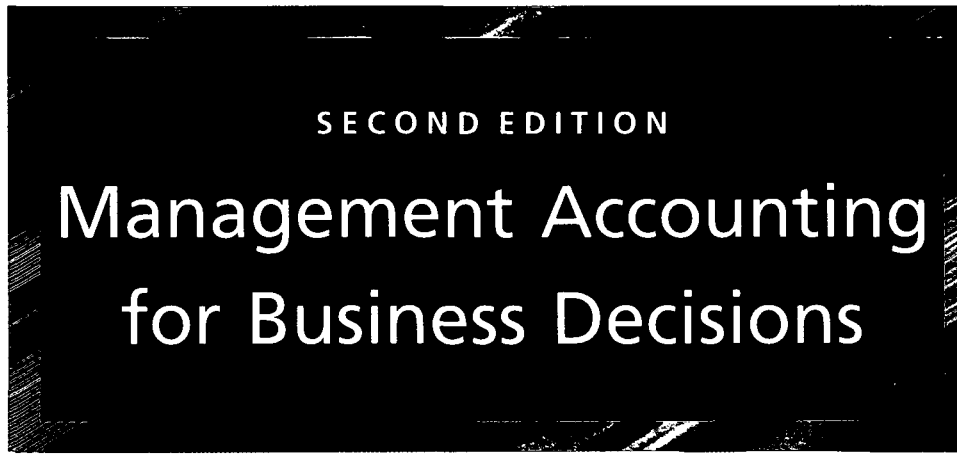

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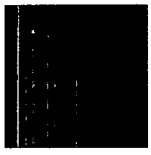

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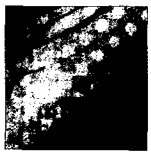

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Preface

The aim of this book is to provide an introduction to the theory and practice of management accounting and emphasize its role in making business decisions. It is intended primarily for non-accounting students who are pursuing a one or two semester basic management accounting course. The more advanced technical aspects which are required by specialist accounting students are not covered. These topics are covered in the author's successful *Management and Cost Accounting*, the fifth edition of which is also published by Thomson Learning.

Feedback from teachers in a large number of universities indicated that they had found the content, structure and presentation of *Management and Cost Accounting* extremely satisfactory and most appropriate for specialist accounting students pursuing a two year management accounting course. They also indicated that there was a need for a book (based on *Management and Cost Accounting*) for non-accounting students that avoided going into the technical detail demanded by specialist accounting students. This book is particularly suitable for non-specialist accounting students on the following courses:

- a first-level course for undergraduate students
- higher national diploma in business and finance and similar qualifications in Europe, Africa, Australia, New Zealand and Asia
- post-graduate introductory management accounting courses, such as MBA courses and conversion Masters.

An introductory course in financial accounting is not a prerequisite, although many students will have undertaken such a course.

The flexibility provided by modular courses can result in introductory classes consisting of a group of students not studying management accounting beyond an intermediate level and a further group continuing their studies beyond the intermediate level. *Management Accounting for Business Decisions* is appropriate for the former group and *Management and Cost Accounting* can be adopted by the latter. Because much of the content (and all of the examples and questions) in *Management Accounting for Business Decisions* have been extracted from *Management and Cost Accounting*, lecturers can assign identical reading and questions and also recommend two separate books that are geared to the specific requirements of the students. The inclusion of the same content in both books also enables lecturers who are familiar with *Management and Cost Accounting* to use the relevant material in this book on introductory courses by adopting *Management Accounting for Business Decisions*.

Structure and plan of the book

In writing this book I have adopted the same structure and included much of the introductory content of *Management and Cost Accounting*. The major theme is that different information is required for different purposes. The framework is based on the principle that there are three ways of constructing accounting information. One is conventional cost accounting with its emphasis on producing product costs for allocating costs between cost of goods sold and inventories to meet external and internal financial accounting inventory valuation and profit measurement requirements. The second is the notion of decision relevant costs with the emphasis on providing information to help managers make good decisions. The third is responsibility accounting, cost control and performance measurement which focuses on both financial and non-financial information, in particular the assignment of cost and revenues to responsibility centres. This book focuses on the second and third of the above purposes. Conventional cost accounting is not emphasized because an understanding of this topic is not essential for those students who are not specializing in accounting.

This book consists of 16 chapters divided into four parts. The first part (Part One) consists of two chapters and provides an introduction to management and cost accounting and a framework for studying the remaining chapters. Part Two consists of seven chapters and is entitled 'Information for Decision-making'. Here the focus is on measuring and identifying those costs which are relevant for different types of decisions. The title of Part Three is 'Information for Planning, Control and Performance Measurement'. It consists of five chapters and concentrates on the process of translating organizational goals and objectives into specific activities and the resources that are required, via the short-term (budgeting) and long-term planning processes, to achieve the goals and objectives. In addition, the management control systems that organizations use are described and the role that management accounting control systems play within the overall control process is examined. The emphasis here is on the accounting process as a means of providing information to help managers control the activities for which they are responsible. Performance measurement and evaluation within different segments of the organization is also examined. Part Four consists of two chapters and is entitled 'Cost Management and Strategic Management Accounting.' The first chapter focuses on cost management and the second on strategic management accounting.

Major changes in the content of the second edition

During the late 1980s and the 1990s the theory and practice of management accounting have been subject to enormous changes. Many of these changes were described in the first edition of this book, but they were presented as emerging management accounting issues. They were also presented as separate topics, rather than being integrated with the existing theories, concepts and techniques. It was unclear at the time of writing the first edition whether the proposed changes would become part of mainstream management accounting. In the intervening years these changes have become firmly established in the literature and adopted by innovative companies around the world.

The major objective in writing the second edition has therefore been to integrate recent developments in management accounting with the established conventional wisdom of the subject. This objective created a need to thoroughly review the content of the first edition and integrate recent developments. The opportunity was also taken to rewrite and improve

the presentation of much of the existing material but the existing structure has been maintained.

The notable alterations are:

1. Chapter 16 (Current developments in management accounting) of the first edition has been deleted. As indicated above the current and future developments have been integrated with established conventional wisdom. Two new chapters (Chapters 15 and 16) have been added that incorporate and extend some of the material that has been deleted from Chapter 16 of the first edition.

   Chapter 15 is titled ' Cost management' and examines the various approaches that fall within the area of cost management. These new approaches are compared with traditional management accounting control techniques and the text emphasizes how the new approaches, combined with traditional techniques, control and manage costs more effectively. Chapter 16 is titled 'Strategic management accounting.' Much has been written about strategic management accounting during the past decade but there is still no comprehensive framework as to what constitutes strategic management accounting. Chapter 16 examines the elements of strategic management accounting and describes the different contributions that have been made to its development. In addition, recent developments, such as the balanced scorecard approach, that seek to incorporate performance measurement within the strategic management process are described.

   Apart from cost management and strategic management accounting, the remaining current developments described in Chapter 16 of the first edition related to activity-based costing, customer profitability analysis and the integration of financial and non-financial measures. The issues relating to activity based costing have been incorporated into Chapter 6 (Activity-based costing). Customer profitability analysis has been incorporated into Chapter 7 (Pricing decisions and profitability analysis) and integration of financial and non-financial measures is presented within a balanced scorecard framework in Chapter 16.
2. Extensive changes have been made to Chapter 2 (Cost and revenue classification) and the chapter has been re-titled 'An introduction to cost terms and concepts.'
3. New material has been added to Chapter 3 (Cost–volume–profit analysis) relating to multi-period cost–volume–profit analysis.
4. Chapter 4 (Special studies: measuring relevant costs for decision-making) has been substantially rewritten. The chapter is now titled 'Measuring relevant costs and revenues for decision-making.'
5. Chapter 5 (Traditional product costing systems) has been rewritten and retitled 'Cost assignment.' The new chapter emphasizes cost system design issues and explains why the optimal cost system is different for different organizations. The factors that determine the choice of an optimal cost system for an organization are also discussed.
6. The chapter relating to activity-based-costing (Chapter 6) has also been extensively revised and a substantial amount of new material has been added including activity-based profitability analysis and ABC in service organizations.
7. Chapter 7 (Accounting information for pricing decisions) has been replaced by a new chapter entitled 'Pricing decisions and profitability analysis.' The new chapter is structured mainly around four areas – *price setting* firms facing *short-run* pricing decisions, *price setting* firms facing *long-run* pricing decisions, *price-taking* firms facing *short-run* product mix decisions and *price-taking* firms facing *long-run* product mix decisions. Profitability analysis is presented within the final category. As indicated above customer profitability analysis is also included within this chapter.

