

6.25%

93.75%

Lathe work

25.0

75.0

6.25

93.75

Milling

12.5

87.5

6.25

93.75

Grinding

20.0

80.0

6.25

93.75

Testing

4.8

95.2

6.25

93.75

Areas where the differences in product cost figures might be important to Aircomposystèmes include:

● *Product pricing and product emphasis.* The activity-based accounting approach indicates that Job

410 is being undercosted while Job 411 is being overcosted. Aircomposystèmes may erroneously push

Job 410 and de-emphasise Job 411. Moreover, by its actions, Aircomposystèmes may encourage a

competitor to enter the market for Job order 411 and take market share away from itself.

● *Product design.* Product designers at Aircomposystèmes will probably find the numbers in the

activity-based costing approach more believable and credible than those in the existing system. In a

machine-paced manufacturing environment, it is unlikely that direct labour-hours would be the

major cost driver. Activity-based costing provides more credible signals to product designers about

the ways the costs of a product can be reduced – for example, use fewer parts, require fewer turns on

the lathe, and reduce the number of machine-hours in the milling area.

An overview of the product costing system is given by Solution Exhibit 11.18.

Solution Exhibit 11.18

Overview of Aircomposystèmes' product costing system

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Appendix A Solutions to selected exercises

CHAPTER 12

Exercise 12.13

1 Hospedeiras de Portugal Lda's full cost per hour of supplying contract labour is:

Variable costs

€12

Fixed costs (€240 000 ÷ 80 000 hours)

3

Full cost per hour

€15

Price per hour at full cost plus 20% = €15 × 1.20 = €18 per hour.

2 Contribution margins for different prices and demand realisations are as follows:

Price per

Variable cost

Contribution

Demand

Total

hour

per hour

margin per hour

in hours

contribution

(1)

(2)

(3) = (1) − (2)

(4)

(5) = (3) × (4)

€16

€12

€4

120 000

€480 000

17

12

5

100 000

500 000

18

12

6

80 000

480 000

19

12

7

70 000

490 000

20

12

8

60 000

480 000

Fixed costs will remain the same regardless of the demand realisations. Fixed costs are therefore

irrelevant since they do not differ among the alternatives. The table above indicates that Hospedeiras de

Portugal can maximise contribution margin and hence operating profit by charging a price of €17 per

hour.

3 The cost-plus approach to pricing in requirement 1 does not explicitly consider the effect of prices on

demand. The approach in requirement 2 models the interaction between price and demand and

determines the optimal level of profitability using concepts of relevant costs. The two different approaches

lead to two different prices in requirements 1 and 2. As the chapter describes, pricing decisions should

consider both demand or market considerations and supply or cost factors. The approach in requirement

2 is the more balanced approach. In most cases, of course, managers use the cost-plus method of

requirement 1 as only a starting point. They then modify the cost-plus price on the basis of market

considerations – anticipated customer reaction to alternative price levels and the prices charged by

competitors for similar products.

Exercise 12.14

1 Sales (1000 crates at DKK 100 per crate)

DKK 100 000

Variable costs:

Manufacturing

DKK 40 000

Marketing

14 000

Total variable costs

54 000

Contribution margin

46 000

Fixed costs

Manufacturing

DKK 20 000

Marketing

16 000

Total fixed costs

36 000

Operating profit

DKK 10 000

Normal mark-up percentage: DKK 46 000 ÷ DKK 54 000 = 85.19% of total variable costs.

2 Only the manufacturing-cost category is relevant to considering this special order; no additional

marketing costs will be incurred. The relevant manufacturing costs for the 200-crate special order are:

Variable manufacturing cost per unit

DKK 40 × 200 crates

DKK 8 000

Special packaging

2 000

DKK 10 000

Any price above DKK 50 per crate (DKK 10 000 ÷ 200) will make a positive contribution to operating

profit.

The reasoning based on a comparison of DKK 55 per crate-price with the DKK 60 per-crate

absorption cost ignores monthly cost–volume–profit relationships. The DKK 60 per-crate absorption

cost includes a DKK 20 per-crate cost component that is irrelevant to the special order. The relevant

range for the fixed manufacturing costs is from 500 to 1500 crates per month; the special order will

increase production from 1000 to 1200 crates per month. Furthermore, the special order requires no

incremental marketing costs.

3 If the new customer is likely to remain in business, Østerbro should consider whether a strictly short-run

focus is appropriate. For example, what is the likelihood of demand from other customers increasing

over time? If Østerbro accepts the 200-crate special offer for more than one month, it may preclude

accepting other customers at prices exceeding DKK 55 per crate. Moreover, the existing customers may

learn about Østerbro's willingness to set a price based on variable cost plus a small contribution margin.

The longer the timeframe over which Østerbro keeps selling 200 crates of canned peaches at DKK 55 a

crate, the more likely that the existing customers will approach Østerbro for their own special price

reductions.

Exercise 12.17

1 A life-cycle profit statement traces revenue and costs of each individual software package from its initial

research and development to its final customer servicing and support in the marketplace. The two main

differences from a calendar-based profit statement are:

● Costs incurred in different calendar periods are included in the same statement.

● Costs and revenue of each package are reported separately rather than aggregated into company-

wide categories.

The benefits of using a product life-cycle report are:

● The full set of revenues and costs associated with each product becomes visible.

● Differences among products in the percentage of total costs committed at early stages in the life cycle

are highlighted.

● Interrelationships among business function cost categories are highlighted. What is the effect, for

example, of cutting back on R&D and product-design cost categories on customer-service costs in

subsequent years?

2

EE-46

ME-83

IE-17

Revenue (€000)

€2500

€1500

€1600

Costs (€000)

R&D

€700

€450

€240

Design

200

120

96

Production

300

210

208

Marketing

500

270

448

Distribution

75

60

96

Customer service

375

2150

150

1260

608

1696

Operating profit (€000)

€350

€240

€(96)

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Appendix A Solutions to selected exercises

As emphasised in this chapter, the time value of money is not taken into account when summing life-

cycle revenue or life-cycle costs.

Rankings of the three packages on profitability (and relative profitability) are:

Operating profit

1 EE-46:

€350 000

1 ME-83:

16.0%

2 ME-83:

€240 000

2 EE-46:

14.0%

3 IE-17:

(€96 000)

3 IE-17:

(6.0%)

The EE-46 and ME-83 packages should be emphasised, and the IE-17 package should be de-emphasised.

It is interesting that IE-17 had the lowest R&D costs but was the least profitable.

3 The cost structures of the three software packages are:

EE-46

ME-83

IE-17

R&D

32.5%

35.7%

14.1%

Design

9.3

9.5

5.7

Production

14.0

16.7

12.3

Marketing

23.3

21.4

26.4

Distribution

3.5

4.8

5.7

Customer service

17.4

11.9

35.8

100.0%

100.0%

100.0%

The major differences are:

● EE-46 and ME-83 have over 40% of their costs in the R&D/product-design categories compared with

less than 20% (19.8%) for IE-17.

● IE-17 has 35.8% of its costs in the customer-service category compared with 17.4% for EE-46 and

11.9% for ME-83.

There are several explanations for these differences:

● EE-46 and ME-83 differ sizably from IE-17 in their R&D/product-design intensity. For example,

EE-46 and ME-83 may require considerably more interaction with users, and more experimentation

with software algorithms than does IE-17.

● The software division should have invested more in the R&D/product-design categories for IE-17.

The high percentage for customer service could reflect the correcting of problems that should have

been corrected prior to manufacture. Life-cycle reports highlight possible causal relationships among

cost categories.

CHAPTER 13

Exercise 13.14

a The optimum approach for this question is to inflate cash flows at their different inflation rates and to

discount at the money discount rate. The lowest common multiple is $2 \times 3 = 6$ years. Hence the cash

will be presented in these terms.

Two-year cycle: (cash flows are inflated according to their individual inflation rates):

0

1

2

3

4

5

6

Original cost

24 500

27 011

29 780

Maintenance

550

968

666

1171

805

1417

Resale values

–17 199

–18 962

–20 905

Total

24 500

550

10 780

666

11 989

805

–19 488

Present values

24 500

478

8151

438

6856

400

–8425

Net present value of costs

32 398

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Three-year cycle: (cash flows are inflated according to their individual inflation rates):

0

1

2

3

4

5

6

Original cost

24 500

28 362

Maintenance

550

968

1996

732

1288

2657

Resale values

–12 968

–15 012

Total

24 500

550

968

17 390

732

1288

–12 355

Present values

24 500

478

732

11 434

418

640

–5341

Net present value of costs

32 861

The two-year cycle is ideal.

b Some of the difficulties with NPV are listed below:

● NPV assumes that firms pursue an objective of maximising the wealth of their shareholders. This is

questionable given the wider range of stakeholders whose interests might conflict with those of the

shareholders.

● NPV is potentially a difficult method to apply in the context of having to estimate what is the correct

discount rate to use. This is particularly so when questions arise as to the incorporation of risk

premiums in the discount rate since an evaluation of the riskiness of the business, or of the project in

particular, will have to be made and which may be difficult to discern.

● NPV assumes that cash surpluses can be reinvested at the discount rate. This is subject to other

projects being available which produce at least a zero NPV at the chosen discount rate.

● NPV can most easily cope with cash flows arising at period ends and is not a technique that is used

easily when complicated, mid-period cash flows are present.

● The conclusion from NPV analysis is the present value of the surplus cash generated from a project.

If reported profits are important to businesses then it is possible that there may be a conflict between

undertaking a positive NPV project and potentially adverse consequences on reported profits. This

will particularly be the case for projects with long horizons, large initial investment and very delayed

cash inflows.

● Managerial incentive schemes may not be consistent with NPV, particularly when long time horizons

are involved. Thus managers may be rewarded on the basis of accounting profits in the short term and

may be incentivised to act in accordance with these objectives and thus ignore positive NPV projects.

Exercise 13.22

1 a Workings £000

Year 0

1

2

3

4

5

6

Money sales

399.600

583.200

642.453

700.652

697.931

Money costs

318.000

393.260

452.586

492.366

535.290

Tax profit

81.600

189.940

189.867

208.286

162.641

Tax

24.480

56.982

56.960

62.486

48.792

Tax offset

24.480

56.982

56.960

62.486

48.792

Capital value

500

375

281.25

210.9375

158.2031

Allowance

125

93.75

70.3125

52.73438

108.2031

C/f

375

281.25

210.9375

158.2031

Tax

37.5

28.125

21.09375

15.82031

32.46094

Offset

37.5

28.125

21.09375

15.82031

32.46094

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Cash flows

Investment

−500

50

Sales-costs

81.600

189.940

189.867

208.286

162.641

Tax

–24.480

–56.982

–56.960

–62.486

–48.792

Tax allow

37.5

28.125

21.09375

15.82031

32.46094

Net cash flow

–500

81.6

202.96

161.01

172.4194

165.9752

–16.3312

Discount factor

1.00

0.893

0.797

0.712

0.636

0.567

0.507

Present Value

–500

72.87

161.76

114.64

109.66

94.11

–8.28

Net present value = £44 760

Sales revenue

399.600

583.200

642.453

700.652

697.931

Operating costs

318.000

393.260

452.586

492.366

535.290

Depreciation

90.00

90.00

90.00

90.00

90.00

Profit

(8.40)

99.94

99.867

118.286

72.641

Total profit

= £382 334.

Average profit

= £382 334/5 = £76 467

Average investment

= (500 000 + 50 000)/2 = £275 000

Accounting Rate of Return = £76 467/£275 000 = 0.278

Accounting Rate of Return = 28%

b **To: Board of Directors**

From: Management Accountant

Date: July 2009

Subject: Investment projects

From a financial perspective based on the information given and that the projects are mutually

exclusive the company should invest in project 2. Investment decisions should be based on net present

values as this methodology is consistent with maximising company wealth. However, the company

will also need to consider non-financial factors that could affect the decision.

Examples include:

● consistency with the company's strategy

● impact on other areas of the business

● technical compatibility and obsolescence.

Accounting rate of return is a simple method of investment appraisal but has many disadvantages.

In particular, it is based on accounting profit rather than cash flow. Accounting profit is subjective

and dependent on the choice of accounting methods used. Accounting rate of return also ignores the

time value of money.

The net present value method is preferable as it ensures that shareholders' wealth is maximised

and recognises that cash received in the future is less valuable than cash received today. Net present

value does suffer from a number of disadvantages as follows:

● the speed of the repayment of the original investment is not highlighted

● non-financial managers may have difficulty in understanding the concept

● determination of the correct discount rate can be difficult.

2 Annual repayment = £250 000/(10 year 8% annuity factor)

= £250 000/6.71

= £37 258

There are just five years remaining therefore the company will be about to make a payment and then will

have four more annual payments to make. The value of these five payments is:

£37 258 + (37 258* 3.312) = £160 656

Source: CIMA 2010 Chartered Management Accounting Qualification – Answers for Specimen Examination Paper

P1. Published November 2009.

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CHAPTER 14

Exercise 14.12

Budgeted sales in units

100 000

Add target closing finished goods stock

11 000

Total requirements

111 000

Deduct opening finished goods stock

7 000

Units to be produced

104 000

Exercise 14.20

Tire-Lire, SNC

Statement of budgeted cash receipts and disbursements for the months of

December 2022 and January 2023

December 2022

January 2023

Cash balance, opening

€10 000

€2 025

Add receipts:

Collections of receivables (schedule 1)

235 900

285 800

(a) Total cash available for needs

245 900

287 825

Deduct disbursements:

For merchandise purchases (schedule 2)

183 875

141 750

For variable costs (schedule 3)

50 000

25 000

For fixed costs (schedule 3)

10 000

10 000

(b) Total disbursements

243 875

176 750

Cash balance, end of month (a – b)

€2 025

€111 075

Enough cash should be available for repayment of the note on 31 January 2023.

Schedule 1: Collections of receivables

December: 14 400[a] + 50 000[b] + 171 500[c] = €235 900

January: 20 000[d] + 60 000[e] + 205 800[f] = €285 800

[a] 0.08 × €180 000

[b] 0.20 × €250 000

[c] 0.70 × €250 000 × 0.98

[d] 0.08 × €250 000

[e] 0.20 × €300 000

[f] 0.70 × €300 000 × 0.98

Schedule 2: Payments for merchandise

December

January

Target closing stock (in units)

875 [a]

800 [c]

Add units sold (Sales ÷ €100)

3 000

1 500

Total requirements

3 875

2 300

Deduct opening stock (in units)

1 250 [b]

875

Purchases (in units)

2 625

1 425

Purchases in euros (units ÷ €70)

€183 750

€99 750

[a] 500 units + 0.25(150 000 ÷ 100)

[b] 87 500 ÷ 70

[c] 500 units + 0.25(120 000 ÷ 100)

December

January

Cash disbursements:

For previous month’s purchases at 50%

€92 000

€91 875

For current month’s purchases at 50%

91 875

49 875

€183 875

€141 750

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Appendix A Solutions to selected exercises

Schedule 3: Marketing, distribution and customer service costs

Total annual fixed costs, €150 000, minus €30 000 depreciation

=

€120 000

Monthly fixed cost requiring cash outlay

=

€10 000

Variable cost ratio to sales = 1

6

December variable costs: 1 = €300 000 sales

=

€50 000

6

January variable costs: 1 × €150 000 sales

=

€25 000

6

Exercise 14.22

1

Soft

Fresh

Packaged

Activity area

drinks

produce

food

Total

Ordering

DKK 90 × 14; 24; 14

DKK 1 260

DKK 2 160

DKK 1 260

DKK 4 680

Delivery

DKK 82 × 12; 62; 19

984

5 084

1 558

7 626

Shelf-stacking

DKK 21 × 16; 172; 94

336

3 612

1 974

5 922

Customer support

DKK 0.18 × 4600; 34 200;

10 750

828

6 156

1 935

8 919

DKK 3 408

DKK 17 012

DKK 6 727

DKK 27 147

2 An ABB approach recognises how different products require different mixes of support activities. The

relative percentage of how each product area uses the cost driver at each activity area is:

Soft

Fresh

Packaged

Activity area

drinks

produce

food

Total

Ordering

26.9

46.2

26.9

100.0%

Delivery

12.9

66.7

20.4

100.0

Shelf-stacking

5.7

61.0

33.3

100.0

Customer support

9.3

69.0

21.7

100.0

By recognising these differences, Nyborg Supermarkets managers are better able to budget for different

unit sales levels and different mixes of individual product line items sold. Using a single cost driver (such

as cost of goods sold, COGS) assumes homogeneity across product lines which does not occur at Nyborg

Supermarkets.

Other benefits cited by managers include: (1) better identification of resource needs, (2) clearer

linking of costs with staff responsibilities, and (3) identification of budgetary slack.

CHAPTER 15

Exercise 15.12

Direct materials

DKK 200 000

DKK 214 000

DKK 225 000

DKK 14 000 F

DKK 11 000 F

Price variance

Efficiency variance

DKK 25 000 F

Flexible-budget variance

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Chapter 15

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Direct manufacturing labour

DKK 90 000

DKK 86 000

DKK 80 000

DKK 4000 U

DKK 6000 U

Price variance

Efficiency variance

DKK 10 000 U

Flexible-budget variance

Exercise 15.20

1 Flexible budget data for Hoofdorp Music Box Fabricators for October.

Budgeted amount

Alternative levels of output

per unit

4000 units

5000 units

6000 units

Revenues

€77.00*

€308 000

€385 000

€462 000

Variable costs

Direct materials

22.00†

88 000

110 000

132 000

Direct manufacturing labour

15.00‡

60 000

75 000

90 000

Variable manufacturing overhead

2.00§

8 000

10 000

12 000

Variable marketing cost

5.50§

22 000

27 500

33 000

Total variable costs

44.50

178 000

222 500

267 000

Contribution margin

€32.50

130 000

162 500

195 000

Fixed costs

Manufacturing

51 700#

51 700

51 700

Marketing and administrative

82 600||

82 600

82 600

Total fixed costs

134 300

134 300

134 300

Total costs

312 300

356 800

401 300

Operating profit (loss)

€(4 300)

€28 200

€60 700

* €70 + 10%(€70) = €77.

† €90 000 ÷ 4500 = €20; €20 + 10%(€20) = €22.

‡ €67 500 ÷ 4500 = €15.

§ Given.

€50 700 + (€12 000 ÷ 12) = €50 700 + €1000 = €51 700.

|| €81 350 + (€15 000 ÷ 12) = €81 350 + €1250 = €82 600.

2 A flexible budget enables Hoofdorp to calculate a richer set of variances than does a static budget.

Hoofdorp will be able to calculate a flexible-budget variance and a sales-volume variance. These

additional variances provide more insight into *why* actual results differ from budgeted amounts.

Exercise 15.24

1 Budgeted selling price (revenue per loan application):

1 % × budgeted average loan amount

1

= % × €200 000 = €1000

2

2

Budgeted variable costs per output unit are:

Professional labour (6 × €40)

€240

Loan filing fees

100

Credit checks

120

Courier mailings

50

Total budgeted variable costs

€510

Budgeted fixed costs = €31 000 per month.

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The static budget for the 90 loan applicant level (and the flexible budget for the 120 loan application level

in requirement 2) are:

Requirement 1:

Requirement 2:

90 loan

120 loan

applications

applications

Budgeted revenue (90, 120 × €1000)

€90 000

€120 000

Budgeted variable costs (90, 120 × €510)

45 900

61 200

Contribution margin

44 100

58 800

Fixed costs

31 000

31 000

Operating profit

€13 100

€27 800

2 The actual results are:

Revenue (120 × 0.5% × €224 000)

€134 400

Variable costs:

Professional labour (120 × 7.2 ×€42)

€36 288

Loan filing fees (120 × €100)

12 000

Credit checks (120 × €125)

15 000

Courier mailings (120 × €54)

6 480

69 768

Contribution margin

64 632

Fixed costs

33 500

Operating profit

€31 132

These actual results can be analysed in a Level 2 variance analysis.

Flexible-

Sales-

Actual

budget

Flexible

volume

Static

results

variances

budget

variance

budget

(1)

(2) = (1) – (3)

(3)

(4) = (3) – (5)

(5)

Units sold

120

0

120

30 F

90

Revenue

€134 400

€14 400 F

€120 000

€30 000 F

€90 000

Variable costs

69 768

8 568 U

61 200

15 300 U

45 900

Contribution margin

64 632

5 832 F

58 800

14 700 F

44 100

Fixed costs

33 500

2 500 U

31 000

0

31 000

Operating profit

€31 132

€3 332 F

€27 800

€14 700 F

€13 100

€3332 F

€14 700 F

Total flexible-budget variance

Total sales-volume variance

€18 032 F

Total static-budget variance

Note that the €18 032 favourable static-budget variance is largely the result of an increase in loan

applications from a budgeted 90 to an actual 120. In addition, the average size of a loan increased from

a budgeted €200 000 to €224 000 which explains the flexible-budget variance of €14 400 F for revenues

(0.5% × €24 000 × 120 = €14 400). One possible explanation is a rapid decrease in interest rates

leading to an increase in demand for loan refinancing.

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CHAPTER 16

Exercise 16.11

1

Actual

Flexible

Static

results

budget

budget

4536 × SFr 11.50

4 × 1080 × SFr 12

4 × 1040 × SFr 12

= SFr 52 164

= SFr 51 840

= SFr 49 920

SFr 324 U

SFr 1920 U

Flexible-budget variance

Sales-volume variance

SFr 2244 U

Static-budget variance

2 Lavertezzo manufactured an extra 40 suits than the 1040 budgeted. This accounts for the unfavourable

sales-volume variance of SFr 1920 for variable manufacturing overhead.

The actual variable manufacturing overhead of SFr 52 164 exceeds the flexible budget amount of SFr

51 840 for 1080 suits by SFr 324 – hence the flexible budget variance is SFr 324 U.

Although not required by the exercise, the spending and efficiency variances provide further insight

into the flexible-budget variance of SFr 324 U for variable manufacturing overhead:

Flexible budget

(Budgeted input

allowed for actual

Actual costs

Actual input

output achieved

incurred

× **Budgeted rate**

× **Budgeted rate)**

4536 × SFr 11.50

4536 × SFr 12

4 × 1080 × SFr 12

= SFr 52 164

= SFr 54 432

= SFr 51 840

SFr 2268 F

SFr 2592 U

Spending variance

Efficiency variance

SFr 324 U

Flexible-budget variance

Lavertezzo had a favourable spending variance of SFr 2268 (the actual variable overhead rate was SFr

11.50 per direct manufacturing labour-hour versus SFr 12 budgeted). It had an unfavourable efficiency

variance of SFr 2592 U (each suit average 4.2 labour-hours versus 4.00 budgeted).

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CHAPTER 17

Exercise 17.11

1 and 2 Actual total quantity of all inputs used and actual input mix percentages for each input are as

follows:

Chemical

Actual quantity

Actual mix percentage

Echol

24 080

24 080 ÷ 86 000 = 0.28

Protex

15 480

15 480 ÷ 86 000 = 0.18

Benz

36 120

36 120 ÷ 86 000 = 0.42

CT-40

10 320

10 320 ÷ 86 000 = 0.12

Total

86 000

1.00

Budgeted total quantity of all inputs allowed and budgeted input mix percentages for each input are as

follows:

Chemical

Budgeted quantity

Budgeted mix percentage

Echol

25 200

25 200 ÷ 84 000 = 0.30

Protex

16 800

16 800 ÷ 84 000 = 0.20

Benz

33 600

33 600 ÷ 84 000 = 0.40

CT-40

8 400

8 400 ÷ 84 000 = 0.10

Total

84 000

1.00

Solution Exhibit 17.11 presents the total direct materials efficiency, yield and mix variances for August.

Solution Exhibit 17.11 Columnar presentation of direct materials efficiency, yield and mix

variances for Paix-Trolls SARL for August 2022

Flexible budget

(Budgeted total quantity

(Actual total quantity

(Actual total quantity

of all inputs allowed for

of all inputs used

of all inputs used

actual output achieved ×

× Actual input mix)

× Budgeted input mix)

Budgeted input mix)

× Budgeted prices

× Budgeted prices

× Budgeted prices

(1)

(2)

(3)

Echol

86 000 × 0.28 × 0.20 = 4 816

86 000 × 0.30 × 0.20 = 5 160

84 000 × 0.30 × 0.20 = 5 040

Protex

86 000 × 0.18 × 0.45 = 6 966

86 000 × 0.20 × 0.45 = 7 740

84 000 × 0.20 × 0.45 = 7 560

Benz

86 000 × 0.42 × 0.15 = 5 418

86 000 × 0.40 × 0.15 = 5 160

84 000 × 0.40 × 0.15 = 5 040

CT-40

86 000 × 0.12 × 0.30 = 3 096

86 000 × 0.10 × 0.30 = 2 580

84 000 × 0.10 × 0.30 = 2 520

20 296

20 640

20 160

€344 F*

€480 U*

Total mix variance

Total yield variance

€136 U

Total efficiency variance

* F = favourable effect on operating profit; U = unfavourable effect on operating profit.

Total direct materials efficiency variance can also be calculated as:

□

Direct materials

□

Budgeted inputs □

□

□□□ Budgeted

efficiency variance = □□Actual input −

□

□

allowed for actual □ ×

□

□□□

for each input

prices

□□□

output achieved □□

Echol

= (24 080 − 25 200) × €0.20 =

€224 F

Protex

= (15 480 − 16 800) × €0.45 =

594 F

Benz

= (36 120 − 33 600) × €0.15 =

378 U

CT-40

= (10 320 − 8400) × €0.30

=

576 U

Total direct materials efficiency variance

=

€136 U

The total direct materials yield variance can also be calculated as the sum of the direct materials yield

variances for each input:

Echol

= (86 000 − 84 000) × 0.30 × €0.20 = 2000 × 0.30 × €0.20 = €120 U

Protex

= (86 000 − 84 000) × 0.20 × €0.45 = 2000 × 0.20 × €0.45 =

180 U

Benz

= (86 000 − 84 000) × 0.40 × €0.15 = 2000 × 0.40 × €0.15 =

120 U

CT-40

= (86 000 − 84 000) × 0.10 × €0.30 = 2000 × 0.10 × €0.30 = 60 U

Total direct materials yield variance

€480 U

The total direct materials mix variance can also be calculated as the sum of the direct materials mix

variances for each input:

SKr 6 888 000

Actual indirect-cost rate =

Actual indirect costs

=

Actual direct labour-hour

164 000 hours

Echol = (0.28 − 0.30) × 86 000 × €0.20 = −0.02 × 86 000 × €0.20 = €344 F

Protex = (0.18 − 0.20) × 86 000 × €0.45 = −0.02 × 86 000 × €0.45 = 774 F

Benz = (0.42 − 0.40) × 86 000 × €0.15 = 0.02 × 86 000 × €0.15 = 258 U

CT-40 = (0.12 − 0.10) × 86 000 × €0.30 = 0.02 × 86 000 × €0.30 = 516 U

Total direct materials mix variance

€344 F

3 Paix-Trolls used a larger total quantity of direct materials inputs than budgeted, and so showed an

unfavourable yield variance. The mix variance was favourable because the actual mix contained more of

the cheapest input, Benz, and less of the costliest input, Protex, than the budgeted mix. The favourable

mix variance offset some, but not all, of the unfavourable yield variance – the overall efficiency variance

was unfavourable. Paix-Trolls will only find it profitable to shift to the cheaper mix if the yield from this

cheaper mix can be improved. Paix-Trolls must also consider the effect on output quality of using the

cheaper mix, and the potential consequences for future revenues.

Exercise 17.16

1 Solution Exhibit 17.16A presents the total price variance (€3100 F), the total efficiency variance (€2560

U) and the total flexible-budget variance (€540 F).

Total direct materials price variance can also be calculated as:

Barley

= (€0.28 – €0.30) × 62 000

= €1240 F

Wheat

= (€0.26 – €0.26) × 155 000

=

0

Rye

= (€0.20 – €0.22) × 93 000

= 1860 F

Total direct materials price variance

€3100 F

Total direct materials efficiency variance can also be calculated as:

Barley

= (62 000 – 45 000) × €0.30

= €5100 U

Wheat

= (155 000 – 180 000) × €0.26 =

6500 F

Rye

= (93 000 – 75 000) × €0.22

=

3960 U

Total direct materials efficiency variance

€2560 U

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Appendix A Solutions to selected exercises

Solution Exhibit 17.16A

Columnar presentation of direct materials price and efficiency variances for Granoline SA November 2022

	Flexible budget		
	Actual costs	(Budgeted inputs	
	incurred	allowed for actual	
	(Actual inputs ×	Actual input	
	outputs achieved	Actual prices)	× Budgeted prices
	× Budgeted prices)		
	(1)		(2)

(3)

Barley

62 000 × 0.28 = 17 360

62 000 × 0.30 = 18 600

45 000 × 0.30 = 13 500

Wheat

155 000 × 0.26 = 40 300

155 000 × 0.26 = 40 300

180 000 × 0.26 = 46 800

Rye

93 000 × 0.20 = 18 600

93 000 × 0.22 = 20 460

75 000 × 0.22 = 16 500

76 260

79 360

76 800

€3100 F*

€2560 U*

Total price variance

Total efficiency variance

€540 F

Total flexible-budget variance

* F = favourable effect on operating profit; U = unfavourable effect on operating profit.

2 Solution Exhibit 17.16B presents the total direct materials yield and mix variances for Granoline SA for

November 2022

Solution Exhibit 17.16B

Columnar presentation of direct materials, yield and mix variances

for Granoline SA for November 2022

Flexible budget

(Budgeted total quantity

(Actual total quantity

(Actual total quantity

of all inputs allowed for

of all inputs used

of all inputs used

actual output achieved ×

× Actual input mix)

× Budgeted input mix)

Budgeted input mix)

× Budgeted prices

× Budgeted prices

× Budgeted prices

(1)

(2)

(3)

Barley

310 000 × 0.20 × 0.30 = 18 600

310 000 × 0.15 × 0.30 = 13 950

300 000 × 0.15 × 0.30 = 13 500

Wheat

310 000 × 0.50 × 0.26 = 40 300

310 000 × 0.60 × 0.26 = 48 360

300 000 × 0.60 × 0.26 = 46 800

Rye

310 000 × 0.30 × 0.22 = 20 460

310 000 × 0.25 × 0.22 = 17 050

300 000 × 0.25 × 0.22 = 16 500

79 360

79 360

76 800

0

€2560 U*

Total mix variance

Total yield variance

€2560 U

Total efficiency variance

* F = favourable effect on operating profit; U = unfavourable effect on operating profit.