8. New material has been added to Chapter 9 (Capital investment decisions) that examines the effect of performance measurement on capital investment decisions.
9. Major structural changes have been made to Part Three (Information for Planning, Control and Performance Measurement). Activity-based budgeting has been incorporated into Chapter 10 (The budgeting process). Chapter 11 (Management control systems) is a new chapter. To fully understand the role that management accounting control systems play in the control process, it is necessary to be aware of how they relate to the entire array of control mechanisms used by organizations. Chapter 11 describes the different types of controls that are used by companies. The elements of management accounting control systems are described within the context of the overall control process and the behavioural issues are also examined. The relevant content from Chapter 14 of the first edition relating to the behavioural aspects of accounting control systems has been incorporated into this chapter.

   Chapters 13 and 14 concentrate on the special problems of control and measuring the performance of divisions and other decentralised units within an organization. In the previous edition these two chapters were combined. Both chapters have been extensively rewritten. Chapter 13 (Divisional financial performance measures) includes new material on Economic Value Added (EVA$^{(TM)}$), a new technique for measuring the performance of business units, and how the dysfunctional consequences of short-term financial measures can be minimized. The content of Chapter 14 (Transfer pricing in divisionalized companies) has also been re-organized and substantially re-written. A case problem has been introduced that is used to illustrate the different methods of transfer pricing.
10. As indicated above Part Four includes two new chapters. Chapters 15 focuses on cost management and Chapter 16 on strategic management accounting.
11. It will be apparent to adopters of the first edition that substantial changes have been made to the presentation of the material. In particular, the text is now presented in several colours and considerable improvements have been made to the exhibits, tables and diagrams in order to improve their explanatory effectiveness.
12. The second edition now includes case studies and a dedicated website.

Case studies

The final section of this book includes seven case studies. These cases generally cover the content of several chapters and contain questions to which there is no ideal answer. They are intended to encourage independent thought and initiative and to relate and apply your understanding of the content of this book in more uncertain situations. They are also intended to develop your critical thinking and analytical skills. The authors of the cases have provided teaching notes for lecturers and are included in the instructors' guide accompanying this book. Additional case studies and teaching notes are also available on the dedicated website.

Highlighting of advanced reading sections AR

Some readers will not require a comprehensive treatment of all of the topics that are contained in the book. To meet the different requirements of the readers, the more advanced material that is not essential for those readers not requiring an in-depth knowledge of a particular topic has been highlighted. The start of each advanced reading section is marked with the symbol AR and a vertical red line is used to highlight the full section. If you do require an in-depth knowledge of a topic you may find it helpful to initially omit the advanced reading sections, or skim them, on your first reading. You should read them in detail only when you fully understand the content of the remaining parts of the chapter. The advanced reading sections are not normally an essential requirement of an introductory course.

International focus

The previous edition of this book presented the content within a UK setting. The book has now become an established text in many different countries throughout the world. Because of this, the second edition has adopted a more international focus and regulatory requirements and taxation aspects have not been restricted to a UK setting. A new feature is the presentation of boxed exhibits of surveys relating to management accounting in many different countries, particularly the European mainland. To simplify the presentation, however, the UK pound monetary unit has been used throughout the book. Most of the assessment material has incorporated questions set within a UK context. These questions are, however, appropriate for world-wide use and contain the beneficial features described above for case study assignments.

Recommended reading

A separate section is included at the end of many of the chapters providing advice on key articles or books which you are recommended to read if you wish to pursue topics and issues in more depth. Many of the references are the original work of writers who have played a major role in the development of management accounting. The contribution of such writers is often reflected in this book but there is frequently no substitute for the original work of the authors. The detailed references are presented in the Bibliography towards the end of the book.

Assessment material

Throughout this book I have kept the illustrations simple. You can check your understanding of each chapter by answering the self-assessment questions. Answers to these questions are contained at the end of each chapter. An *Instructors' Manual* that provides answers to the remaining end-of-chapter questions and teaching notes relating to the case studies is available to lecturers on the dedicated website. In recognition of the increasing need for the integration of IT teaching into the curriculum, this book is accompanied by an on-line *Spreadsheet Applications Manual,* which has been written by Dr Alicia Gazely of Nottingham Business School. This explains basic spreadsheet techniques and then builds

up ten spreadsheet models which illustrate and allow students to explore examples in the main text. The spreadsheets, guidance notes and on-line access are available to teachers on adoption. Further details of this package are given in the section covering the dedicated website below.

Supplementary material

Dedicated website

The dedicated website can be found at **http://www.drury-online.com**. The lecturer section is password protected and the password is available free to lecturers who confirm their adoption of the second edition – lecturers should complete the registration form on the website to apply for their password, which will then be sent to them by email.

The following range of material is available:

For students and lecturers (open access)

Testbank (compiled by Wayne Fiddler of Huddersfield University)

Interactive multiple choice questions to accompany each chapter. The student takes the test on-line to check their grasp of the key points in each chapter. Detailed feedback is provided for each question if the student chooses the wrong answer.

Links to accounting and finance sites on the web

Including links to the main accounting firms, accounting magazines and journals and careers and job search pages.

IEBM definitions

Alphabetical list of accounting and finance definitions taken from the pocket edition of the *International Encyclopedia of Business and Management.*

For lecturers only (password protected)

Extra case studies

Internationally focused case studies. (NB Teaching notes to accompany the cases are available in the password protected lecturer area of the site). Additional case studies will be added to the website during the life of the second edition.

Instructors' manual

Available to download free from the site in PDF (Portable Document Format), the manual includes answers to the end of chapter questions included in the book and teaching notes to the case studies.

Teaching notes to the case studies

To accompany the extra case studies available on the website.

Spreadsheet excercises (compiled and designed by Alicia Gazely of Nottingham Trent University)

Created in Excel to accompany the self-assessment exercises in the book, the exercises can be saved by the lecturer to their own directories and distributed to students as each topic is covered. Each exercise explains a basic spreadsheet technique which illustrates, and allows the student to explore, examples in the main text.

Overhead transparencies

Available to download free from the site in PDF.

PowerPoint (TM) slides

PowerPoint presentations to accompany each chapter.

Alternative course sequences

Although conceived and developed as a unified whole for a one year introductory course, the book can be tailored to the individual requirements of two separate modular semester courses. All or selected chapters from Parts One and Two can be assigned to the first module and Parts Three and Four to the second module. Alternatively, Part One and selected chapters from Parts Two and Three can be assigned to the first module and the remaining chapters to the second module. For example, topics selected from Chapters 1–5 and Chapters 10–12 may be assigned to the first module and the remaining content to the second module.

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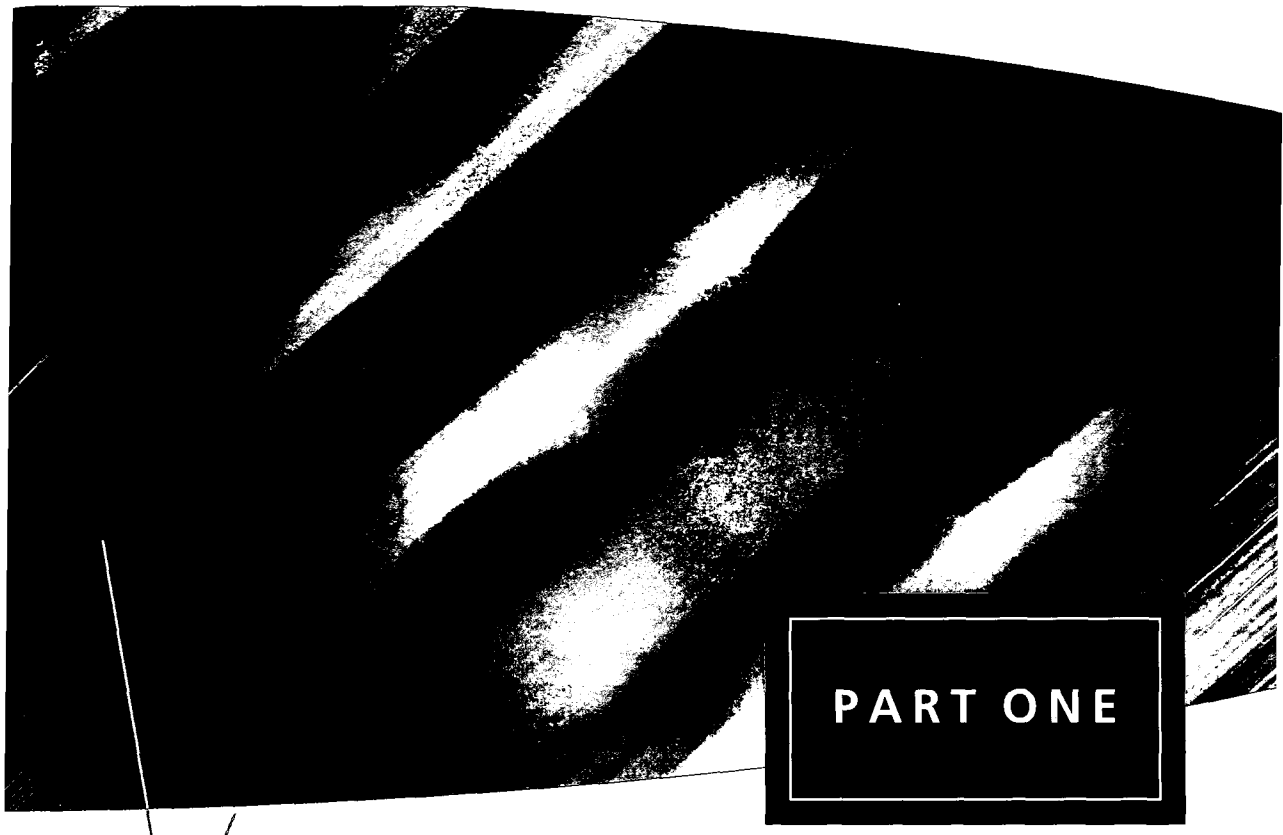