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The total direct materials yield variance can also be calculated as the sum of the direct materials yield

variances for each input:

Barley = (310 000 − 300 000) × 0.15 × €0.30 = 10 000 × 0.15 × €0.30

=

450 U

Wheat = (310 000 − 300 000) × 0.60 × €0.26 = 10 000 × 0.60 × €0.26 =

1560 U

Rye

= (310 000 − 300 000) × 0.25 × €0.22 = 10 000 × 0.25 × €0.22 = 550 U

Total direct materials yield variance

€2560 U

The total direct materials mix variance can also be calculated as the sum of the direct materials mix

variances for each input:

Barley = (0.20 − 0.15) × 310 000 × €0.30 = 0.05 × 310 000 × €0.30

=

€4650 U

Wheat = (0.50 − 0.60) × 310 000 × €0.26 = −0.10 × 310 000 × €0.26 =

8060 F

Rye

= (0.30 − 0.25) × 310 000 × €0.22 = 0.05 × 310 000 × €0.22

=

3410 U

Total direct materials mix variance

€0 U

3 Granoline paid less for barley and rye and so had a favourable direct materials price variance of €3100.

It also had an unfavourable efficiency variance of €2560. Granoline would need to evaluate whether these

were unrelated events or whether the lower price resulted from the purchase of cereals of poorer quality

that affected efficiency. The net effect in this case from a cost standpoint was favourable – the savings in

price being greater than the loss in efficiency. Of course, if the porridge is of poorer quality, Granoline

must also evaluate the potential effects on current and future revenues that have not been considered in

the variances described in requirements 1 and 2.

The unfavourable efficiency variance is attributable entirely to an unfavourable yield. The actual mix

does deviate from the budgeted mix, but at the budgeted prices, the greater quantity of barley and rye

cereals used in the actual mix exactly offsets the fewer wheat cereals used. Again, management should

evaluate the reasons for the unfavourable yield variance. Is it due to poor quality barley and rye cereals

(recall from requirement 1 that these cereals were acquired at a price lower than the standard price)? Is it

due to the change in mix (recall that the mix used is different from the budgeted mix, even though the

mix variance is €0)? Isolating the reasons can lead management to take the necessary corrective actions.

Exercise 17.21

1 and 2 Solution Exhibit 17.21 presents the sales-volume, sales-quantity and sales-mix variances for the

Choc and Chic wine glasses and in total for Rusti-Verres SNC in June 2011. The steps to fill in the num-

bers in Solution Exhibit 17.21 follow:

● *Step 1*

Consider the static budget column (column 3):

Static budget total contribution margin

SFr 5600

Budgeted units of all glasses to be sold

2000

Budgeted contribution margin per unit of Choc

SFr 2

Budgeted contribution margin per unit of Chic

SFr 6

Suppose that the budgeted sales mix percentage of Choc is y. Then the budgeted sales mix percentage of

Chic is $(1 - y)$. Hence,

$(2000 \times y \times \text{SFr } 2) + (2000 \times (1 - y) \times \text{SFr } 6) =$

SFr 5600

$4000\,y + 12\,000 - 12\,000\,y$

=

5600

8000 y

=

6400

y

= 0.8 or 80%

$1 - y = 1 - 0.8$

= 0.2 or 20%

Rusti-Verres' budgeted sales mix is 80% of Choc and 20% of Chic. We can then fill in all the numbers in

column 3.

● *Step 2*

Consider next column 2 of Solution Exhibit 17.21.

The total of column 2 in Panel C is SFr 4200 (the static budget total contribution margin of SFr 5600 –

the total sales-quantity variance of SFr 1400 U which was given in the problem).

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Appendix A Solutions to selected exercises

We need to find the actual units sold of all glasses, which we denote by q. From column 2, we know that:

(q × 0.8 × SFr 2) + (q × 0.2 × SFr 6) =

SFr 4200

SFr 1. q

6 × SFr 1. q

2

=

SFr 4200

SFr 2. q

8

=

SFr 4200

q = 1500 units

Hence, the total quantity of all glasses sold is 1500 units. This calculation allows us to fill in all the

numbers in column 2.

Columnar presentation of sales-volume, salesquantity

Solution Exhibit 17.21

and sales-mix variances for Rusti-Verres SNC

Flexible budget

Static budget

(Actual units sold

(Actual units sold

(Budgeted units sold

of all glasses

of all glasses

of all glasses

× Actual sales mix)

× Budgeted sales mix)

× Budgeted sales mix)

× Budgeted unit

× Budgeted unit

× Budgeted unit

contribution margin

contribution margin

contribution margin

(1)

(2)

(3)

Panel A:

(1500 × 0.6) × SFr 2

(1500 × 0.8) × SFr 2

(2000 × 0.8) × SFr 2

Choc

= 900 × SFr 2

= 1200 × SFr 2

= 1600 × SFr 2

= SFr 1800

= SFr 2400

= SFr 3200

SFr 600 U*

SFr 800 U

Sales-mix variance

Sales-quantity variance

SFr 1400 U

Sales-volume variance

Panel B:

(1500 × 0.4) × SFr 6

(1500 × 0.2) × SFr 6

(2000 × 0.2) × SFr 6

Chic

= 600 × SFr 6

= 300 × SFr 6

= 400 × SFr 6

= SFr 3600

= SFr 1800

= SFr 2400

SFr 1800 F

SFr 600 U

Sales-mix variance

Sales-quantity variance

SFr 1200 F

Sales-volume variance

Panel C:

SFr 5400

SFr 4200

SFr 5600

All glasses

SFr 1200F

SFr 1400 U

Total sales-mix variance Total sales-quantity variance

SFr 200 U

Total sales-volume variance

* F = favourable effect on operating profit; U = unfavourable effect on operating profit.

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● *Step 3*

Consider next column 1 of Solution Exhibit 17.21. We know the actual units sold of all glasses (1500

units), the actual sales-mix percentage (given in the problem information as Choc 60% and Chic 40%),

and the budgeted unit contribution margin of each product (Choc SFr 2, Chic SFr 6). We can therefore

determine all the numbers in column 1.

Solution Exhibit 17.21 displays the following sales-quantity, sales-mix and sales-volume variances:

Sales-volume variance

Choc

SFr 1400 U

Chic

1200 F

All glasses

SFr 200 U

Sales-mix variances

Sales-quantity variances

Choc

SFr 600 U

Choc

SFr 800 U

Chic

1800 F

Chic

600 U

All glasses

SFr 1200 F

All glasses

SFr 1400 U

2 Rusti-Verres SNC shows an unfavourable sales-quantity variance because it sold fewer wine glasses in

total than was budgeted. This unfavourable sales-quantity variance is partially offset by a favourable

sales-mix variance because the actual mix of wine glasses sold has shifted in favour of the higher

contribution margin Chic wine glasses. The problem illustrates how failure to achieve the budgeted

market penetration can have negative effects on operating profit.

CHAPTER 18

Exercise 18.15

1 Transfer prices for X23 and Y99 follow:

X23

Y99

Variable costs per unit

€11.00

€8.00

Allocated fixed costs per unit

14.00

7.00

Full costs per unit

25.00

15.00

10% of full costs per unit

2.50

1.50

Transfer price per unit

€27.50

€16.50

2 For X23 to have a transfer price of €23.65 per unit, its full cost would have to be €23.65 ÷ 1.10 = €21.50,

because the transfer price per unit is determined by adding 10% to the full costs per unit.

Check

Full costs per unit of X23

€21.50

Add 10% of full costs per unit

2.15

Transfer price per unit

€23.65

Fixed costs per unit that Eberhard would have to allocate to X23 can be calculated as follows:

Full costs per unit of X23

€21.50

Deduct variable costs per unit

11.00

Fixed costs per unit to be allocated

€10.50

3 Allocating overhead costs to products using methods that are in direct violation of corporate guidelines

is unethical. In assessing the situation, professional standards of ethics, where they exist, should be

consulted. For instance, competence, integrity and objectivity may be relevant.

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Competence

Clear reports using relevant and reliable information should be prepared. Reports prepared on the basis

of incorrectly allocating fixed costs would violate the management accountant's responsibility to

competence. It is unethical for Wilhelm to suggest that Eberhard should change the cost numbers that

were prepared for costing product X23 and for Wilhelm to change the numbers in order to reduce the

cost and hence the transfer price for X23.

Integrity

The management accountant has a responsibility to avoid actual or apparent conflicts of interest and to

advise all appropriate parties of any potential conflict. Lowering the fixed costs allocated to X23 will

increase the costs allocated to Y99. If they changed the method of fixed-cost allocation, Wilhelm and

Eberhard would appear to favour the Hanover Division (that uses X23) over the Bremen Division (that

uses Y99). This action could be viewed as violating the responsibility for integrity. It is desirable for the

management accountant to communicate favourable as well as unfavourable information. In this regard

both Wilhelm's and Eberhard's behaviour (if Eberhard agrees to reduce the overhead costs allocated to

X23) could be viewed as unethical.

Objectivity

Information should be fairly and objectively communicated and all relevant information should be

disclosed. From a management accountant's standpoint, allocating fewer costs to a product in violation

of company policy clearly violates both these precepts. For the various reasons cited above, we should

take the position that the behaviour described by Wilhelm and Eberhard (if he goes along with Wilhelm's

wishes) is unethical.

Eberhard should indicate to Wilhelm that the overhead costs allocated to X23 are indeed appropriate,

given the long-term nature of the relationship between Leipzig and Hanover, and also as required by

company policy. If Wilhelm still insists on making the changes and reducing the costs of making X23,

Eberhard should raise the matter with Wilhelm's superior. If, after taking all these steps, there is

continued pressure to misallocate costs, Eberhard should consider resigning from the company, and not

engage in unethical behaviour.

Some students may raise the issue of whether full-cost transfer pricing is appropriate in this context.

The problem does not provide enough details for a complete discussion of this issue. Management may

well conclude that full-cost-based transfer prices should not be used. But that is a management decision.

The management accountant should not unilaterally use methods of allocating fixed costs that are in

direct violation of company policy.

Exercise 18.19

This problem explores the ‘general transfer-pricing guideline’ discussed in the chapter.

1 No, transfers should not be made to Division B if there is no excess capacity in Division A.

An incremental (outlay) cost approach shows a positive contribution for the company as a whole.

Selling price of final product

€300

Incremental costs in Division A

€120

Incremental costs in Division B

150

270

Contribution (loss)

€30

However, if there is no excess capacity in Division A, any transfer will result in diverting product from

the market for the intermediate product. Sales in this market result in a greater contribution for the

company as a whole. Division B should not assemble the bicycle since the incremental revenue Liberaki

can earn, €100 per unit (€300 from selling the final product – €200 from selling the intermediate product)

is less than the incremental costs of €150 to assemble the bicycle in Division B.

Selling price of intermediate product

€200

Incremental (outlay) costs in Division A

120

Contribution (loss)

€80

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The general guideline described in the chapter is:

Minimum transfer price = Additional incremental costs per unit incurred up to the point of

transfer + Opportunity costs per unit to the supplying division

= €120 + (€200 − €120)

= €200, which is the market price

Market price is the transfer price that leads to the correct decision; that is, do not transfer to Division B

unless there are extenuating circumstances for continuing to market the final product. Therefore, B must

either drop the product or reduce the incremental costs of assembly from €150 per bicycle to less than

€100.

2 If (i) A has excess capacity, (ii) there is intermediate external demand for only 800 units at €200, and (iii)

the €200 price is to be maintained, then the opportunity costs per unit to the supplying division are €0.

The general guideline indicates a minimum transfer price of: €120 + €0 = €120, which is the

incremental or outlay costs for the first 200 units. B would buy 200 units from A at a transfer price of

€120 because B can earn a contribution of €30 per unit [€300 − (€120 + €150)]. In fact, B would be

willing to buy units from A at any price up to €150 per unit because any transfers at a price of up to €150

will still yield B a positive contribution margin.

Note, however, that if B wants more than 200 units, the minimum transfer price will be €200 as

calculated in requirement 1 because A will incur an opportunity cost in the form of lost contribution of

€80 (market price, €200 – outlay costs of €120) for every unit above 200 units that are transferred to B.

The following schedule summarises the transfer prices for units transferred from A to B.

Units

Transfer price

0–200

€120–€150

200–1000

€200

For an exploration of this situation when imperfect markets exist, see Exercise 18.22.

3 Division B would show zero contribution, but the company as a whole would generate a contribution of

€30 per unit on the 200 units transferred. Any price between €120 and €150 would induce the transfer

that would be desirable for the company as a whole. A motivational problem may arise regarding how to

split the €30 contribution between Divisions A and B. Unless the price is below €150, B would have little

incentive to buy.

Note: The transfer price that may appear optimal in an economic analysis may, in fact, be totally

unacceptable from the viewpoints of (1) preserving autonomy of the managers and (2) evaluating the

performance of the divisions as economic units. For instance, consider the simplest case discussed above,

where there is idle capacity and the €200 intermediate price is to be maintained. To direct that A should

sell to B at A's variable cost of €120 may be desirable from the viewpoint of B and the company as a

whole. However, the autonomy (independence) of the manager of A is eroded. Division A will earn

nothing, although it could argue that it is contributing to the earning of profit on the final product.

If the manager of A wants a portion of the total company contribution of €30 per unit, the question

is: How is an appropriate amount determined? This is a difficult question in practice. The price can be

negotiated upwards to somewhere between €120 and €150 so that some 'equitable' split is achieved. A

dual transfer pricing scheme has also been suggested whereby the supplier gets credit for the full

intermediate market price and the buyer is charged only with variable or incremental costs. In any event,

when there is heavy interdependence between divisions, such as in this case, some system of subsidies

may be needed to deal with the three problems of goal congruence, management effort and subunit

autonomy. Of course, where heavy subsidies are needed, a question can be raised as to whether the

existing degree of decentralisation is optimal.

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Appendix A Solutions to selected exercises

Exercise 18.22

An alternative presentation, which contains the same numerical answers, can be found at the end of this

solution.

1 Potential contribution from external intermediate sale:

1000 × (€195 − €120)

€75 000

Contribution through keeping price at €200:

800 × €80.

64 000

Forgone contribution by transferring 200 units

€11 000

Opportunity cost per unit to the supplying division:

By transferring internally = 11 000/200 = €55

Transfer price

= €120 + €55 = €175

An alternative approach to obtaining the same answer is to recognise that the incremental or outlay cost

is the same for all 1000 units in question. Therefore, the total revenue desired by A would be the same for

selling outside or inside.

Let X equal the transfer price at which Division A is indifferent between selling all units outside versus

transferring 200 units inside:

1000 (€195) = 800 (€200) + 200 X

X = €175

The €175 price will lead to the correct decision. Division B will not buy from Division A because its total

costs of €175 + €150 will exceed its prospective selling price of €300. Division A will then sell 1000

units at €195 to the outside; Division A and the company will have a contribution margin of €75 000.

Otherwise, if 800 units were sold at €200 and 200 units were transferred to Division B, the company

would have a contribution of €64 000 plus €6000 (200 units of final product × €30), or €70 000.

A comparison might be drawn regarding the calculation of the appropriate transfer prices between

the preceding exercise and this:

Additional incremental costs

Opportunity costs

Minimum transfer price =

per unit incurred up to the

+

point of transfeer

per unit to division A

Perfect markets

Minimum transfer price = €120 + (Selling price − Outlay costs per unit)

= €120 + (€200 − €120) = €200

Imperfect markets

Marginal revenues − Outlay costs

Minimum transfer price = €120 +

Number of units transferred

The marginal revenues of Division A from selling 200 units outside rather than transferring to Division

B are = (€195 × 1000) − (€200 × 800) = €195 000 − €160 000 = €35 000. The incremental (outlay)

costs incurred by Division A to produce 200 units = €120 = 200 × €24 000. Therefore

Minimum transfer price = €120 + [(35 000 − 24 000)/200] = €175

Therefore, selling price (€195) and marginal revenues per unit (€175 = €35 000 ÷ 200) are not the same.