PART ONE

Introduction to Management and Cost Accounting

The objective of this section is to provide an introduction to management and cost accounting. In Chapter 1 we define accounting and distinguish between financial, management and cost accounting. This is followed by an examination of the role of management accounting in providing information to managers for decision-making, planning, control and performance measurement. In addition, the important changes that are taking place in the business environment are considered. Progression through the book will reveal how these changes are influencing management accounting systems. In Chapter 2 the basic cost terms and concepts that are used in the management accounting literature are described.

Introduction to management accounting

There are many definitions of accounting, but the one that captures the theme of this book is the definition formulated by the American Accounting Association. It describes accounting as

> the process of identifying, measuring and communicating economic information to permit informed judgements and decisions by users of the information.

In other words, accounting is concerned with providing both financial and non-financial information that will help decision-makers to make good decisions. An understanding of accounting therefore requires an understanding of the decision-making process and an awareness of the users of accounting information.

During the past decade many organizations in both the manufacturing and service sectors have faced dramatic changes in their business environment. Deregulation combined with extensive competition from overseas companies in domestic markets has resulted in a situation where most companies are now competing in a highly competitive global market. At the same time there has been a significant reduction in product life cycles arising from technological innovations and the need to meet increasingly discriminating customer demands. To compete successfully in today's highly competitive global environment companies are making customer satisfaction an overriding priority, adopting new management approaches, changing their manufacturing systems and investing in new technologies. These changes are having a significant influence on management accounting systems. Progression through the book will reveal how these changes are influencing management accounting systems, but first of all it is important that you have a good background knowledge of some of the important changes that are occurring in the business environment. This chapter aims to provide such knowledge.

The objective of this first chapter is to provide the background knowledge that will enable you to achieve a more meaningful insight into the issues and problems of management accounting

Learning objectives

After studying this chapter, you should be able to:

- differentiate between management accounting, cost accounting and financial accounting;
- list and describe each of the seven factors involved in the decision-making, planning and control process;
- justify the view that, broadly, firms seek to maximize the present value of future net cash inflows;
- explain the factors that have influenced the changes in the competitive environment;
- outline the key success factors that directly affect customer satisfaction;
- describe the functions of a management accounting system.

that are discussed in the book. We begin by looking at the users of accounting information and identifying their requirements. This is followed by a description of the decision-making process and the changing business and manufacturing environment. Finally, the different functions of management accounting are described.

The users of accounting information

Accounting is a language that communicates financial and non-financial information to people who have an interest in an organization – managers, shareholders and potential investors, employees, creditors and the government. Managers require information that will assist them in their decision-making and control activities; for example, information is needed on the estimated selling prices, costs, demand, competitive position and profitability of various products that are made by the organization. Shareholders require information on the value of their investment and the income that is derived from their shareholding. Employees require information on the ability of the firm to meet wage demands and avoid redundancies. Creditors and the providers of loan capital require information on a firm's ability to meets its financial obligations. Government agencies like the Central Statistical Office collect accounting information and require such information as the details of sales activity, profits, investments, stocks, dividends paid, the proportion of profits absorbed by taxation and so on. In addition, the tax authorities need information on the amount of profits that are subject to taxation. All this information is important for determining policies to manage a country's economy.

Accounting information is not confined to business organizations. Accounting information about individuals is also important and is used by other individuals; for example, credit will only be extended to an individual after the prospective borrower has furnished a reasonable accounting of his or her private financial affairs. Non-profit-making organizations such as churches, charitable organizations, clubs and government units such as local authorities, also require accounting information for decision-making, and for reporting the results of their activities. For example, a tennis club will require information on the cost of undertaking its various activities so that a decision can be made as to the amount of the annual subscription that it will charge to its members. Similarly, local authorities need information on the costs of undertaking specific activities so that decisions can be made as to which activities will be undertaken and the resources that must be raised to finance them.

The foregoing discussion has indicated that there are many users of accounting information who require information for decision-making. The objective of accounting is to provide sufficient information to meet the needs of the various users at the lowest possible cost. Obviously, the benefit derived from using an information system for decision-making must be greater than the cost of operating the system.

An examination of the various users of accounting information indicates that they can be divided into two categories:

1. internal parties within the organization;
2. external parties such as shareholders, creditors and regulatory agencies, outside the organization.

It is possible to distinguish between two branches of accounting, that reflect the internal and external users of accounting information. Management accounting is concerned with

the provision of information to people within the organization to help them make better decisions and improve the efficiency and effectiveness of existing operations, whereas financial accounting is concerned with the provision of information to external parties outside the organization. Thus, management accounting could be called internal accounting and financial accounting could be called external accounting. This book concentrates on management accounting.

Differences between management accounting and financial accounting

The major differences between these two branches of accounting are:

- *Legal requirements.* There is a statutory requirement for public limited companies to produce annual financial accounts regardless of whether or not management regards this information as useful. Management accounting, by contrast, is entirely optional and information should be produced only if it is considered that the benefits from the use of the information by management exceed the cost of collecting it.
- *Focus on individual parts or segments of the business.* Financial accounting reports describe the whole of the business whereas management accounting focuses on small parts of the organization, for example the cost and profitability of products, services, customers and activities. In addition, management accounting information measures the economic performance of decentralized operating units, such as divisions and departments.
- *Generally accepted accounting principles.* Financial accounting statements must be prepared to conform with the legal requirements and the generally accepted accounting principles established by the regulatory bodies such as the Financial Accounting Standards Board (FASB) in the USA and the Accounting Standards Board (ASB) in the UK. These requirements are essential to ensure the uniformity and consistency that is needed for external financial statements. Outside users need assurance that external statements are prepared in accordance with generally accepted accounting principles so that the inter-company and historical comparisons are possible. In contrast, management accountants are not required to adhere to generally accepted accounting principles when providing managerial information for internal purposes. Instead, the focus is on the serving management's needs and providing information that is useful to managers relating to their decision-making, planning and control functions.
- *Time dimension.* Financial accounting reports what has happened in the past in an organization, whereas management accounting is concerned with *future* information as well as past information. Decisions are concerned with *future* events and management therefore requires details of expected *future* costs and revenues.
- *Report frequency.* A detailed set of financial accounts is published annually and less detailed accounts are published semi-annually. Management requires information quickly if it is to act on it. Consequently management accounting reports on various activities may be prepared at daily, weekly or monthly intervals.

The decision-making process

Because information produced by management accountants must be judged in the light of its ultimate effect on the outcome of decisions, a necessary precedent to an understanding of management accounting is an understanding of the *decision-making process*.