Some students will erroneously say that the ‘new’ market price of €195 is the appropriate transfer

price. They will claim that the general guideline says that the transfer price should be

€120 + (€195 − €120) = €195, the market price. This conclusion assumes a perfect market. But here

there are imperfections in the intermediate market. That is, the market price is *not* a good approximation

of alternative revenue. If a division's sales are heavy enough to reduce market prices, marginal revenue

will be less than market price.

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It is true that *either* €195 *or* €175 will lead to the correct decision by B in this case. But suppose that B's

variable costs were €120 instead of €150. Then B would buy at a transfer price of €175, but not at a price

of €195, because then B would earn a negative contribution of €15 per unit [€300 − (€195 + €120)].

Note that if B's variable costs were €120, transfers would be desirable:

Division A contribution,

800 × (200 − 120) + 200 (175 − 120) = €75 000

Division B contribution,

200 × [€300 − (€175 + €120)] =

1 000

Total contribution

€76 000

Or the same facts can be analysed for the company as a whole:

Sales of intermediate product, 800 × (€200 − €120) =

€64 000

Sales of final products, 200 + [300 − (€120 + €120)] =

12 000

Total contribution

€76 000

If the transfer price were €195, B would not accept the transfer and would not earn any contribution. As

shown above, Division A and the company as a whole will earn a total contribution of €75 000 instead

of €76 000.

2 a Division A can sell 900 units at €195 to the outside market and 100 units to Division B, or 800 at €200

to the outside market and 200 units to Division B. Note that, under both alternatives, 100 units can

be transferred to Division B at no opportunity cost to A.

Using the general guideline, the minimum transfer price of *the first 100 units* [901 to 1000] is

TP1 = €120 + 0 = €120. If Division B needs 100 additional units, the opportunity cost to A is not

zero, because Division A will then have to sell only 800 units to the outside market for a contribution

of 800 × (€200 − €120) = €64 000 instead of 900 units for a contribution of

900 (€195 − €120) = €67 500. Each unit sold to B in addition to the first 100 units has an opportunity

cost to A of (€67 500 − €64 000) ÷ 100 = €35.

Using the general guideline, the minimum transfer price of *the next 100 units* [801 to 900] is

TP2 = €120 + €35 = €155.

Alternatively, the calculation could be as follows:

Increase in contribution from 100 more units, 100 × €75

€7500

Loss in contribution on 800 units, 800 × (€80 − €75)

4000

Net ‘marginal revenue’

€3500

Net ‘marginal revenue’ per unit, €3500 ÷ 100

€35

(Minimum) transfer price applicable to first 100 units

offered by A, €120 + €0

€120 per unit

(Minimum) transfer price applicable to next 100 units

offered by A, €120 + (€3500 ÷ 100)

€155 per unit

(Minimum) transfer price applicable to next 800 units

€195 per unit

b The manager of Division B will not want to purchase more than 100 units because the units at €155

would decrease his contribution (€155 + €150 > €300). Because the manager of B does not buy

more than 100 units, the manager of A will have 900 units available for sale to the outside market. The

manager of A will strive to maximise the contribution by selling them all at €195.

This solution maximises the company's contribution:

900 × (€195 − €120)

€67 500

100 × (€300 − €270)

3 000

€70 500

This compares favourably with:

800 × (€200 − €120)

€64 000

200 × (€300 − €270)

6 000

€70 000

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Alternative presentation from company viewpoint (by James Patell)

1

Sell 1000 outside at €195

Price

€195

Variable costs

120

Contribution

€75 × 1000 = €75 000

Sell 800 outside at €200, transfer 200

Transfer price

€200

Variable costs

120

Contribution

€80 × 800 = €64 000

Total contribution given up if transfer occurs = €75 000 − €64 000 = €11 000. (The contribution

of €30 per unit by B is not given up if transfer occurs, so it is not relevant here.)

On a per-unit basis, the relevant costs are the incremental costs to point of transfer + opportunity

costs to Division A of transfer = transfer price, i.e. 120 + 11 000/200 = €175.

By formula, the costs are the incremental costs to point of transfer + lost opportunity to sell 200 at

€195 for contribution of €75 – gain when first 800 sell at €200 instead of €195, i.e.

€120 + €75 − €20 = €175.

2 a At most, Division A can sell only 900 units and can produce 1000. Therefore, at least 100 units should

be transferred, at a transfer price no less than €120. The question is whether or not a second 100 units

should be transferred.

Sell 900 outside at €195

Transfer price

€195

Variable cost

120

Contribution

€75 × 900 = €67 500

Sell 800 outside at €200, transfer 100

Transfer price

€200

Variable cost

120

Contribution

€80 × 800 = €64 000

Total contribution forgone if transfer of 100 units occurs = €67 500 − €64 000 = €3500 (or €35

per unit).

On a per-unit basis, the relevant costs are the incremental costs to point of transfer + opportunity

costs to Division A of transfer = transfer price, i.e. €120 + €35 = €155.

b By formula, the costs are the incremental costs to point of transfer + lost opportunity to sell 100 at

€195, for contribution of €75 – gain when first 800 sell at €200 instead of €195, i.e.

€120 + €75 − €40 = €155.

Transfer price schedule (minimum acceptable transfer price)

Units

Transfer price

0–100

€120

101–200

€155

201–1000

€195

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CHAPTER 19

Exercise 19.13

1

Lorry Rental Division

Transportation Division

Total assets

€650 000

€950 000

Less: current liabilities

120 000

200 000

Investment

€530 000

€750 000

Required return (12% × investment)

63 600

90 000

Operating profit before tax

75 000

160 000

Residual income (profit – return)

€11 400

€70 000

2 After-tax cost of debt financing = (1 − 0.4) × 10% = 6%

After-tax cost of equity financing = 15%

Weighted average cost of capital = 9.6%

Required return for EVA®:

Lorry Rental Division

Transportation Division

Investment

€530 000

€750 000

9.6% × investment

50 880

72 000

Operating profit after tax

= 0.6 × operating profit before tax

45 000

96 000

EVA® (profit after tax – required return)

(€5 880)

€24 000

3 Both the residual profit and the EVA® calculations indicate that the Transportation Division is performing

better than the Lorry Rental Division. The Transportation Division has a higher residual profit (€70 000

versus €11 400) and a higher EVA® (€24 000 versus negative €5880). The negative EVA® for the Lorry

Rental Division indicates that on an after-tax basis the division is *destroying* value – the after-tax

economic return from the Lorry Rental Division's assets is less than the required return. If EVA®

continues to be negative, Intervilles may have to consider shutting down the Lorry Rental Division.

Exercise 19.15

1 The separate components highlight several features of return on investment not revealed by a single

calculation:

● The importance of investment turnover as a key to profit is stressed.

● The importance of revenues is explicitly recognised.

● The important components are expressed as ratios or percentages instead of monetary figures. This

form of expression often enhances comparability of different divisions, businesses and time periods.

● The breakdown stresses the possibility of trading-off investment turnover for income as a percentage

of revenues so as to increase the average ROI at a given level of output.

2 (Filled-in blanks are in bold face.)

Companies in same industry

A

B

C

Revenue

€1 000 000

€500 000

€10 000 000

Profit

€100 000

€50 000

€50 000

Investment

€500 000

€5 000 000

€5 000 000

Profit as % of revenue

10%

10%

0.5%

Investment turnover

2.0

0.1

2.0

Return on investment

20%

1%

1%

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Income and investment alone shed little light on comparative performances because of disparities in size

between Company A and the other two companies. Thus, it is impossible to say whether B's low return

on investment in comparison with A's is attributable to its larger investment or to its lower profit.

Furthermore the fact that Companies B and C have identical profit and investment may suggest that the

same conditions underlie the low ROI, but this conclusion is erroneous. B has higher margins but a lower

investment turnover. C has very small margins (1/20 of B's) but turns over investment 20 times faster.

The following analysis of the situation could be made:

Introducing revenues to measure level of operations helps to disclose specific areas for more intensive

investigation. Company B does as well as Company A in terms of profit margin, for both companies earn 10%

on revenues. But Company B has a much lower turnover of investment than does Company A. Whereas a

euro of investment in Company A supports 2 euros in revenues each period, a euro investment in Company

B supports only 10 cents in revenues each period. This suggests that the analyst should look carefully at

Company B's investment. Is the company keeping a level of stocks larger than necessary for its revenue

level? Are debts being collected promptly? Or did Company A acquire its fixed assets at a price level that was

much lower than that at which Company B purchased its plant?

On the other hand, C's investment turnover is as high as A's, but C's profit as a percentage of revenue is

much lower. Why? Are its operations inefficient, are its material costs too high, or does its location entail

high transportation costs?

Analysis of ROI raises questions such as the foregoing. When answers are obtained, basic reasons for

differences between rates of return may be discovered. For example, in Company B's case, it is apparent that

the emphasis will have to be on increasing turnover by reducing investment or increasing revenues. Clearly,

B cannot appreciably increase its ROI simply by increasing its profit as a percentage of revenue. In contrast,

Company C's management should concentrate on increasing the percentage of profit on revenue.

Exercise 19.19

1 *Computer Power*

2017

1.111

0.250

0.278

2022

0.941

0.125

0.118

Plum Computer

2017

1.250

0.100

0.125

2022

1.458

0.171

0.250

Computer Power’s ROI has declined sizably over the year, largely because of a decline in operating profit

to revenues. Plum Computer’s ROI has doubled over the year, in large part due to an increase in operating

profit to revenues.

2

Computer Power

Plum Computer

Business function

2017

2022

2017

2022

R&D

12.0%

6.0%

10.0%

15.0%

Design

5.0

3.0

2.0

4.0

Production

34.0

40.0

46.0

34.0

Marketing

25.0

33.0

20.0

23.0

Distribution

9.0

8.0

10.0

8.0

Customer service

15.0

10.0

12.0

16.0

Total costs

100.0%

100.0%

100.0%

100.0%

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Business functions with increases/decreases in the percentage of total costs over the year are:

Computer Power

Plum Computer

Increases

Production

R&D

Marketing

Design

Marketing

Customer service

Decreases

R&D

Production

Design

Distribution

Distribution

Customer service

Computer Power has decreased expenditures in several key business functions that are critical to its long-

term survival, notably research and development and design. These costs are discretionary and can be

reduced in the short run without any short-run effect on customers, but such action is likely to create

serious problems in the long run.

3 Based on the information provided, Kamel is the better candidate for president of User Friendly

Computer. Both Computer Power and Plum Computer are in the same industry. Kamel has headed Plum

Computer at a time when it has considerably outperformed Computer Power:

● The ROI of Plum Computer has increased over the year while that of Computer Power has decreased.

● The computer magazine has increased the ranking of Plum Computer's main product, while it has

decreased the ranking of Computer Power's main product.

● Plum Computer has received high marks for new products (the lifeblood of a computer company),

while Computer Power new-product introductions have been described as 'mediocre'.

CHAPTER 20

Exercise 20.11

1 La Quinta's 2023 strategy is a cost leadership strategy. La Quinta plans to grow by producing high-

quality boxes at a low cost delivered to customers in a timely manner. La Quinta's boxes are not

differentiated and there are many other manufacturers who produce similar boxes. To succeed, La

Quinta must achieve lower costs relative to competitors through productivity and efficiency improvements.

2 Measures that we would expect to see on a La Quinta's balanced scorecard are:

Financial perspective

● operating income from productivity gain

● operating income from growth

● cost reductions in key areas.

These measures evaluate whether La Quinta has successfully reduced costs and generated growth

through cost leadership:

Customer perspective

● market share

● new customers

● customer satisfaction index

● customer retention

● time taken to fulfil customer orders.

The logic is that improvements in these customer measures are leading indicators of superior financial

performance:

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Internal business process perspective

● yield

● productivity

● order delivery time

● on-time delivery.

Improvements in these measures are expected to lead to more satisfied customers and in turn to superior

financial performance:

● Learning and growth perspective

● percentage of employees trained in process and quality management

● employee satisfaction

● number of major process improvements.

Improvements in these measures have a cause-and-effect relationship with improvements in internal

business processes, which in turn lead to improved customer satisfaction and financial performance.

Exercise 20.13

1 Snyder's strategy is cost leadership. Snyder's consulting services for implementing sales management

software are not distinct from those of its competitors. The market for these services is very competitive.

To succeed, Snyder must deliver quality service at low cost. Improving productivity while maintaining

quality is key.

2 Balanced scorecard measures follow:

Financial perspective

● increase operating income from productivity gains and growth

● revenues per employee

● cost reductions in key areas, for example, software implementation and overhead costs.

These measures indicate whether Snyder has been able to reduce costs and achieve operating income

increases through cost leadership:

Customer perspective

● market share

● new customers

● customer responsiveness

● customer satisfaction.

Improvements in these customer measures are regarded as leading indicators of superior financial

performance:

● Internal business process perspective

● time to complete customer jobs

● time lost due to errors

● quality of job. (Is system running smoothly after job is completed?)

Improvements in these measures are expected to lead to more satisfied customers, lower costs and

superior financial performance:

Learning and growth perspective

● time required to analyse and design implementation steps

● time taken to perform key steps implementing the software

● skill levels of employees

● hours of employee training

● employee satisfaction and motivation.

Improvements in these measures have a cause-and-effect relationship with improvements in internal

business processes, leading to improved customer satisfaction and financial performance.

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Exercise 20.14

1 Caltex's strategy is to focus on 'service-oriented customers' who are willing to pay a higher price for

services. Even though its product is largely a commodity product, petrol, Caltex wants to differentiate

itself through the service it provides at its retailing stations.

Does the scorecard represent Caltex's strategy? By and large it does. The focus of the scorecard is on

measures of process improvement, quality, market share, and financial success from product

differentiation. There are some deficiencies that the subsequent assignment exercises raise but, abstracting

from these concerns for the moment, the scorecard does focus on implementing a product differentiation

strategy.

Having concluded that the scorecard has been reasonably well designed, how has Caltex performed

relative to its strategy in 2022? It appears from the scorecard that Caltex was successful in implementing

its strategy in 2022. It achieved all targets in the financial, internal business, and learning and growth

perspectives. The only target it missed was the market share target in the customer perspective. At this

stage, students may raise some questions about whether this is a good scorecard measure. Requirement

3 gets at this issue in more detail. The bottom line is that measuring 'market share in the overall petrol

market' rather than in the 'service-oriented customer' market segment is not a good scorecard measure,

so not achieving this target may not be as big an issue as it may at first seem.

2 Yes, Caltex should include some measure of employee satisfaction and employee training in the learning

and growth perspective. Caltex's differentiation strategy and ability to charge a premium price is based

on customer service. The key to good, fast and friendly customer service is well-trained and satisfied

employees. Untrained and dissatisfied employees will have poor interactions with customers and cause

the strategy to fail. Hence, training and employee satisfaction are important to Caltex for implementing

its strategy. These measures are leading indicators of whether Caltex will be able to successfully

implement its strategy and, hence, should be measured on the balanced scorecard.