FIGURE 1.1 *The decision-making, planning and control process.*

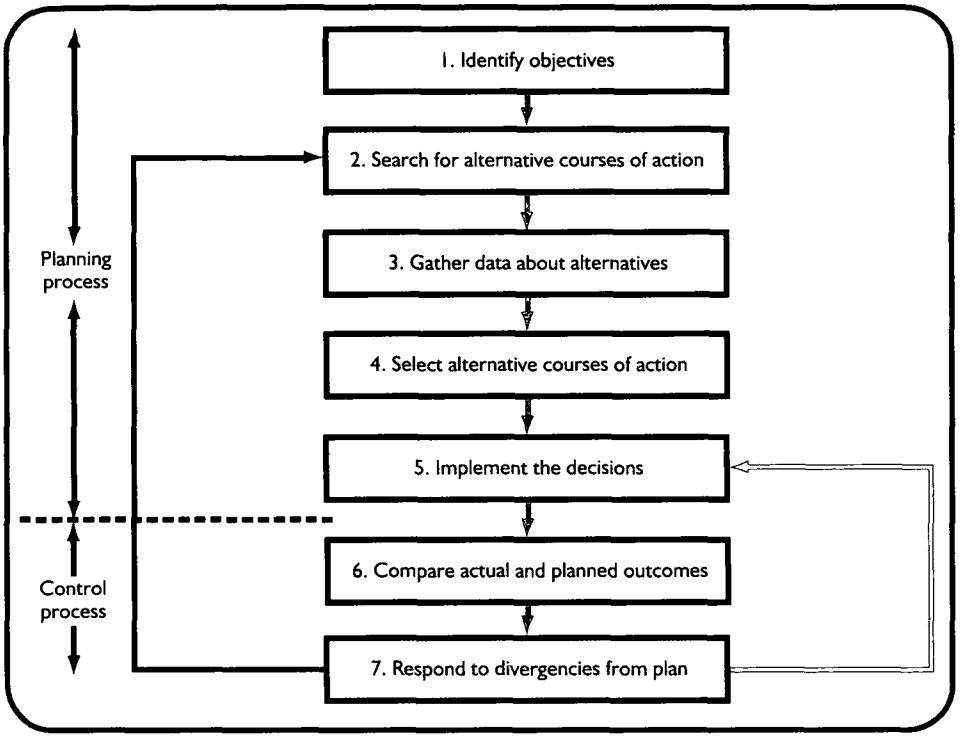


Figure 1.1 presents a diagram of a decision-making model. The first five stages represent the decision-making or the planning process. Planning involves making choices between alternatives and is primarily a decision-making activity. The final two stages represent the *control process*, which is the process of measuring and correcting actual performance to ensure that the alternatives that are chosen and the plans for implementing them are carried out. Let us now consider each of the elements of the decision-making and control process.

IDENTIFYING OBJECTIVES

Before good decisions can be made there must be some guiding aim or direction that will enable the decision-makers to assess the desirability of favouring one course of action over another. Hence, the first stage in the decision-making process should be to specify the goals or objectives of the organization.

Considerable controversy exists as to what the objectives of firms are or should be. Economic theory normally assumes that firms seek to maximize profits for the owners of the firm (the ordinary shareholders in a limited company) or, more precisely, the maximization of shareholders' wealth. Various arguments have been used to support the profit maximization objective. There is the legal argument that the ordinary shareholders are the owners of the firm, which therefore should be run for their benefit by trustee managers. Another argument supporting the profit objective is that profit maximization leads to the maximization of overall economic welfare. That is, by doing the best for yourself, you are unconsciously doing the best for society. Moreover, it seems a reasonable belief that the interests of firms will be better served by a larger profit than by a smaller profit, so that maximization is at least a useful approximation.

Some writers (e.g. Simon, 1959) believe that businessmen are content to find a plan that provides satisfactory profits rather than to maximize profits. Because people have limited powers of understanding and can deal with only a limited amount of information at a time (Simon uses the term **bounded rationality** to describe these constraints), they tend to search for solutions only until the first acceptable solution is found. No further attempt is made to find an even better solution or to continue the search until the best solution is discovered. Such behaviour, where the search is terminated on finding a satisfactory, rather than optimal solution, is known as **satisficing**.

Cyert and March (1969) have argued that the firm is a coalition of various different groups – shareholders, employees, customers, suppliers and the government – each of whom must be paid a minimum to participate in the coalition. Any excess benefits after meeting these minimum constraints are seen as being the object of bargaining between the various groups. In addition, a firm is subject to constraints of a societal nature. Maintaining a clean environment, employing disabled workers and providing social and recreation facilities are all examples of social goals that a firm may pursue.

Clearly it is too simplistic to say that the only objective of a business firm is to maximize profits. Some managers seek to establish a power base and build an empire; another goal is security; the removal of uncertainty regarding the future may override the pure profit motive. Nevertheless, the view adopted in this book is that, broadly, firms seek to maximize the value of future net cash inflows (that is, future cash receipts less cash payments) or to be more precise the present value of future net cash inflows.[1] This is equivalent to maximizing shareholder value. (The concept of present value is explained in Chapter 9.) The reasons for choosing this objective are as follows:

1. It is unlikely that any other objective is as widely applicable in measuring the ability of the organization to survive in the future.
2. It is unlikely that maximizing the present value of future cash flows can be realized in practice, but by establishing the principles necessary to achieve this objective you will learn how to increase the present value of future cash flows.
3. It enables shareholders as a group in the bargaining coalition to know how much the pursuit of other goals is costing them by indicating the amount of cash distributed among the members of the coalition.

THE SEARCH FOR ALTERNATIVE COURSES OF ACTION

The second stage in the decision-making model is a search for a range of possible courses of action (or **strategies**) that might enable the objectives to be achieved. If the management of a company concentrates entirely on its present product range and markets, and market shares and cash flows are allowed to decline, there is a danger that the company will be unable to generate sufficient cash flows to survive in the future. To maximize future cash flows, it is essential that management identifies potential opportunities and threats in its current environment and takes specific steps immediately so that the organization will not be taken by surprise by any developments which may occur in the future. In particular, the company should consider one or more of the following courses of action:

1. developing *new* products for sale in *existing* markets;
2. developing *new* products for *new* markets;
3. developing *new* markets for *existing* products.

The search for alternative courses of action involves the acquisition of information concerning future opportunities and environments; it is the most difficult and important stage of the decision-making process. Ideally, firms should consider all alternative courses of action, but, in practice they consider only a few alternatives, with the search process being localized initially. If this type of routine search activity fails to produce satisfactory solutions, the search will become more widespread (Cyert and March, 1969). We shall examine the search process in more detail in Chapter 10.

GATHER DATA ABOUT ALTERNATIVES

When potential areas of activity are identified, management should assess the potential growth rate of the activities, the ability of the company to establish adequate market shares, and the cash flows for each alternative activity for various states of nature. Because decision problems exist in an uncertain environment, it is necessary to consider certain factors that are outside the decision-maker's control, which may occur for each alternative course of action. These uncontrollable factors are called states of nature. Some examples of possible states of nature are economic boom, high inflation, recession, the strength of competition and so on.

The course of action selected by a firm using the information presented above will commit its resources for a lengthy period of time, and how the overall place of the firm will be affected within its environment – that is, the products it makes, the markets it operates in and its ability to meet future changes. Such decisions dictate the firm's long-run possibilities and hence the type of decisions it can make in the future. These decisions are normally referred to as long-run or strategic decisions. Strategic decisions have a profound effect on the firm's future position, and it is therefore essential that adequate data are gathered about the firm's capabilities and the environment in which it operates. We shall discuss this topic in Chapters 9 and 10. Because of their importance, strategic decisions should be the concern of top management.

Besides strategic or long-term decisions, management must also make decisions that do not commit the firm's resources for a lengthy period of time. Such decisions are known as short-term or operating decisions and are normally the concern of lower-level managers. Short-term decisions are based on the environment of today, and the physical, human and financial resources presently available to the firm. These are, to a considerable extent, determined by the quality of the firm's long-term decisions. Examples of short-term decisions include the following.

1. What selling prices should be set for the firm's products?
2. How many units should be produced of each product?
3. What media shall we use for advertising the firm's products?
4. What level of service shall we offer customers in terms of the number of days required to deliver an order and the after-sales service?

Data must also be gathered for short-term decisions; for example, data on the selling prices of competitors' products, estimated demand at alternative selling prices, and predicted costs for different activity levels must be assembled for pricing and output decisions. When the data have been gathered, management must decide which courses of action to take.

SELECT APPROPRIATE ALTERNATIVE COURSES OF ACTION

In practice, decision-making involves choosing between competing alternative courses of action and selecting the alternative that best satisfies the objectives of an organization. Assuming that our objective is to maximize future net cash inflows, the alternative selected should be based on a comparison of the differences between the cash flows. Consequently, an incremental analysis of the net cash benefits for each alternative should be applied. The alternatives are ranked in terms of net cash benefits, and those showing the greatest benefits are chosen subject to taking into account any qualitative factors. We shall discuss how incremental cash flows are measured for short-term and long-term decisions and the impact of qualitative factors in Chapters 4–9.

IMPLEMENTATION OF THE DECISIONS

Once alternative courses of action have been selected, they should be implemented as part of the budgeting process. The **budget** is a financial plan for implementing the various decisions that management has made. The budgets for all of the various decisions are expressed in terms of cash inflows and outflows, and sales revenues and expenses. These budgets are merged together into a single unifying statement of the organization's expectations for future periods. This statement is known as a **master budget**. The master budget consists of a budgeted profit and loss account, cash flow statement and balance sheet. The budgeting process communicates to everyone in the organization the part that they are expected to play in implementing management's decisions. Chapter 10 focuses on the budgeting process.

COMPARING ACTUAL AND PLANNED OUTCOMES AND RESPONDING TO DIVERGENCIES FROM PLAN

The final stages in the process outlined in Figure 1.1 of comparing actual and planned outcomes and responses to divergencies from plan represent the firm's control process. The managerial function of **control** consists of the measurement, reporting and subsequent correction of performance in an attempt to ensure that the firm's objectives and plans are achieved. In other words, the objective of the control process is to ensure that the work is done so as to fulfil the original intentions.

To monitor performance, the accountant produces **performance reports** and presents them to the appropriate managers who are responsible for implementing the various decisions. Performance reports consisting of a comparison of actual outcomes (actual costs and revenues) and planned outcomes (budgeted costs and revenues) should be issued at regular intervals. Performance reports provide **feedback** information by comparing planned and actual outcomes. Such reports should highlight those activities that do not conform to plans, so that managers can devote their scarce time to focusing on these items. This process represents the application of **management by exception**. Effective control requires that corrective action is taken so that actual outcomes conform to planned outcomes. Alternatively, the plans may require modification if the comparisons indicate that the plans are no longer attainable.

The process of taking corrective action so that actual outcomes conform to planning outcomes, or the modification of the plans if the comparisons indicate that actual outcomes do not conform to planned outcomes, is indicated by the arrowed lines in Figure 1.1 linking stages 7 and 5 and 7 and 2. These arrowed lines represent '**feedback loops**'. They

signify that the process is dynamic and stress the interdependencies between the various stages in the process. The feedback loop between stages 7 and 2 indicates that the plans should be regularly reviewed, and if they are no longer attainable then alternative courses of action must be considered for achieving the organization's objectives. The second loop stresses the corrective action taken so that actual outcomes conform to planned outcomes. Chapters 10–13 focus on the planning and control process.

Changing competitive environment

Prior to the 1980s many organizations in Western countries operated in a protected competitive environment. Barriers of communication and geographical distance, and sometimes protected markets, limited the ability of overseas companies to compete in domestic markets. There was little incentive for firms to maximize efficiency and improve management practices, or to minimize costs, as cost increases could often be passed on to customers. During the 1980s, however, manufacturing organizations began to encounter severe competition from overseas competitors that offered high-quality products at low prices. By establishing global networks for acquiring raw materials and distributing goods overseas, competitors were able to gain access to domestic markets throughout the world. To be successful companies now have to compete not only against domestic competitors but also against the best companies in the world.

Excellence in manufacturing can provide a competitive weapon to compete in sophisticated world-wide markets. In order to compete effectively companies must be capable of manufacturing innovative products of high quality at a low cost, and also provide a first-class customer service. At the same time, they must have the flexibility to cope with short product life cycles, demands for greater product variety from more discriminating customers and increasing international competition. World-class manufacturing companies have responded to these competitive demands by replacing traditional production systems with new just-in-time production systems and investing in advanced manufacturing technologies (AMTs). The major features of these new systems and their implications for management accounting will be described throughout the book.

Virtually all types of service organization have also faced major changes in their competitive environment. Before the 1980s many service organizations, such as those operating in the airlines, utilities and financial service industries, were either government-owned monopolies or operated in a highly regulated, protected and non-competitive environment. These organizations were not subject to any great pressure to improve the quality and efficiency of their operations or to improve profitability by eliminating services or products that were making losses. Furthermore, more efficient competitors were often prevented from entering the markets in which the regulated companies operated. Prices were set to cover operating costs and provide a predetermined return on capital. Hence cost increases could often be absorbed by increasing the prices of the services. Little attention was therefore given to developing cost systems that accurately measured the costs and profitability of individual services.

Privatization of government-controlled companies and deregulation in the 1980s completely changed the competitive environment in which service companies operated. Pricing and competitive restrictions have been virtually eliminated. Deregulation, intensive competition and an expanding product range created the need for service organizations to focus on cost management and develop management accounting information systems that enabled them to understand their cost base and determine the sources of profitability for their products, customers and markets. Many service organizations have only recently turned their attention to management accounting.

Changing product life cycles

A **product's life cycle** is the period of time from initial expenditure on research and development to the time at which support to customers is withdrawn. Intensive global competition and technological innovation combined with increasingly discrimating and sophisticated customer demands have resulted in a dramatic decline in product life cycles. To be successful companies must now speed up the rate at which they introduce new products to the market. Being later to the market than the competitors can have a dramatic effect on product profitability.

In many industries a large fraction of a product's life-cycle costs are determined by decisions made early in its life cycle. This has created a need for management accounting to place greater emphasis on providing information at the design stage because many of the costs are committed or locked in at this time. Therefore to compete successfully companies must be able to manage their costs effectively at the design stage, have the capability to adapt to new, different and changing customer requirements and reduce the time to market of new and modified products.

Focus on customer satisfaction and new management approaches

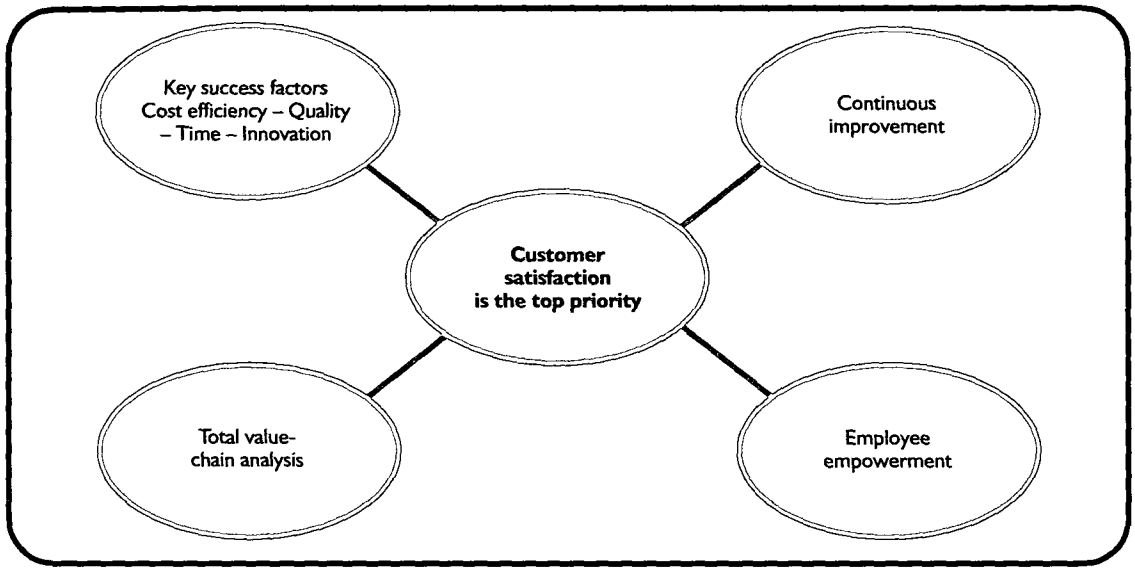
In order to compete in today's competitive environment companies are having to become more 'customer-driven' and make customer satisfaction an overriding priority. Customers are demanding ever-improving levels of service in cost, quality, reliability, delivery, and the choice of innovative new products. Figure 1.2 illustrates this focus on customer satisfaction as the overriding priority. In order to provide customer satisfaction organizations must concentrate on those key success factors that directly affect it. Figure 1.2 identifies cost efficiency, quality, time and innovation as the key success factors. In addition to concentrating on these factors organizations are adopting new management approaches in their quest to achieve customer satisfaction. These new approaches are illustrated in Figure 1.2. They are continuous improvement, employee empowerment and total value-chain analysis. Let us now examine each of the items shown in Figure 1.2 in more detail.

Since customers will buy the product with the lowest price, all other things being equal, keeping costs low and being **cost efficient** provides an organization with a strong competitive advantage. Increased competition has also made decision errors due to poor cost information more probable and more costly. If the cost system results in distorted product costs being reported, then overcosted products will lead to higher bid prices and business lost to those competitors who are able to quote lower prices purely because their cost systems produce more accurate cost information. Alternatively, there is a danger that undercosted profits will result in the acceptance of unprofitable business.