3 Caltex's strategy is to focus on the 60% of petrol consumers who are service-oriented, not on the 40%

price-shopper segment. To evaluate if it has been successful in implementing its strategy, Caltex needs to

measure its market share in its targeted market segment, 'service-oriented customers', not its market

share in the overall market. Given Caltex's strategy, it should not be concerned if its market share in the

price-shopper segment declines. In fact, charging premium prices will probably cause its market share in

this segment to decline. Caltex should replace 'market share in overall petrol market' with 'market share

in the service-oriented customer segment' in its balanced scorecard customer measure. Caltex may also

want to consider putting a customer satisfaction measure on the scorecard. This measure should capture

an overall evaluation of customer reactions to the facility, the convenience store, employee interactions

and quick turnround. The customer satisfaction measure would serve as a leading indicator of market

share in the service-oriented customer segment.

4 Although there is a cause-and-effect link between internal business process measures and customer

measures on the current scorecard, Caltex should add more measures to tighten this linkage. In particular,

the current scorecard measures focus exclusively on refinery operations and not on petrol station

operations. Caltex should add measures of petrol station performance such as cleanliness of the facility,

turnround time at the pumps, the shopping experience at the convenience store, and the service provided

by employees. Many companies do random audits of their facilities to evaluate how well their branches

and retail outlets are performing. These measures would serve as leading indicators of customer

satisfaction and market share in Caltex's targeted segments.

5 Caltex is correct in not measuring changes in operating profit from productivity improvements on its

scorecard under the financial perspective. Caltex's strategy is to grow by charging premium prices for

customer service. The scorecard measures focus on Caltex's success in implementing this strategy.

Productivity gains *per se* are not critical to Caltex's strategy and, hence, should not be measured on the

scorecard.

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Appendix A Solutions to selected exercises

Exercise 20.23

1 The ±2σ rule will trigger a decision to investigate when the round-trip fuel usage is outside the control

limit:

Mean ± 2 = σ 1000 ± 2σ = 1000 ± (2 × 100)

= 800 to 1200 litre-units

Any fuel usage less than 80 litre-units or greater than 1200 litre-units will trigger a decision to investigate.

The only plane to be outside the specified $\mu \pm 2\ \sigma$ fuel usage control limit is the Eclair des Alpilles on

flights 5 (1220 litre-units), 7 (1260 litre-units) and 10 (1230 litre-units).

2 The Eclair des Cévennes has no observation outside the $\mu \pm 2\,\sigma$ control limits. However, there was an

increase in fuel use in each of the last eight round-trip flights. The probability of eight consecutive

increases from an in-control process is very low.

The Eclair des Vosges appears in control regarding fuel usage.

The Eclair des Alpilles has three observations outside the $\mu \pm 2\,\sigma$ control limits. Moreover, the mean

on the last six flights is 1200 compared with a mean of 1040 for the first four flights.

3 The advantage of using euro fuel costs as the unit of analysis in an SQC chart is that it focuses on a

variable of overriding concern to top managers: operating costs.

However, the disadvantages of using euro fuel costs are:

● Split responsibilities. Operations managers may not control the purchase of fuel, and may want to

exclude from their performance measures any variation stemming from factors outside their control.

● Offsetting factors may mask important underlying trends when the quantity used and the price paid

are combined in a single observation. For example, decreasing litre usage may be offset by increasing

fuel costs. Both of these individual patterns are important in budgeting for an airline.

● The distribution of fuel usage in litres may be different from the distribution of fuel prices per litre.

More reliable estimates of the μ and σ parameters might be obtained by focusing separately on the

individual usage and price distributions.

Note: The above disadvantages are most marked if actual fuel prices are used. The use of standard fuel

prices can reduce many of these disadvantages.

CHAPTER 21

Exercise 21.11

1 Journal entries for August are as follows:

Entry (a)

Stock: Raw and In-Progress Control

550 000

Creditors' Control

550 000

(raw materials and components purchased)

Entry (b)

Conversion Costs Control

440 000

Various accounts (such as Creditors

Control and Wages Payable)

440 000

(conversion costs incurred)

Entry (c)

Finished Goods Control

945 000

Stock: Raw and In-Progress Control

525 000

Conversion Costs Allocated

420 000

(standard costs of 21 000 units of finished goods

produced at €45 per unit; direct materials,

€25 per unit; conversion costs, €20 per unit)

Entry (d)

Cost of Goods Sold

900 000

Finished Goods Control

900 000

(standard costs of 20 000 units of finished goods

sold at €45 per unit)

Exercise 21.20

1 Cost of defective unit at machining operation which is not a bottleneck operation is the loss in direct

materials (variable costs) of €32 per unit. Producing 2000 units of defectives does not result in loss

of throughput contribution. Despite the defective production, machining can produce and transfer

80 000 units to finishing. Therefore cost of 2000 defective units at the machining operation is

€32 × 2000 = €64 000.

2 A defective unit produced at the bottleneck finishing operation costs Salamanca materials costs plus the

opportunity cost of lost throughput contribution. Bottleneck capacity not wasted in producing defective

units could be used to generate additional sales and throughput contribution. Cost of 2000 defective

units at the finishing operation is as follows:

Loss of direct materials: €32 × 2000

€64 000

Forgone throughput contribution:

80 000

(€72 − €32) × 2000

Total cost of 2000 defective units

€144 000

Alternatively, the cost of 2000 defective units at the finishing operation can be calculated as the lost

revenue of €72 × 2000 = €144 000. That is, the direct materials costs of €32 × 2000 = €64 000 and

all fixed operating costs in the machining and finishing operations are irrelevant since these costs would

be incurred anyway whether a defective or good unit is produced. The cost of producing a defective unit

is the revenue lost of €144 000.

Exercise 21.27

1 Sarantis has successfully implemented JIT in its production operations and hence minimised work-in-

progress stock. It still has a fair amount of raw material and finished goods stock. It is therefore

recommended that Sarantis adopt a backflush costing system with two trigger points as follows:

● direct materials purchases charged to stock: Raw and In-Progress Control

● finished goods recorded as Finished Goods Control.

The backflush approach described closely approximates the costs calculated using sequential tracking.

There is no work in progress so there is no need for a Work-in-Progress stock account.

Further, by maintaining a Raw and In-Progress Stock Control and Finished Goods Control account,

Sarantis can keep track of and control the stocks of direct materials and finished goods in its plant.

2 a A backflush costing system with a single trigger point: Finished Goods Control. This would

approximate the sequential tracking approach since the question assumes Sarantis has no raw

materials or work-in-progress stocks. There is therefore no need for these stock accounts.

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b A backflush costing system with two trigger points: (1) when purchases are made (debited to Stock

Control) and (2) when finished goods are sold, would approximate sequential tracking, since the

question assumes Sarantis has no work-in-progress or finished goods stocks.

c A backflush costing system with a single trigger point when finished goods are sold would approximate

sequential tracking since the question assumes Sarantis has no raw material, work-in-progress or

finished goods stock.

The principle here is that backflushing of costs should be triggered at the finished goods stock stage if

Sarantis plans to hold finished goods inventory. If Sarantis plans to hold no finished goods stock,

backflushing can be postponed until the finished goods are sold. In other words, the trigger points for

backflushing relate to the points where stock is being accumulated. As a result, backflushing matches the

sequential tracking approach and also maintains a record for the monitoring and control of the stock.

3 Some comments on the quotation follow:

● The backflush system is a standard costing system, not an actual costing system.

● If standard costing is used, an up-to-date realistic set of standard costs is always desirable – as long

as the set meets the cost–benefit test as related to the task of updating.

● The operating environments of 'the present JIT era' have induced many companies towards more

simplicity (backflush) and abandoning the typical standard costing system (sequential tracking).

● Backflush is probably closer to being a periodic system than a perpetual system. However, a periodic

system may be cost-effective, particularly where physical stocks are relatively low or stable.

● The textbook points out that, to be attractive, backflush costing should generate the same financial

measurements as sequential tracking – and at a lower accounting cost.

● The choice of a product costing system is highly contextual. Its characteristics should be heavily

affected by its costs, the preferences of operating managers and the underlying operating processes.

Sweeping generalisations about any cost accounting system or technique are unjustified.

Exercise 21.29

1 It will cost Autronic €50 per unit to reduce manufacturing time. But manufacturing is not a bottleneck

operation, installation is. Therefore manufacturing more equipment will not increase sales and

throughput contribution. Autronic AG should not implement the new manufacturing method.

2 Additional relevant costs of new direct materials = €2000 × 320 units = €640 000. Increase in

throughput contribution = €25 000 × 20 units = €500 000. The additional incremental costs exceed

the benefits from higher throughput contribution by €140 000, so Autronic AG should not implement the

new design.

Alternatively, compare throughput contribution under each alternative. Current throughput

contribution is €25 000 × 300 = €7 500 000. With the modification, throughput contribution is

€23 000 × 320 = €7 360 000. The current throughput contribution is greater than the throughput

contribution resulting from the proposed change in direct materials. Hence, Autronic should not

implement the new design.

3 Increase in throughput contribution, €25 000 × 10 units = €250 000. Increase in relevant costs = €50 000.

costs = €50 000. The additional throughput contribution exceeds incremental costs by €200 000 so Autronic

should implement the new installation technique.

4 Motivating installation workers to increase productivity is worthwhile because installation is a bottleneck

operation and any increase in productivity at the bottleneck will increase throughput contribution. On the

other hand, motivating workers in the Manufacturing Department to increase productivity is not

worthwhile. Manufacturing is not a bottleneck operation, so any increase in output will only result in extra

stock of equipment. Autronic AG should only encourage manufacturing to produce as much equipment as

the Installation Department needs, not to produce as much as it can. In these circumstances, it would not

be a good idea to evaluate and compensate manufacturing workers on the basis of their productivity.

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Exercise 21.32

1

EOQ = $\sqrt{}$(2 *DP* / *C*)

D = 2000; *P* = €40; *C* = €4 + (10% × €50) = €9

EOQ = $\sqrt{}$(2 × 2000 × 40/9) = 133.333 tyres 133 tyres

TRC = *DP* / *Q* + *QC* /2 where *Q* can be any quantity, including the EOQ

= (2000 × 40/133.3) + (133.3 × 9/2) + €600 + €600 = €1200

If students used an EOQ of 133 tyres (order quantities rounded to the nearest whole number),

TRC = €601.5 + €598.5 = €1200

The sum of annual relevant ordering and carrying costs equals €1200.

2 The prediction error affects *C,* which is now:

C = €4 + (10% × €30) = €7

$D = 2000$ $P = €40$ $C = €7$

EOQ = √(2 × 2000 × 40/7) = 151.186 tyres 151 tyres

The cost of the prediction error can be calculated using a three-step procedure.

● *Step 1.* Calculate the monetary outcome from the best action that could have been taken, given the

actual amount of the cost input:

TRC = $DP / Q + QC /2$ = €529.15 + €529.15 = €1058.30

● *Step 2.* Calculate the monetary outcome from the best action based on the incorrect amount of the

predicted cost input:

TRC = $DP / Q + QC /2$ = €600 + €466.67 = €1066.67

● *Step 3.* Calculate the difference between the monetary outcomes from steps 1 and 2:

Monetary outcome

Step 1

€1058.30

Step 2

1066.67

Difference

€(8.37)

The cost of the prediction error is €8.37

Note: The €20 prediction error for the purchase price of the heavy-duty tyres is irrelevant in computing

purchase costs under the two alternatives because the same purchase costs will be incurred whatever the

order size.

Some students may prefer to round off the EOQs to 133 tyres and 151 tyres, respectively. The

calculations under each step in this case are:

● *Step 1.* TRC = €529.80 + €528.50 = €1058.30

● *Step 2.* TRC = €601.50 + €465.50 = €1067.00

● *Step 3.* Difference = €1058.30 − €1067.00 = €8.70

CHAPTER 22

Exercise 22.11

1 Gardini's strategy is to focus on 'service-oriented customers' who are willing to pay a higher price for

services. Even though candy bars are largely a commodity product, Gardini wants to differentiate itself

through the service it provides with its custom labeling and high-quality product.

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Does the scorecard represent Gardini's strategy? By and large it does. The focus of the scorecard is on

measures of process improvement, quality, market share, and financial success from product

differentiation and charging higher prices for customer service. There are some deficiencies that the

subsequent assignment questions raise, but abstracting from these concerns for the moment, the

scorecard does focus on implementing a product differentiation strategy.

Based on the scorecard being reasonably well designed, how has Gardini performed relative to its

strategy in 2022? It appears from the scorecard that Gardini was successful in implementing its strategy in

2022. It achieved all targets in the financial, internal business, and learning and growth perspectives (other

than women and minorities in the workplace). The only target it missed was the market share target in the

customer perspective. At this stage, students may raise some questions about whether this is a good

scorecard measure. Requirement 3 gets at this issue in more detail. The bottom line is that measuring

'market share in the overall candy market' rather than in the 'specialty candy' market segment is not a

good scorecard measure, so not achieving this target may not be as big a miss as it may seem at first.

2 Yes, Gardini should include some measure of customer satisfaction in the customer perspective. Gardini's

differentiation strategy and ability to charge a premium price is based on meeting and/or exceeding

customer expectations, especially in the custom design of the labels. Unsatisfied customers will not be

loyal or will be unlikely to recommend the company's product. Hence, customer satisfaction is very

important to Gardini for implementing its strategy. These measures are leading indicators of whether

Gardini will be able to increase its market share in the specialty candy market and should be measured

on the balanced scorecard.

3 To evaluate if it has been successful in implementing its strategy, Gardini needs to measure its market

share in its targeted market segment, not its market share in the overall market. Given Gardini's strategy,

it should not be concerned if its market share in the candy bar segment declines. In fact, charging

premium prices will probably cause its market share in this segment to decline. Gardini should replace

‘market share in overall candy bar market’ with ‘market share in the specialty food/candy segment’ in its

balanced scorecard customer measure. If Gardini is successfully implementing its strategy, its market

share in the specialty candy segment should increase.

4 Gardini is correct in not measuring changes in operating income from productivity improvements on its

scorecard under the financial perspective. Gardini’s strategy is to grow by charging premium prices for

customer service. The scorecard measures focus on Gardini’s success in implementing this strategy.

Productivity gains per se are not critical to Gardini’s strategy and, therefore, should not be measured on

the scorecard.

5 Gardini included social and environmental performance measures in its balanced scorecard because it

believes strong environmental and social performance gives it a competitive advantage by (1) attracting

and inspiring outstanding employees, (2) enhancing its reputation with socially conscious customers,

investors and analysts, and (3) boosting its image with governments and citizens, all of which contribute

to long-run financial performance. Gardini also believes that focusing on environmental and social

performance in addition to financial performance helps it to innovate in technologies, processes,

products, and business models to reduce the trade-offs between financial and sustainability goals and

build transformational leadership and change capabilities to implement these ‘triple bottom line’

strategies.

Following the concept of shared value, Gardini includes social and environmental measures (together

with business goals and measures) in its balanced scorecard to evaluate how well it is doing toward

achieving its social and environmental goals. The balanced scorecard indicates that Gardini’s social and

environmental initiatives are having an effect. Gardini’s increased use of recycled materials as a percentage

of total materials used has resulted in attracting customers for whom using recycled materials matters,

creating long-term financial benefit. Similarly increasing the number of women and minorities employed

will allow Gardini to target a larger number of talented individuals. Reducing the size of packaging both

increases income and reduces waste, achieving both financial and sustainability objectives.

Not all companies believe in implementing sustainability goals, but those that do find the balanced

scorecard to be a useful tool to simultaneously implement both financial and sustainability goals.