These developments have made many companies aware of the need to improve their cost systems so that they can produce more accurate cost information to determine the cost of their products, pinpoint loss-making activities and analyse profits by products, sales outlets, customers and markets.

In addition to demanding low cost product customers are demanding high quality products and services. Most companies are responding to this by focusing on **total quality management** (TQM). The goal of TQM is customer satisfaction. TQM is a term used to describe a situation where *all* business functions are involved in a process of continuous quality improvement. TQM has broadened from its early concentration on the statistical

FIGURE 1.2 *Focus on customer satisfaction.*



monitoring of manufacturing processes, to a customer-oriented process of continuous improvement that focuses on delivering products or services of consistently high quality in a timely fashion.

Most European and American companies had always considered quality an additional cost of manufacturing, but by the end of the 1980s they began to realize that quality saved money. The philosophy had been to emphasize production volume over quality; but this resulted in high levels of stocks at each production stage in order to protect against shortages caused by inferior quality at previous stages and excessive expenditure on inspection, rework, scrap and warranty repairs. Companies discovered that it was cheaper to produce the items correctly the first time rather than to waste resources making substandard items that had to be detected, reworked, scrapped or returned by customers. In other words, the emphasis in TQM is to design and build quality in rather than trying to inspect and repair it in. The emphasis on TQM has created fresh demands on the management accounting function to expand its role by becoming involved in measuring and evaluating the quality of products and services and the activities that produce them.

Organizations are also seeking to increase customer satisfaction by providing a speedier response to customer requests, ensuring 100% on-time delivery and reducing the time taken to develop and bring new products to market. For these reasons management accounting systems are starting to place more emphasis on time-based measures, which are now an important competitive variable. Cycle time is one measure that management accounting systems have begun to focus on. It is the length of time from start to completion of a product or service. It consists of the sum of processing time, move time, wait time, inspection and rework time. Move time is the amount of time it takes to transfer the product during the production process from one location to another. Wait time is the amount of time that the product sits around waiting for processing, moving, inspecting, reworking or the amount of time it spends in finished goods stock waiting to be sold and despatched. Inspection time is the amount of time making sure that the product is defect free and rework time is the amount of time actually spent reworking the product to remedy identified defects in quality. Only processing time adds value to the product, and the remaining activities are non-value added activities in the sense that they can be reduced or eliminated without altering the product's service potential to the customer.

Organizations are therefore focusing on minimizing cycle time by reducing the time spent on such activities. The management accounting system has an important role to play in this process by identifying and reporting on the time devoted to value added and non-value added activities.

The final key success factor shown in Figure 1.2 relates to innovation. To be successful companies must develop a steady stream of innovative new products and services and have the capability to adapt to changing customer requirements. It has already been stressed earlier in this chapter that being later to the market than competitors can have a dramatic effect on product profitability. Companies have therefore begun to incorporate performance measures that focus on flexibility and innovation into their management accounting systems. Flexibility relates to the responsiveness in meeting customer requirements. Flexibility measures include the total launch time for new products, the length of development cycles and the ability to change the production mix quickly. Innovation measures include an assessment of the key characteristics of new products relative to those of competitors, feedback on customer satisfaction with the new features and characteristics of newly introduced products, and the number of new products launched and their launch time.

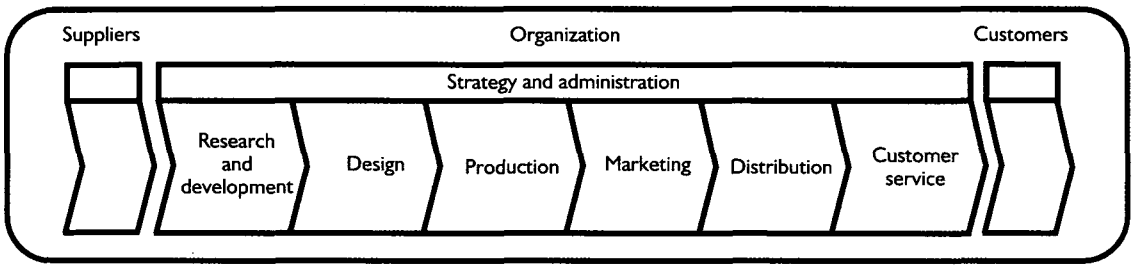
You can see by referring to Figure 1.2 that organizations are attempting to achieve customer satisfaction by adopting a philosophy of continuous improvement. Traditionally, organizations have sought to study activities and establish standard operating procedures and materials requirements based on observing and establishing optimum input/output relationships. Operators were expected to follow the standard procedures and management accountants developed systems and measurements that compared actual results with predetermined standards. This process created a climate whereby the predetermined standards represented a target to be achieved and maintained rather than a policy of continuous improvement. In today's competitive environment performance against static historical standards is no longer appropriate. To compete successfully companies must adopt a philosophy of continuous improvement, an ongoing process that involves a continuous search to reduce costs, eliminate waste, and improve the quality and performance of activities that increase customer value or satisfaction.

Benchmarking is a technique that is increasingly being adopted as a mechanism for achieving continuous improvement. It is a continuous process of measuring a firm's products, services or activities against the other best performing organizations, either internal or external to the firm. The objective is to ascertain how the processes and activities can be improved. Ideally, benchmarking should involve an external focus on the latest developments, best practice and model examples that can be incorporated within various operations of business organizations. It therefore represents the ideal way of moving forward and achieving high competitive standards.

In their quest for the continuous improvement of organizational activities managers have found that they have had to rely more on the people closest to the operating processes and customers to develop new approaches to performing activities. This has led to employees being provided with relevant information to enable them to make continuous improvements to the output of processes. Allowing employees to take such actions without the authorization by superiors has come to be known as employee empowerment. It is argued that by empowering employees and giving them relevant information they will be able to respond faster to customers, increase process flexibility, reduce cycle time and improve morale. Management accounting is therefore moving from its traditional emphasis on providing information to managers to monitor the activities of employees to providing information to employees to empower them to focus on the continuous improvement of activities.

Increasing attention is now being given to value-chain analysis as a means of increasing customer satisfaction and managing costs more effectively. The value chain

FIGURE 1.3 *The value chain.*



is illustrated in Figure 1.3. It is the linked set of value-creating activities all the way from basic raw material sources for component suppliers through to the ultimate end-use product or service delivered to the customer. Coordinating the individual parts of the value chain together to work as a team creates the conditions to improve customer satisfaction, particularly in terms of cost efficiency, quality and delivery. It is also appropriate to view the value chain from the customer's perspective, with each link being seen as the customer of the previous link. If each link in the value chain is designed to meet the needs of its customers, then end-customer satisfaction should ensue. Furthermore, by viewing each link in the value chain as a supplier–customer relationship, the opinions of the customers can be used to provide useful feedback information on assessing the quality of service provided by the supplier. Opportunities are thus identified for improving activities throughout the entire value chain. The aim is to value the linkages in the value chain better than competitors and thus create a competitive advantage.

Finally, there is one aspect of customer satisfaction that is not specified in Figure 1.2 – namely, **social responsibility** and **corporate ethics**. Customers are no longer satisfied if companies simply comply with the legal requirements of undertaking their activities. They expect company managers to be more proactive in terms of their social responsibility. Company stakeholders are now giving high priority to social responsibility, safety and environmental issues, besides corporate ethics. In response to these pressures many companies are now introducing a code of ethics as an essential part of their corporate culture. In addition, professional accounting organizations play an important role in promoting a high standard of ethical behaviour by their members. Both of the professional bodies representing management accountants in the UK (Chartered Institute of Management Accountants) and the USA (Institute of Management Accountants) have issued a code of ethical guidelines for their members.

The impact of the changing environment of management accounting systems

All of the changes in the business environment that have been described in this chapter are having a significant influence on management accounting systems. Most organizations have faced changing cost structures with a growth in those costs which do not change directly with changes in output, and which are difficult to trace accurately to products or services. This change in cost structure has created a need for organizations to review their existing management accounting systems and consider implementing new systems that have emerged during the late 1980s and early 1990s.

In today's world-wide competitive environment we have noted that companies are competing in terms of product (or service) quality, delivery, reliability, after-sales service

and customer satisfaction. Until recently management accounting systems have not reported on these variables, despite the fact that they represent key competitive variables. Traditionally management accounting systems have focused mainly on reporting financial measures. However, in response to the changing environment management accounting systems have begun to place greater emphasis on collecting and reporting non-financial quantitative and qualitative information on those key variables that are necessary to compete effectively and which also support the strategies of an organization. There has been a shift from treating financial figures as the foundation of the management accounting system to treating them as part of a broader set of measures.

Functions of management accounting

A cost and management accounting system should generate information to meet the following requirements. It should:

1. allocate costs between cost of goods sold and inventories for internal and external profit reporting;
2. provide relevant information to help managers make better decisions;
3. provide information for planning, control and performance measurement.

Financial accounting rules require that we match costs with revenues to calculate profit. Consequently any unsold finished goods stock or partly completed stock (work in progress) will *not* be included in the cost of goods sold, which is matched against sales revenue during a given period. In an organization that produces a wide range of different products it will be necessary, for stock (inventory) valuation purposes, to charge the costs to each individual product. The total value of the stocks of completed products and work in progress plus any unused raw materials forms the basis for determining the inventory valuation to be deducted from the current period's costs when calculating profit. This total is also the basis for determining the stock valuation for inclusion in the balance sheet. Costs are therefore traced to each individual job or product for financial accounting requirements in order to allocate the costs incurred during a period between cost of goods sold and inventories. This information is required for meeting external financial accounting requirements, but most organizations also produce *internal* profit reports at monthly intervals. Thus product costs are also required for periodic internal profit reporting. Many service organizations, however, do not carry any stocks and product costs are therefore not required by these organizations for valuing inventories.

The second requirement of a cost and management accounting system is to provide relevant financial information to managers to help them make better decisions. This involves both routine and non-routine reporting. Routine information is required relating to the profitability of various segments of the business such as products, services, customers and distribution channels in order to ensure that only profitable activities are undertaken. Information is also required for making resource allocation and product mix and discontinuation decisions. In some situations cost information extracted from the costing system also plays a crucial role in determining selling prices, particularly in markets where customized products and services are provided that do not have readily available market prices. Non-routine information is required for strategic decisions. These decisions are made at infrequent intervals and include decisions relating to the development and introduction of new products and services, investment in new plant and equipment and the negotiation of long-term contracts with customers and suppliers.

Accurate cost information is required in decision-making for distinguishing between profitable and unprofitable activities. If the cost system does not capture accurately enough the consumption of resources by products, the reported product (or service) costs will be distorted, and there is a danger that managers may drop profitable products or continue the production of unprofitable products. Where cost information is used to determine selling prices the undercosting of products can result in the acceptance of unprofitable business whereas overcosting can result in bids being rejected and the loss of profitable business.

Management accounting systems should also provide information for planning, control and performance measurement. Planning involves translating goals and objectives into the specific activities and resources that are required to achieve the goals and objectives. Companies develop both long-term and short-term plans and the management accounting function plays a critical role in this process. Short-term plans, in the form of the budgeting process, are prepared in more detail than the longer-term plans and are one of the mechanisms used by managers as a basis for control and performance evaluation. Control is the process of ensuring that the actual outcomes conform with the planned outcomes. The control process involves the setting of targets or standards (often derived from the budgeting process) against which actual results are measured. Performance is then measured and compared with the targets on a periodic basis. The management accountant's role is to provide managers with feedback information in the form of periodic reports, suitably analysed, to enable them to determine if operations are proceeding according to plan and identify those activities where corrective action is necessary. In particular, the management accounting function should provide economic feedback to managers to assist them in controlling costs and improving the efficiency and effectiveness of operations.

Periodic performance reports comparing actual and targeted outcomes rely heavily on financial measures (such as costs, revenues and profits) to report on managerial performance. These reports are used to evaluate managerial performance and therefore provide incentives for managers to try and ensure that favourable results are reported. In particular, managers are encouraged to achieve organizational goals by having rewards (or punishments) linked to their success (or failure) in achieving the targeted outcomes. The way in which managerial performance is measured and evaluated can have a profound effect on their rewards and behaviour. There is a danger, however, that the performance measurement system can cause serious behavioural problems and be harmful to motivation if accounting performance measures are used and interpreted without a sufficient consideration of the potential organizational behavioural problems. These issues will be considered in Chapter 11.

It is appropriate at this point to distinguish between cost accounting and management accounting. **Cost accounting** is concerned with cost accumulation for inventory valuation to meet the requirements of external reporting and internal profit measurement, whereas **management accounting** relates to the provision of appropriate information for decision-making, planning, control and performance evaluation. It is apparent from an examination of the literature that the distinction between cost accounting and management accounting is extremely vague with some writers referring to the decision-making aspects in terms of 'cost accounting' and other writers using the term 'management accounting'; the two terms are often used synonymously. In this book no attempt will be made to distinguish between these two terms.

You should now be aware from the above discussion that a management accounting system serves multiple purposes. The emphasis throughout the book is that costs must be assembled in different ways for different purposes. A firm can choose to have multiple accounting systems (i.e. a separate system for each purpose) or one basic accounting system and set of accounts that serve inventory valuation and profit measurement, decision-making and performance evaluation requirements. Most firms choose, on the basis of costs versus benefits criteria, to operate a single accounting system. A single

database is maintained with costs appropriately coded and classified so that relevant cost information can be extracted to meet each of the above requirements. Where future cost information is required the database may be maintained at target (standard) costs, or if actual costs are recorded, they are adjusted for anticipated price changes. We shall examine in the next chapter how relevant cost information can be extracted from a single database and adjusted to meet different user requirements.

Summary of the contents of this book

This book is divided into four parts. The first part (Part One) consists of two chapters and provides an introduction to management and cost accounting and a framework for studying the remaining chapters. Part Two consists of seven chapters and is entitled 'Information for Decision-making'. Here the focus is on measuring and identifying those costs which are relevant for different types of decisions.

The title of Part Three is 'Information for Planning, Control and Performance Measurement'. It consists of five chapters and concentrates on the process of translating goals and objectives into specific activities and the resources that are required, via the short-term (budgeting) and long-term planning processes, to achieve the goals and objectives. In addition, the management control systems that organizations use are described and the role that management accounting control systems play within the overall control process is examined. The emphasis here is on the accounting process as a means of providing information to help managers control the activities for which they are responsible. Performance measurement and evaluation within different segments of the organization is also examined.

Part Four consists of two chapters and is entitled 'Cost Management and Strategic Management Accounting.' The first chapter focuses on cost management and the second on strategic management accounting.

Summary

Accounting is defined as the process of identifying, measuring and communicating financial and non-financial information to permit informed judgements and decisions by users of the information. We have distinguished between internal users (management accounting) and external users (financial accounting), and have considered a decision-making, planning and control model.

This chapter has also described some of the major changes in the business environment which organizations have faced over the past decade. Intensive competition from overseas companies has resulted in a situation where most companies are now having to operate in a highly competitive global market. Technical innovation and customer demands for a constant stream of innovative products have also resulted in a significant reduction in product life cycles. To compete successfully in today's highly competitive environment companies are finding that it is in their best interests to make customer satisfaction a top priority.

In order to provide customer satisfaction organizations must concentrate on four key success factors: cost efficiency, quality, time and innovation. Companies must manage their costs effectively if they are to become low cost suppliers and compete on the basis of selling price. Total quality management is a customer-oriented process that focuses on delivering products or services of consistent high quality in a timely fashion. Customers also value a prompt service and a speedy response to their request for products or services. Organizations have therefore begun to concentrate on time-based measures that focus on the length of time it takes to complete various activities. Finally, there is now an increasing awareness that a continuous flow of innovative products is essential to an organization's continued success. In addition to concentrating on key success factors organizations are adopting new management approaches such as continuous improvement and employee empowerment.

Conventional management accounting systems were designed for use in an environment which is very different from that of today. It is therefore important that, where necessary, management accounting systems are modified to meet the requirements of today's manufacturing and global competitive environment.

Finally, three different objectives of a management accounting system were described. They are:

1. to allocate costs between cost of goods sold and inventories for internal and external profit reporting;
2. to provide relevant information to help managers make better decisions;
3. to provide information for planning, operational control and performance measurement.

Notes

1 The total profits over the life of a business are identical with total net cash inflows. However, the profits calculated for a particular accounting period will be different from the net cash flows for that period. The difference arises because of the accruals concept in financial accounting. For most situations in this book, decisions that will lead to changes in profits are also assumed to lead to identical changes in net cash flows.