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GLOSSARY

absorption costing Stock costing method in which all

autonomy The degree of freedom to make decisions.

variable manufacturing costs and all fixed manufacturing

average cost See unit cost.

costs are included as inventoriable costs.

backflush accounting A cost accounting system which

account analysis method Approach to cost estimation

focuses on the output of the organisation and then works

that classifies cost accounts in the ledger as variable,

backwards to allocate costs between cost of goods sold and

fixed or mixed with respect to the cost driver. Typically,

stock.

qualitative rather than quantitative analysis is used in

making these classification decisions.

backflush costing Costing system that delays recording

changes in the status of a product being produced

accounting rate of return (ARR) Accounting measure of
until good finished units appear; it then uses budgeted
income divided by an accounting measure of investment.
or standard costs to work backwards to flush out
Also called return on investment (ROI).
manufacturing costs for the units produced. Also called
activity An event, task or unit of work with a specified
delayed costing, endpoint costing or post-deduct costing.
purpose.
balanced scorecard A measurement and management
activity-based accounting Examination of activities
system that views a business unit's performance from four
across the entire chain of value-adding organisational
perspectives: financial, customer, internal business process,
processes underlying causes (drivers) of cost and profit.
and learning and growth.
activity-based budgeting Approach to budgeting that
batch-level costs The costs of resources sacrificed on
focuses on the costs of activities necessary to produce and
activities that are related to a group of units of products or

sell products and services.

services rather than to each individual unit of product or

activity-based costing (ABC) Approach to costing that

service.

focuses on activities as the fundamental cost objects. It uses

belief systems Levers of control that articulate the

the cost of these activities as the basis for assigning costs to

mission, purpose, norms of behaviours and core values

other cost objects such as products, services or customers.

of a company; intended to inspire managers and other

activity-based management (ABM) Management

employees to do their best.

system which uses activity-based costing information to

benchmark Point of reference from which comparisons

improve profits and enhance value to customers.

may be made.

actual costing A costing method that traces direct costs

benchmarking The continuous process of measuring

to a cost object by using the actual direct cost rate(s)

products, services or activities against the best levels of

times the actual quantity of the direct cost input(s) and

performance.

allocates indirect costs based on the actual indirect cost

rate(s) times the actual quantity of the cost allocation base.

big data Datasets for which traditional processing

techniques (for capturing, storing, querying or analysing)

actual costs Costs incurred (historical costs), as

are inadequate due to the quantity or complexity of the

distinguished from budgeted or forecast costs.

data. Such data sources are increasingly available because

appraisal costs Costs incurred in detecting which of the

of the presence of inexpensive sensors, including those

individual units of products do not conform to specifications.

found on mobile devices, cameras, drones, satellites, and

artificial costs See complete reciprocated cost.

personal fitness devices.

artificial intelligence (AI) The simulation of human

blockchain An accounting technology that can

intelligence processes by machines. It can increase the

be described as a ‘distributed ledger’ which records

effectiveness of human decision making and enhance

transactions continuously such that the transacting

the advice financial professionals give to other business

parties leave a permanent verifiable record. It provides full

executives.

visibility on past transactions which cannot be altered by

attention directing Management accountant’s function

any participant.

that involves making visible both opportunities and

book value The original cost minus accumulated

problems on which managers need to focus.

depreciation of an asset.

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Glossary

bottleneck An operation where the work required

coefficient of determination (*r* 2) Measures the

approaches or exceeds the available capacity.

percentage of variation in a dependent variable explained

boundary systems Levers of control that describe

by one or more independent variables.

standards of behaviour and codes of conduct expected of

collusive pricing Companies in an industry conspire in

all employees, especially actions that are off-limits.

their pricing and output decisions to achieve a price above

breakeven point Quantity of output where total

the competitive price.

revenues and total costs are equal; that is where the

combined variance analysis Approach to overhead

operating profit is zero.

variance analysis that combines variable-cost and fixed-cost

budget The quantitative expression of a plan of action

variances.

and an aid to the coordination and implementation of the

common cost The cost of operating a facility, operation,

plan.

activity area or like cost object that is shared by two or

budgetary slack See padding.

more users.

budgeted costing See extended normal costing.

complete reciprocated cost The actual cost incurred by the service department plus a part of the costs of the other

bundled product A package of two or more products

support departments that provide services to it; it is always

or services, sold for a single price, where the individual

larger than the actual cost. Also called artificial cost of the

components of the bundle may be sold as separate items,

service department.

each with its stand-alone price.

composite product unit A hypothetical unit of product

business function costs The sum of all the costs in a

with weights related to the individual products of the

particular business function.

company.

business governance The performance dimension of an

computer-aided design (CAD) Computer-based

enterprise.

technology allowing interactive design and testing of a

by-product Product from a joint process that has a low

manufacturing component on a visual display terminal.

sales value compared with the sales value of the main or

computer-aided manufacturing (CAM) Computer-

joint product(s).

based technology to permit the programming and control

capital budgeting The process of making long-term

of production equipment in the manufacturing task.

planning decisions for investments.

computer-integrated manufacturing (CIM) The use of

capitalised costs Costs that are first recorded as an asset

computers and other advanced manufacturing techniques

(capitalised) when they are incurred.

to monitor and perform manufacturing tasks.

carrying costs Costs that arise when a business holds

conference method Approach to cost estimation

stocks of goods for sale.

that develops cost estimates on the basis of analysis

cash budget Schedule of expected cash receipts and

and opinions gathered from various departments of

disbursements.

an organisation (purchasing, process engineering,
manufacturing, employee relations, and so on).
cash cycle See self-liquidating cycle.
constant The component of total costs that, within the
cause-and-effect diagram Diagram that identifies
relevant range, does not vary with changes in the level of
the potential causes of failures or defects. Four major
the cost driver. Also called intercept.
categories of potential causes of failure are identified
human factors, methods and design factors, machine-
constant gross-margin percentage NRV method Joint
related factors and materials and components factors.
cost allocation method that allocates joint costs in such a
Also called a fishbone diagram.
way that the overall gross-margin percentage is identical for
all the individual products.
Chartered Institute of Management Accountants
(CIMA) The principal professional management
constraint A mathematical inequality or equality that
accounting body in the UK, founded in 1919 as the Institute

must be satisfied by the variables in a mathematical model.

of Cost and Works Accountants. Today, in terms of

continuous improvement budgeted cost Budgeted cost

membership, it is the third largest professional accounting

that is successively reduced over succeeding time periods.

body in the UK.

contribution income statement Income statement that

chief accounting officer The financial executive

groups line items by cost behaviour pattern to highlight the

primarily responsible for both management accounting and

contribution margin.

financial accounting.

contribution margin Revenues minus all costs of the

choice criterion Objective that can be quantified in a

output (a product or service) that vary with respect to the

decision model.

number of output units.

contribution margin percentage Total contribution

cost incurrence Occurs when a resource is sacrificed or

margin divided by revenues.

used up.

control Covers both the action that implements the

cost leadership An organisation’s ability to achieve lower

planning decision and the performance evaluation of the

costs relative to competitors through productivity and

personnel and operations.

efficiency improvements, elimination of waste and tight

control chart Graph of a series of successive

cost control.

observations of a particular step, procedure or operation

cost management Actions by managers undertaken

taken at regular intervals of time. Each observation is

to satisfy customers while continuously reducing and

plotted relative to specified ranges that represent the

controlling costs.

expected distribution.

cost object Anything for which a separate measurement

controllability The degree of influence that a specific

of costs is desired.

manager has over costs, revenues or other items in

cost-plus contract Contract in which reimbursement is

question.

based on actual allowable cost plus a fixed fee.

controllable cost Any cost that is primarily subject to

cost pool A grouping of individual cost items.

the influence of a given manager of a given responsibility

centre for a given time span.

cost predictions Forecasts of future costs.

conversion costs All manufacturing costs other than

cost smoothing A costing approach that uses broad

direct materials costs.

averages to uniformly assign (spread or smooth out) the

cost of resources to cost objects (such as products, services

corporate governance The conformance dimension of

or customers) when the individual products, services or

an enterprise.

customers in fact use those resources in a non-uniform way.

cost Resource sacrificed or forgone to achieve a specific

cost tables Databases of all costs involved in production

objective.

incorporating cost-based knowledge of sub-components.

cost accounting Measures and reports financial and

cost tracing The assigning of direct costs to the chosen

other information related to the organisation's acquisition

cost object.

or consumption of resources. It provides information for

both management accounting and financial accounting.

cost–volume–profit (CVP) analysis Examines the

behaviour of total revenues, total costs and operating profit

cost accumulation The collection of cost data in some

as changes occur in the output level, selling price, variable

organised way through an accounting system.

costs or fixed costs; a single revenue driver and a single cost

cost allocation The assigning of indirect costs to the

driver are used in this analysis.

chosen cost object.

costs of quality (COQ) Costs incurred to prevent or

cost-allocation base A factor that is the common

rectify the production of a low-quality product.

denominator for systematically linking an indirect cost or

cumulative average-time learning model Learning

group of indirect costs to a cost object.

curve model in which the cumulative average time per unit

cost assignment General term that encompasses both

declines by a constant percentage each time the cumulative

tracing accumulated costs to a cost object and allocating

quantity of units produced is doubled.

accumulated costs to a cost object.

current cost Asset measure based on the cost of

cost–benefit approach Primary criterion for choosing

purchasing an asset today identical to the one currently

among alternative accounting systems, which is how each

held. It is the cost of purchasing the services provided

system achieves organisational goals in relation to the cost

by that asset if an identical asset cannot currently be

of those systems.

purchased.

cost centre A responsibility centre in which a manager is

customer cost hierarchy Categorisation of costs

accountable for costs only.

related to customers into different cost pools on the basis

cost driver Any factor that affects total costs. That is, a

of different classes of cost drivers or different degrees

change in the cost driver will cause a change in the level of

of difficulty in determining cause-and-effect (or benefits

the total cost of a related cost object.

received) relationships.

cost estimation The measurement of past cost

customer life-cycle costs Focuses on the total costs to a

relationships.

customer of acquiring and using a product or service until

cost hierarchy Categorisation of costs into different

it is replaced.

cost pools on the basis of different classes of cost drivers

customer profitability analysis Examines how individual

or different degrees of difficulty in determining cause-and-

customers, or groupings of customers, differ in their

effect (or benefits received) relationships.

profitability.

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customer relationship management (CRM)

digitally advanced enterprise control loop An approach

CRM initiatives use technology to coordinate all customer-

that lets developed or emerging digitally advanced firms

facing activities and the design and production activities

visualise their financial and non-financial information

necessary to get products to customers.

needs and allows continuous alteration to broad strategic

customer-response time Amount of time from when a

direction as well as operational activities.

customer places an order for a product or requests a service

direct allocation method Method of support cost allocation

to when the product or service is delivered to the customer.

that ignores any service rendered by one support department

customer revenues Inflows of assets from customers

to another; it allocates each support department's total costs

received in exchange for products or services being

directly to the operating departments. Also called direct method.

provided to those customers.

direct costing See variable costing.

customer service The support activities provided to

direct costs of a cost object Costs that are related to

customers.

the particular cost object and that can be traced to it in an

decentralisation The freedom for managers at lower

economically feasible way.

levels (subunits) of the organisation to make decisions.

direct manufacturing labour costs Compensation of all

decision model Formal model for making a choice under

manufacturing labour that is considered to be specifically

uncertainty, frequently involving quantitative analysis.

identified with the cost object (say, units finished or in

decision table Summary of the contemplated actions,

process) and that can be traced to the cost object in an

events, outcomes and probabilities of events in a decision.

economically feasible way.

delayed costing See backflush costing.

direct material costs The acquisition costs of all

materials that eventually become part of the cost object

denominator level Quantity of the allocation base

(say, units finished or in progress) and that can be traced to

usedto allocate fixed overhead costs to a cost object. Also

that cost object in an economically feasible way.

called a production denominator level or a production

denominator volume.

direct materials stock Direct materials in stock and

awaiting use in the manufacturing process.

denominator-level variance See production-volume

variance.

direct method See direct allocation method.

dependent variable The cost variable to be predicted in

discount rate See required rate of return.

a cost estimation or prediction model.

discounted cash flow (DCF) Capital budgeting method

design of products, services or processes The detailed

that measures the cash inflows and outflows of a project as

planning and engineering of products, services or

if they occurred at a single point in time so that they can be

processes.

compared in an appropriate way.

designed-in costs See locked-in costs.

discretionary costs Arise from periodic (usually yearly)

diagnostic control systems Levers of control that

decisions regarding the maximum outlay to be incurred.

monitor critical performance variables that help managers

They are not tied to a clear cause-and-effect relationship

track progress toward achieving a company's strategic

between inputs and outputs.

goals. Managers are held accountable for meeting these

distribution The mechanism by which products or

goals.

services are delivered to the customer.

differential approach Approach to decision making

downsizing An integrated approach to configuring

and capital budgeting that analyses only those future cash

processes, products and people in order to match costs

outflows and inflows that differ among alternatives.

to the activities that need to be performed for operating

differential cost Difference in total cost between two

effectively and efficiently.

alternatives. Also called net relevant cost.

dual pricing Approach to transfer pricing using

digitalisation The process whereby use of digital

two separate transfer-pricing methods to price each

technologies changes the business model and provides

interdivision transaction.

new revenue and value-producing possibilities.

dual-rate cost-allocation method Allocation method

digitally advanced company A company which

that first classifies costs in one cost pool into two sub-pools

adopts a range of digital technologies, including cloud,

(typically into a variable-cost sub-pool and a fixed-cost

online channels, big data/analytics, Internet of Things,

sub-pool). Each sub-pool has a different allocation rate or a

P2P models, blockchain structures, artificial intelligence

different allocation base.

and machine learning and diffuses them across their

e-business The use of digital and Internet technologies

organisational structure to support applications and

incorporating e-commerce in the full range of business

processes

functions across the entire value chain.

e-commerce The exchange and tracking of information,

direct-cost rate(s) times the actual quantity of the direct-

goods and services using digital media.

cost input and allocates indirect costs based on the

economic order quantity (EOQ) Decision model that

budgeted indirect-cost rate(s) times the actual quantity of

calculates the optimal quantity of stock to order. Simplest

the cost-allocation base. Also called budgeted costing.

model incorporates only ordering costs and carrying costs.

external failure costs Costs incurred when a non-

economic value added (EVA®) After-tax operating

conforming product is detected after it is shipped to

profit minus the (after-tax) weighted average cost of capital

customers.

multiplied by total assets minus current liabilities.

facility-sustaining costs The costs of resources sacrificed

effectiveness The degree to which a predetermined

on activities that cannot be traced to specific products or

objective or target is met.

services but support the organisation as a whole.

efficiency The relative amount of inputs used to achieve

factory overhead costs See indirect manufacturing

a given level of output.

costs.

efficiency variance The difference between the actual

favourable variance Variance that increases operating

quantity of input used (such as metres of materials) and

profit relative to the budgeted amount. Denoted F.

the budgeted quantity of input that should have been

finance director The senior officer empowered with

used, multiplied by the budgeted price. Also called input-

overseeing the financial operations of an organisation. Also

efficiency variance or usage variance.

called chief financial officer (CFO).

effort Exertion towards a goal.

financial accounting Focuses on external reporting that

endpoint costing See backflush costing.

is guided by generally accepted accounting principles.

engineered costs Costs that result specifically from

financial budget That part of the master budget that

a clear cause-and-effect relationship between costs and

comprises the capital budget, cash budget, budgeted

outputs.

balance sheet and budgeted statement of cash flows.

enterprise governance The entire accountability

financial planning models Mathematical representations

framework of an organisation.

of the relationships among all operating activities, financial

environmental management accounting

activities and financial statements.

(EMA) Enables environmental costs to be identified,

finished goods stock Goods fully completed but not

measured and allocated appropriately to a process or to

yet sold.

products and makes it easier for managers to control and

first-in, first-out (FIFO) process-costing

put into effect cost savings.

method Method of process costing that assigns the cost

equivalent units Measure of the output in terms of

of the earliest equivalent units available (starting with the

the physical quantities of each of the inputs (factors of

equivalent units in opening work-in-progress stock) to

production) that have been consumed when producing the

units completed and transferred out, and the cost of the

units. It is the physical quantities of inputs necessary to

most recent quivalent units worked on during the period to

produce output of one fully complete unit.

closing work-in-progress stock.

estimated net realisable value (NRV) method Joint cost

fishbone diagram See cause-and-effect diagram.

allocation method that allocates joint costs on the basis of

fixed cost Cost that does not change in total despite

the relative estimated net realisable value (expected final

changes in a cost driver.

sales value in the ordinary course of business minus the

expected separable costs of production and marketing of

flexible budget A budget that is developed using

the total production of the period).

budgeted revenues or cost amounts; when variances are

computed, the budgeted amounts are adjusted (flexed)

event A possible occurrence in a decision model.

to recognise the actual level of output and the actual

excess capacity See unused capacity.

quantities of the revenue and cost drivers.

expected monetary value See expected value.

flexible-budget variance Difference between the actual

expected value Weighted average of the outcomes of a

result and the flexible budget amount for the actual output

decision with the probability of each outcome serving as

achieved.

the weight. Also called expected monetary value.

flexible manufacturing system (FMS) An integrated

experience curve Function that shows how full product

production system that is computer controlled to produce a

costs per unit (including manufacturing, distribution,

family of parts in a flexible manner.

marketing and so on) decline as units of output increase.

full product costs The sum of all the costs in all the

extended normal costing A costing method that

business functions – R&D, design, production, marketing,

traces direct costs to a cost object by using the budgeted

distribution and customer service.

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functional analysis An activity aimed at linking product

inflation The decline in the general purchasing power of

functions and perceived value to customers with the cost of

the monetary unit.

designing functions.

infrastructure costs Costs that arise from having

goal congruence Exists when individuals and

property, plant, equipment and a functioning organisation.

groups work towards the organisational goals that top

input-efficiency variance See efficiency variance.

management desires.

input-price variance See price variance.

gross margin Revenues minus cost of goods sold.

insourcing Process of producing goods or providing

gross margin percentage Gross margin divided by

services within the firm rather than purchasing those same

revenues.

goods or services from outside vendors.

high–low method Method used to estimate a cost

institute of Management Accountants (IMA) The

function that entails using only the highest and lowest

largest association of management accountants in the USA.

observed values of the cost driver within the relevant range.

interactive control systems Formal information systems

homogeneous cost pool Cost pool in which all the

that managers use to focus an organisation's attention and

activities whose costs are included in the pool have the

learning on key strategic issues.

same or a similar cause-and-effect relationship or benefits-

received relationship between the cost allocator and the

intercept See constant.

costs of the activity.

intermediate product Product transferred from one

hurdle rate See required rate of return.

subunit to another subunit of the organisation. This

product may be processed further and sold to an external

hybrid-costing system Blends of characteristics from

customer.

both job-costing systems and process-costing systems.

internal failure costs Costs incurred when a non-

imputed costs Costs recognised in particular situations

conforming product is detected before it is shipped to

that are not regularly recognised by accrual accounting

customers.

procedures.

internal rate of return (IRR) Discount rate at which

incongruent decision making See suboptimal decision

the present value of expected cash inflows from a project

making.

equals the present value of expected cash outflows of the

incremental cost-allocation method Cost-allocation

project. The IRR is the discount rate that makes net present

method requiring that one user be viewed as the primary

value (NPV) equal to zero. Also called the time-adjusted

party and the second user be viewed as the incremental party.

rate of return.

incremental costs Additional costs to obtain an

internet The physical network that links computers

additional quantity over and above existing or planned

across the globe. It consists of the infrastructure of

quantities of a cost object. Also called outlay costs or out-

network servers and communication links between them,

of-pocket costs.

which are used to uphold and transport information. The

incremental unit-time learning model Learning curve

Internet enables the transfer of messages and transactions

model in which the incremental unit time (the time needed

between connected computers world-wide.

to produce the last unit) declines by a constant percentage

Internet of Things The interconnection via the internet

each time the cumulative quantity of units produced is

of computing devices embedded in everyday objects,

doubled.

enabling them to send and receive data.

independent variable The level of activity to predict the

inventoriable costs See stock-related costs.

dependent variable in a cost estimation model.

investment Resources or assets used to generate income.

indirect costs of a cost object Costs that are related to

investment centre A responsibility centre in which

the particular cost object but cannot be traced to it in an

a manager is accountable for investments, revenues and

economically feasible way.

costs.

indirect manufacturing costs All manufacturing costs

investment programmes See investment projects.

considered to be part of the cost object (say, units finished

or in progress) but that cannot be individually traced to

investment projects Investments and outcomes from

that cost object in an economically feasible way. Also called

those investments (which generally cover a number of

manufacturing overhead costs and factory overhead costs.

years). Also called investment programmes.

industrial engineering method Approach to cost

job cost record Source document that records and

estimation that first analyses the relationship between

accumulates all the costs assigned to a specific job. Also

inputs and outputs in physical terms. Also called work

called job cost sheet.

measurement method.

job cost sheet See job cost record.

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job-costing system Costing system in which the cost

make-or-buy decisions Decisions about whether a

of a product or service is obtained by assigning costs to a

producer of goods or services will produce goods or

distinct unit, batch or lot of a product or service.

services within the firm or purchase them from outside

joint cost Cost of a single process that yields multiple

vendors.

products simultaneously.

management accounting The application of accounting

joint products Products from a joint process that have

and financial management principles to create, protect,

relatively high sales value and are not separately identifiable

preserve and increase value so as to deliver that value to

as individual products until the split-off point.

stakeholders of for-profit and not-for-profit enterprises,

just-in-time (JIT) production Production system in
both public and private (see Chapter 1 for an expanded
which each component on a production line is produced
definition).
immediately as needed by the next step in the production
management by exception The practice of
line.
concentrating on areas that are not operating as
just-in-time (JIT) purchasing The purchase of goods or
expected and placing less attention on areas operating as
materials such that delivery immediately precedes demand
expected.
or use.
management control system Means of gathering and
kaizen budgeting Budgetary approach that explicitly
using information to aid and coordinate the process of
incorporates continuous improvement during the budget
making planning and control decisions throughout the
period into the resultant budget numbers.
organisation and to guide employee behaviour.

key success factors Factors that directly affect customer

manufacturing cells Grouping of all the different types

satisfaction such as cost, quality, time and innovative

of equipment used to manufacture a given product.

products and services.

manufacturing lead time Time from when an order is

labour-paced operations Worker dexterity and

ready to start on the production line (ready to be set up) to

productivity determine the speed of production.

when it becomes a finished good.

labour time record Record used to charge departments

manufacturing overhead allocated All manufacturing

and job cost records for labour time used on a specific job.

costs that are assigned to a product (or service) using a cost

learning curve Function that shows how labour-hours

allocation base because they cannot be traced to a product

per unit decline as units of production increase.

(or service) in an economically feasible way.

life-cycle budgeting Budget that incorporates the

manufacturing overhead costs See indirect

revenues and costs attributable to each product from its

manufacturing costs.

initial R&D to its final customer servicing and support in

manufacturing-sector companies Companies that

the marketplace.

provide to their customers tangible products that have been

life-cycle costing System that tracks and accumulates

converted to a different form from that of the products

the actual costs attributable to each product from start to

purchased from suppliers.

finish.

margin of safety Excess of budgeted revenues over the

line management Managers directly responsible for

breakeven revenues.

attaining the objectives of the organisation.

market-share variance The difference between (a) the

linear cost function Cost function in which the graph of

budgeted amount at budgeted mix based on the actual

total costs versus a single cost driver forms a straight line

market size in units and the actual market share and (b) the

within the relevant range.

budgeted amount at budgeted mix based on actual market

locked-in costs

size in units and the budgeted market share.

Costs that have not yet been incurred

but that will be incurred in the future on the basis of

market-size variance The difference between (a) the

decisions that have already been made. Also called

budgeted amount based on the actual market size in units

designed-in costs.

and the budgeted market share and (b) the static-budget

machine-paced operations Machines conduct most

amount based on the budgeted market size in units and the

(or all) phases of production, such as movement of

budgeted market share.

materials to the production line, assembly and other

marketing The manner by which individuals or groups

activities on the production line and shipment of finished

(a) learn about and value the attributes of products or

goods to the delivery dock areas.

services and (b) purchase those products or services.

main product When a single process yielding two or

master budget Budget that summarises the financial

more products yields only one product with a relatively

projections of all the organisation’s individual budgets.

high sales value, that product is termed a main product.

It describes the financial plans for all value-chain functions.

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master-budget utilisation The denominator-level

non-value-added cost A cost that, if eliminated, would

concept based on the anticipated level of capacity

not reduce the value customers obtain from using the

utilisation for the coming budget period.

product or service.

materials requirement planning (MRP) A system that

normal costing A costing method that traces direct costs

maximises the efficiency of the timing of raw material

to a cost object by using the actual direct cost rate(s) times

orders through to the manufacture and assembly of the

the actual quantity of the direct cost input and allocates

final product.

indirect costs based on the budgeted indirect cost rate(s)

materials requisition record Record used to charge

times the actual quantity of the cost-allocation base.

departments and job cost records for the cost of the

normal spoilage Spoilage that arises under efficient

materials used on a specific job.

operating conditions; it is an inherent result of the

merchandising-sector companies Companies that

particular production process.

provide to their customers tangible products they have

normal utilisation The denominator-level concept based

previously purchased in the same basic form from

on the level of capacity utilisation that satisfies average

suppliers.

customer demand over a period (say, two or three years)

mixed cost A cost that has both fixed and variable

that includes seasonal, cyclical or other trend factors.

elements. Also called a semivariable cost.

numerical control machine (NC machine) A manu-

moral hazard Describes contexts in which an employee

facturing tool that can be programmed within predefined

prefers to exert less effort (or report distorted information)

performance criteria to perform required production

than the effort (or information) desired by the owner

activities. It can be computer controlled (Computer NC,

because the employee's effort (or information) cannot be

CNC) or centrally controlled (Direct NC, DNC).

accurately monitored and enforced.

objective function Expresses the objective to be

motivation The desire to attain a selected goal (the goal-

maximised (for example, operating profit) or minimised

congruence aspect) combined with the resulting drive or

(for example, operating costs) in a decision model, for

pursuit towards that goal (the effort aspect).

example a linear programming model.

multicollinearity Exists when two or more independent

operating budget The budgeted income statement and

variables in a regression model are highly correlated with

its supporting schedules.

each other.

operating costs All costs associated with generating

multiple regression Regression model that uses more

revenues, other than cost of goods sold.

than one independent variable to estimate the dependent

operating cycle See self-liquidating cycle.

variable.

operating department A department that adds value

net present value (NPV) method Discounted cash flow

to a product or service that is observable by a customer.

method that calculates the expected net monetary gain or

Also called a production department in manufacturing

loss from a project by discounting all expected future cash

organisations.

inflows and outflows to the present point in time, using the

operating leverage The effects that fixed costs have on

required rate of return.

changes in operating income as changes occur in units sold

net profit Operating profit plus non-operating revenues

and hence in contribution margin.

(such as interest revenues) minus non-operating costs (such

operating profit Total revenues from operations minus

as interest costs) minus income taxes.

total costs from operations (excluding income taxes).

net relevant cost See differential cost.

operation A standardised method or technique that is

new economy A period in which there is discontinuity in

performed repetitively regardless of the distinguishing

the normal progression of economic events resulting from

features of the finished good.

a fundamental change in the structure of the economy.

operation costing Hybrid costing system applied to

Currently, this change stems from the convergence of

batches of similar products. Each batch of products is

telecommunications and digital technologies.

often a variation of a single design and proceeds through

nominal rate of return Rate of return required to cover

a sequence of selected (though not necessarily the same)

investment risk and the anticipated decline due to inflation,

activities or operations. Within each operation all product

in the general purchasing power of the cash that the

units use identical amounts of the operation’s resources.

investment generates.

opportunity cost The contribution to income that is

non-linear cost function Cost function in which the

forgone (rejected) by not using a limited resource in its best

graph of total costs versus a single cost driver does not

alternative use.

form a straight line within the relevant range.

opportunity cost of capital See required rate of return.

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ordering costs Costs of preparing and issuing a purchase

predatory pricing Company deliberately prices below

order.

its costs in an effort to drive out competitors and restrict

organisational structure The arrangement of activities

supply and then raises prices rather than enlarge demand

and possibly lines of responsibility within the entity.

or meet competition.

out-of-pocket costs See incremental costs.

present value An asset measure based on discounted

cash flow estimates.

outcomes Predicted consequences of the various possible

combinations of actions and events in a decision model.

prevention costs Costs incurred in precluding the

production of products that do not conform to specifications.

outlay costs See incremental costs.

previous department costs See transferred-in costs.

output-level overhead variance See production-volume

variance.

price discounting The reduction of selling prices below

listed levels in order to encourage an increase in purchases

output-unit-level costs The costs of resources sacrificed

by customers.

on activities performed on each individual unit of product or service.

price variance The difference between actual price and budgeted price multiplied by the actual quantity of input in outsourcing Process of purchasing goods and services question. Also called input-price variance or rate variance from outside vendors rather than producing the same (especially when those variances are for direct-labour goods or providing the same services within the firm. categories).

overabsorbed indirect costs See overallocated indirect

prime costs All direct manufacturing costs.

costs.

pro forma statements Budgeted financial statements of

overallocated indirect costs Allocated amount of an organisation.

indirect costs in an accounting period is greater than the actual (incurred) amount in that period. Also called

probability Likelihood or chance of occurrence of an event.

overapplied indirect costs and overabsorbed indirect costs.

probability distribution Describes the likelihood

overapplied indirect costs See overallocated indirect costs.

(or probability) of each of the mutually exclusive and

collectively exhaustive sets of events.

padding The practice of underestimating budgeted

revenues (or overestimating budgeted costs) in order to

problem solving Management accountant's function

make budgeted targets more easily achievable. Also called

that involves comparative analysis to identify the best

budgetary slack.

alternatives in relation to the organisation's goals.

Pareto diagram Diagram that indicates how frequently

process-costing system Costing system in which the cost

each type of failure (defect) occurs.

of a product or service is obtained by using broad averages

to assign costs to masses of similar units.

payback method Capital budgeting method that

measures the time it will take to recoup, in the form of net

product Any output sold to a customer that has a

cash inflows, the net initial investment in a project.

positive sales value (or an output used internally that enables an organisation to avoid incurring costs).

perfectly competitive market Exists when there is a homogeneous product with equivalent buying and selling prices and no individual buyers or sellers can affect those prices by their own actions.

product cost Sum of the costs assigned to a product for a specific purpose.

product-cost cross-subsidisation Costing outcome where at least one miscosted product is resulting in the miscosting of other products in the organisation.

period costs Costs not classed as inventoriable and therefore expensed during the accounting period.

physical measure method Joint cost allocation method that allocates joint costs on the basis of their relative proportions at the split-off point, using a common physical measure such as weight or volume of the total production of each product.

product differentiation An organisation's ability to offer products or services that are perceived by its customers to be superior and unique relative to those of its competitors.

product life cycle Spans the time from initial R&D to

planning Choosing goals, predicting results under

the time at which support to customers is withdrawn.

various ways of achieving those goals and then deciding

product line A grouping of similar products.

how to attain the desired goals.

product overcosting A product consumes a relatively

post-deduct costing See backflush costing.

low level of resources but is reported to have a relatively

practical capacity The denominator-level concept that

high total cost.

reduces theoretical capacity for unavoidable operating

product-sustaining costs The costs of resources

interruptions such as scheduled maintenance time,

sacrificed on activities undertaken to support specific

shutdowns for holidays and other days, and so on.

products or services.

Glossary

product undercosting A product consumes a relatively

relevant costs Expected future costs that differ among

high level of resources but is reported to have a relatively

alternative courses of action.

low total cost.

relevant range Range of the cost driver in which a

production The coordination and assembly of resources

specific relationship between cost and driver is valid.

to produce a product or deliver a service.

relevant revenues Expected future revenues that differ

production denominator level See denominator level.

among alternative courses of action.

production denominator volume See denominator level.

reorder point The quantity level of the stock on hand

production department See operating department.

that triggers a new order.

production-volume variance Difference between budgeted

required rate of return (RRR) The minimum acceptable

fixed overhead and the fixed overhead allocated. Fixed

rate of return on an investment; the return that the

overhead is allocated based on the budgeted fixed overhead

organisation could expect to receive elsewhere for an

rate times the budgeted quantity of the fixed-overhead

investment of comparable risk. Also called discount rate,

allocation base for the actual output units achieved. Also called

hurdle rate and opportunity cost of capital.

denominator-level variance and output-level overhead variance.

research and development (R&D) The generation of

productivity Measures the relationship between actual

and experimentation with, ideas related to new products,

inputs used (both physical inputs and costs) and actual

services or processes.

outputs achieved; the lower the inputs for a given set of

residual income Income minus a required monetary

outputs or the higher the outputs for a given set of inputs,

return on the investment.

the higher the level of productivity.

residual term The difference between the actual and

profit centre A responsibility centre in which a manager

predicted amount of a dependent variable (such as a cost)

is accountable for revenues and costs.

in a regression model. Also called the disturbance term or

proration The spreading of underallocated or overallocated

error term.

overhead among closing stocks and cost of goods sold.

responsibility accounting System that measures the

purchase-order lead time Amount of time between the

plans (by budgets) and actions (by actual results) of each

placement of an order and its delivery.

responsibility centre.

purchasing costs Cost of goods acquired from suppliers,

responsibility centre A part, segment or subunit of an

including freight and transportation costs.

organisation whose manager is accountable for a specified

PV graph Shows the impact on operating profit of

set of activities.

changes in the output level.

return on investment (ROI) See accounting rate of

qualitative factors Outcomes that cannot be measured in

return.

numerical terms.

revenue centre A responsibility centre in which a

quality costs See costs of quality (COQ).

manager is accountable for revenues only.

quantitative factors Outcomes that are measured in

revenue costs Costs that are recorded as expenses of the

numerical terms.

accounting period when they are incurred.

rate variance See price variance.

revenue driver Any factor that affects revenues.

real rate of return The rate of return required to cover

revenue mix The relative contribution of quantities of

only investment risk.

products or services that constitutes total revenues. See

reciprocal allocation method Method of support-cost

sales mix.

allocation that explicitly includes the mutual services

revenues Inflows of assets received in exchange for

rendered among all support departments.

products or services provided to customers.

reengineering The fundamental rethinking and redesign

reworked units Unacceptable units of production that

of business processes to achieve improvements in critical

are subsequently reworked and sold as acceptable finished

measures of performance such as cost, quality, service,

goods.

speed and customer satisfaction.

rolling budget Budget or plan that is always available

refined costing system Costing system that results

for a specified future period by adding a month, quarter or

in a better measure of the non-uniformity in the use of

year in the future as the month, quarter or year just ended

resources by jobs, products and customers.

is dropped.

regression analysis Statistical model that measures the

safety stock Stock held at all times regardless of stock

average amount of change in the dependent variable that is

ordered using EOQ. It is a buffer against unexpected

associated with a unit change in one or more independent

increases in demand or lead time and unexpected

variables.

unavailability of stock from suppliers.

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sales mix See revenue mix.

single-rate cost-allocation method Allocation method

sales-mix variance The difference between the budgeted

that pools all costs in one cost pool and allocates them

amount for the actual sales mix and the budgeted amount

to cost objects using the same rate per unit of the single

if the budgeted sales mix had been unchanged.

allocation base.

sales-quantity variance The difference between the

slope coefficient Coefficient term in a cost estimation

budgeted amount based on actual quantities sold of all

model indicates how much total costs change for each unit

products and the budgeted-mix and the amount in the

change in the cost driver within the relevant range.

static budget (which is based on the budgeted quantities to

source documents The original records that support

be sold of all products and the budgeted mix).

journal entries in an accounting system.

sales value at split-off method Joint cost allocation

specification analysis Testing of the assumptions of

method that allocates joint costs on the basis of the relative

regression analysis.

sales value at the split-off point of the total production in

split-off point Juncture in the process when one or

the accounting period of each product.

more products in a joint-cost setting become separately

sales-volume variance Difference between the flexible-

identifiable.

budget amount and the static-budget amount; unit

spoilage Unacceptable units of production that are

selling prices, unit variable costs and fixed costs are held

discarded or sold for net disposal proceeds.

constant.

staff management Managers who provide advice and

scorekeeping Management accountant's function that

assistance to line management.

involves accumulating data and reporting reliable results to

stand-alone cost-allocation method Cost allocation

all levels of management.

method that allocates the common cost on the basis of

scrap Product that has a minimal (frequently zero)

each user's percentage of the total of the individual stand-

sales value.

alone costs.

segment Identifiable part or subunit of an organisation.

standard Carefully predetermined amount; it is usually

self-liquidating cycle The movement of cash to stocks

expressed on a per-unit basis.

to receivables and back to cash. Also called cash cycle or

standard cost Carefully predetermined cost. Standard

operating cycle.

costs can relate to units of inputs or units of outputs.

selling-price variance Flexible-budget variance that

standard costing Costing method that traces direct costs

pertains to revenues; arises solely from differences between

to a cost object by multiplying the standard price(s) or

the actual selling price and the budgeted selling price.

rate(s) times the standard inputs allowed for actual outputs

semivariable cost See mixed cost.

achieved and allocates indirect costs on the basis of the

sensitivity analysis A what-if technique that examines

standard indirect rate(s) times the standard inputs allowed

how a result will change if the original predicted data are

for the actual outputs achieved.

not achieved or if an underlying assumption changes.

standard error of the estimated coefficient Regression

separable costs Costs incurred beyond the split-off point

statistic that indicates how much the estimated value is

that are assignable to one or more individual products.

likely to be affected by random factors.

sequential allocation method See step-down allocation

standard input Carefully predetermined quantity of

method.

inputs (such as kilograms of materials or hours of labour time) required for one unit of output.

sequential tracking Product-costing method in which the accounting system entries occur in the same order as

static budget Budget that is based on one level of output; actual purchases and production. Also called synchronous

when variances are computed at the end of the period, no tracking.

adjustment is made to the budgeted amounts.

service department See support department.

step allocation method See step-down allocation method.

service-sector companies Companies that provide services or intangible products to their customers – for

step cost function A cost function in which the cost is example legal advice or an audit.

constant over various ranges of the cost driver, but the cost increases by discrete amounts (that is, in steps) as the cost

service-sustaining costs The costs of resources sacrificed driver moves from one range to the next.

on activities undertaken to support specific services.

step-down allocation method Method of support

set-up Process of preparing a machine or manufacturing

cost allocation that allows for partial recognition of

cell for production.

services rendered by support departments to other support

simple regression Regression model that uses only one

departments. Also called step or sequential allocation

independent variable to estimate the dependent variable.

method.

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Glossary

stock management The planning, organising and

sustainability The development and implementation

control activities focused on the flow of materials into,

of strategies to achieve long-term financial, social, and

through and from the organisation.

environmental goals.

stock-related costs Specific type of capitalised costs.

synchronous tracking See sequential tracking.

Those capitalised costs associated with the purchase of

tableau de bord Multicriterial model of control that

goods for resale (in the costs of merchandise stock) or costs

uses financial as well as non-financial means to identify

associated with the acquisition and conversion of materials

and measure objectives, key variables and indicators.

and all other manufacturing inputs into goods for sale (in

the case of manufacturing stocks). Also called inventoriable

target cost per unit Estimated long-run cost per unit of

costs.

a product (or service) that when sold at the target price

enables the company to achieve the targeted income per

stockout A stockout arises when a supplier runs out of a

unit. Target cost per unit is derived by subtracting the

particular item for which there is customer demand.

target operating profit per unit from the target price.

stockout costs Costs that result when a company runs

target operating profit per unit Operating profit that

out of a particular item for which there is customer

a company wants to earn on each unit of a product (or

demand. The company must act to meet that demand or

service) sold.

suffer the costs of not meeting it.

target price Estimated price for a product (or service)

straight-line depreciation (SL) Depreciation method in

that potential customers will be willing to pay.

which an equal amount of depreciation is taken each year.

target rate of return on investment The target operating

strategic analysis Considers how an organisation

profit that an organisation must earn divided by invested

attempts to best combine its own capabilities with the

capital.

opportunities in the marketplace in seeking to accomplish

its overall objectives.

theoretical capacity The denominator-level concept that

is based on the constant production of output at maximum

strategic investment appraisal (SIA) Linking corporate

efficiency.

strategy to costs and benefits associated with AMT

adoption by combining both formal and informal

theory of constraints (TOC) Describes methods

evaluation procedures.

to maximise operating profit when faced with some

strategic management accounting

bottleneck and some non-bottleneck operations.

A form of

management accounting in which emphasis is placed on

throughput contribution Revenues minus all variable

information which relates to factors external to the firm, as

direct materials costs.

well as non-financial information and internally generated

throughput costing Stock costing method that treats all

information.

costs except those related to variable direct materials as

strategic scorecard A method of assisting company

costs of the accounting period in which they are incurred;

boards in the oversight of the strategic process, dealing

only variable direct materials costs are inventoriable.

with strategic choice and change, and giving a view of

time-adjusted rate of return See internal rate of return

strategic progress.

(IRR).

strategy A course of action, including the specification

time-driven activity based costing (TDABC)

of resources required to achieve a specific objective (see

systems ABC systems that use available time to calculate

Chapter 22 for an expanded definition).

the cost of a resource and to allocate costs to cost objects.

suboptimal decision making Decisions in which the

time driver Any factor where a change in the factor

benefit to one subunit is more than offset by the costs or

causes a change in the speed with which an activity is

loss of benefits to the organisation as a whole. Also called

undertaken.

incongruent decision making.

total direct manufacturing labour mix variance The

sunk costs Past costs that are unavoidable because they

difference between (a) the budgeted cost for the actual

cannot be changed no matter what action is taken.

direct manufacturing labour input mix and (b) the

supply chain Describes the flow of goods, services and

budgeted cost if the budgeted direct labour input mix had

information ‘from cradle to grave’, irrespective of whether

been unchanged, for the actual total quantity of all direct

those activities occur in the same organisation or other

manufacturing labour used.

organisations.

total direct manufacturing labour yield variance

support department A department that provides

The difference between (a) the budgeted cost of direct

the services that maintain other internal departments

manufacturing labour based on actual total quantity of

(operating departments and other support departments) in

all direct manufacturing labour used and (b) the flexible

the organisation. Also called a service department.

budget cost of direct manufacturing labour based on the

budgeted total quantity of direct manufacturing labour

value chain The sequence of business functions in which

inputs for the actual output achieved, given that the

utility (usefulness) is added to the products or services of

budgeted labour input mix is unchanged.

an organisation.

total direct materials mix variance The difference

value engineering Systematic evaluation of all aspects

between (a) the budgeted cost for the actual direct materials

of the value-chain business functions, with the objective of

input mix and (b) the budgeted cost if the budgeted direct

reducing costs while satisfying customer needs.

materials input mix had been unchanged, for the actual

variable cost Cost that changes in total in proportion to

total quantity of all direct material inputs used.

changes in a cost driver.

total direct materials yield variance The difference

variable-cost percentage Total variable costs (with

between (a) the budgeted cost of direct materials based on respect to units of output) divided by revenues.

actual total quantity of all direct materials inputs used and (b) the flexible-budget cost of direct materials based on the

variable costing Stock costing method in which all budgeted total quantity of direct materials inputs for the variable manufacturing costs are included as inventoriable actual output achieved, given that the budgeted materials costs. All fixed manufacturing costs are excluded from input mix is unchanged.

inventoriable costs; they are costs of the period in which they are incurred. Also called direct costing.

transactions Physical and electronic documentation of any production activity.

variable-overhead efficiency variance The difference between the actual and budgeted quantity of the variable-

transfer price Price that one subunit

overhead cost-allocation base allowed, for the actual output

(segment,department, division, etc.) of an organisation

units achieved, times the budgeted variable overhead cost

charges for a product or service supplied to another subunit

allocation rate.

of the same organisation.

variable-overhead spending variance The difference

transferred-in costs Costs incurred in a previous

between the actual amount of variable overhead incurred

department that are carried forward as part of the

and the budgeted amount allowed for the actual quantity

product’s cost as it moves to a subsequent department for

of the variable-overhead allocation base used, for the actual

processing. Also called previous department costs.

output units achieved.

uncertainty The possibility that an actual amount will

variance Difference between an actual result and a

deviate from an expected amount.

budgeted amount when that budgeted amount is a financial

underabsorbed indirect costs See underallocated

variable reported by the accounting system.

indirect costs.

weighted-average process-costing method Method of

underallocated indirect costs Allocated amount of

process costing that assigns the average equivalent unit cost

indirect costs in an accounting period is less than the actual

of all work done to date (regardless of when it was done)

(incurred) amount in that period. Also called underapplied

to equivalent units completed and transferred out and to

indirect (overhead) costs or underabsorbed indirect costs.

equivalent units in closing stock.

underapplied indirect costs See underallocated indirect

work cell Grouping of individuals or machines to

costs.

perform a manufacturing task.

unfavourable variance Variance that decreases operating

work in process See work-in-progress stock.

profit relative to the budgeted amount. Denoted U.

work in progress See work-in-progress stock.

unit cost Computed by dividing some total cost (the

work-in-progress stock Goods partially worked on but

numerator) by some number of units (the denominator).

not yet fully completed. Also called work in process.

Also called average cost.

working-capital cycle The movement from cash to

unused capacity The difference between the productive

stocks to receivables and back to cash.

capacity available and the productive capacity required to

work-measurement method See industrial engineering

meet consumer demand in the current period. Also called

method.

excess capacity.

usage variance

zero-based budgeting (ZBB) A budgeting approach in

See efficiency variance.

which all expenses are to be justified rather than assumed

value-added activities Activities that customers perceive

to be modelled based on the previous period. What is

as adding value to the products or services they purchase.

required for the upcoming period has to be thought

value-added cost A cost that, if eliminated, would reduce

through irrespective of whether each element of cost was

the value customers obtain from using the product or service.

higher or lower than in the past.

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