Key Terms and Concepts

Each chapter includes a section like this. You should make sure that you understand each of the terms listed below before you proceed to the next chapter. Their meanings are explained on the page numbers indicated.

benchmarking (p. 13)
bounded rationality (p. 7)
budget (p. 9)
continuous improvement (p. 13)

control (p. 9)
corporate ethics (p. 14)
cost accounting (p. 16)
cost efficient (p. 11)
cycle time (p. 12)
employee empowerment (p. 13)
feedback (p. 9)
feedback loop (p. 9)
financial accounting (pp. 5, 15)
goals of the organization (p. 6)
innovation (p. 13)
long-run decisions (p. 8)
management accounting (pp. 4, 16)
management by exception (p. 9)
master budget (p. 9)
non-value added activities (p. 12)
objectives of the organization (p. 6)
operating decisions (p. 8)
performance reports (p. 9)
planning (p. 6)
product life cycle (p. 11)
satisficing (p. 7)
short-term decisions (p. 8)
social responsibility (p. 14)
states of nature (p. 8)
strategic decisions (p. 8)
strategies (p. 7)
time-based measures (p. 12)
total quality management (p. 11)
value-chain analysis (p. 13)

2

An introduction to cost terms and concepts

In Chapter 1 it was pointed out that accounting systems measure costs which are used for profit measurement and inventory valuation, decision-making, performance measurement and controlling the behaviour of people. The term cost is a frequently used word that reflects a monetary measure of the resources sacrificed or forgone to achieve a specific objective, such as acquiring a good or service. However, the term must be defined more precisely before 'the cost' can be determined. You will find that the word *cost* is rarely used without a preceding adjective to specify the type of cost being considered.

To understand how accounting systems calculate costs and to communicate accounting information effectively to others requires a thorough understanding of what cost means. Unfortunately, the term has multiple meanings and different types of costs are used in different situations. Therefore a preceding term must be added to clarify the assumptions that underlie a cost measurement. A large terminology has emerged to indicate more clearly which cost meaning is being conveyed. Examples include variable cost, fixed cost, opportunity cost and sunk cost. The aim of this chapter is to provide you with an understanding of the basic cost terms and concepts that are used in the management accounting literature.

Learning objectives

After studying this chapter, you should be able to:

- define and illustrate a cost object;
- explain the meaning of each of the key terms listed at the end of this chapter;
- describe the three purposes for which cost information is required;
- distinguish between job costing and process costing;
- explain why in the short term some costs and revenues are not relevant for decision-making.

Cost objects

A **cost object** is any activity for which a separate measurement of costs is desired. In other words, if the users of accounting information want to know the cost of something, this something is called a cost object. Examples of cost objects include the cost of a product, the cost of rendering a service to a bank customer or hospital patient, the cost of operating a particular department or sales territory, or indeed anything for which one wants to measure the cost of resources used.

We shall see that the cost collection system typically accounts for costs in two broad stages:

1. It accumulates costs by classifying them into certain categories such as labour, materials and overhead costs (or by cost behaviour such as fixed and variable).
2. It then assigns these costs to cost objects.

In this chapter we shall focus on the following cost terms and concepts:

- direct and indirect costs;
- period and product costs;
- cost behaviour in relation to volume of activity;
- relevant and irrelevant costs;
- avoidable and unavoidable costs;
- sunk costs;
- opportunity costs;
- incremental and marginal costs.

Direct and indirect costs

Costs that are assigned to cost objects can be divided into two categories: direct costs and indirect costs. **Direct costs** are those costs that can be specifically and exclusively identified with a particular cost object. In contrast, **indirect costs** cannot be identified specifically and exclusively with a given cost object. Let us assume that our cost object is a product, or to be more specific a particular type of desk that is manufactured by an organization. In this situation the wood that is used to manufacture the desk can be specifically and exclusively identified with a particular desk and can thus be classified as a direct cost. Similarly, the wages of operatives whose time can be traced to the specific desk are a direct cost. In contrast, the salaries of factory supervisors or the rent of the factory cannot be specifically and exclusively traced to a particular desk and these costs are therefore classified as indirect.

Sometimes, however, direct costs are treated as indirect because tracing costs directly to the cost object is not cost effective. For example, the nails used to manufacture a particular desk can be identified specifically with the desk, but, because the cost is likely to be insignificant, the expense of tracing such items does not justify the possible benefits from calculating more accurate product costs.

Direct costs can be accurately traced because they can be physically identified with a particular object whereas indirect costs cannot. An estimate must be made of resources consumed by cost objects for indirect costs. Therefore, the more direct costs that can be traced to a cost object, the more accurate is the cost assignment.

The distinction between direct and indirect costs also depends on the cost object. A cost can be treated as direct for one cost object but indirect in respect of another. If the cost object is the cost of using different distribution channels, then the rental of warehouses and the salaries of storekeepers will be regarded as direct for each distribution channel. Also consider a supervisor's salary in a maintenance department of a manufacturing company. If the cost object is the maintenance department, then the salary is a direct cost. However, if the cost object is the product, both the warehouse rental and the salaries of the storekeepers and the supervisor will be an indirect cost because these costs cannot be specifically identified with the product.

CATEGORIES OF MANUFACTURING COSTS

In manufacturing organizations products are frequently the cost object. Traditionally, cost accounting systems in manufacturing organizations have reflected the need to assign costs to products to value stocks and measure profits based on imposed external financial accounting requirements. Traditional cost accounting systems accumulate product costs as follows:

Direct materials	xxx
Direct labour	xxx
Prime cost	xxx
Manufacturing overhead	xxx
Total manufacturing cost	xxx

Direct materials consist of all those materials that can be identified with a specific product. For example, wood that is used to manufacture a desk can easily be identified as part of the product, and can thus be classified as direct materials. Alternatively, materials used for the repair of a machine that is used for the manufacture of many different desks are classified as **indirect materials**. These items of materials cannot be identified with any one product, because they are used for the benefit of all products rather than for any one specific product. Note that indirect materials form part of the manufacturing overhead cost.

Direct labour consists of those labour costs that can be specifically traced to or identified with a particular product. Examples of direct labour costs include the wages of operatives who assemble parts into the finished product, or machine operatives engaged in the production process. By contrast, the salaries of factory supervisors or the wages paid to the staff in the stores department cannot be specifically identified with the product, and thus form part of the **indirect labour costs**. The wages of all employees who do not work on the product itself but who assist in the manufacturing operation are thus classified as part of the indirect labour costs. As with indirect materials, indirect labour is classified as part of the manufacturing overhead cost.

Prime cost refers to the direct costs of the product and consists of direct labour costs plus direct material costs plus any direct expenses. The cost of hiring a machine for producing a specific product is an example of a direct expense.

Manufacturing overhead consists of all manufacturing costs other than direct labour, direct materials and direct expenses. It therefore includes all indirect manufacturing labour and materials costs plus indirect manufacturing expenses. Examples of indirect manufacturing expenses in a multi-product company include rent of the factory and depreciation of machinery.

To ascertain the total manufacturing cost of a product, all that is required for the direct cost items is to record the amount of resources used on the appropriate documents. For example, the units of materials used in making a particular product are recorded on a stores requisition, and the hours of direct labour used are recorded on job cards. Having obtained the quantity of resources used for the direct items, it is necessary to ascertain the price paid for these resources. The total of the resources used multiplied by the price paid per unit of resources used provides us with the total of the direct costs or the prime cost for a product.

Manufacturing overheads cannot be directly traced to products. Instead they are assigned to products using **cost allocations**. A cost allocation is the process of estimating the cost of resources consumed by products that involves the use of surrogate, rather than direct measures. The process of assigning indirect costs (overheads) to cost objects will be explained in the next chapter.

Period and product costs

External financial accounting rules in most countries require that for inventory valuation, only manufacturing costs should be included in the calculation of product costs (see United Kingdom Statement of Standard Accounting Practice (SSAP 9), published by the Accounting Standards Committee). Accountants therefore classify costs as product costs and period costs. **Product costs** are those costs that are identified with goods purchased or produced for resale. In a manufacturing organization they are costs that the accountant attaches to the product and that are included in the inventory valuation for finished goods, or for partly completed goods (work in progress), until they are sold; they are then recorded as expenses and matched against sales for calculating profit. **Period costs** are those costs that are not included in the inventory valuation and as a result are treated as expenses in the period in which they are incurred. *Hence no attempt is made to attach period costs to products for inventory valuation purposes.*

In a manufacturing organization all manufacturing costs are regarded as product costs and non-manufacturing costs are regarded as period costs.[1] Companies operating in the merchandising sector, such as retailing or wholesaling organizations, purchase goods for resale without changing their basic form. The cost of the goods purchased is regarded as a product cost and all other costs such as administration and selling and distribution expenses are considered to be period costs. The treatment of period and product costs for a manufacturing organization is illustrated in Figure 2.1. You will see that both product and period costs are eventually classified as expenses. The major difference is the point in time at which they are so classified.

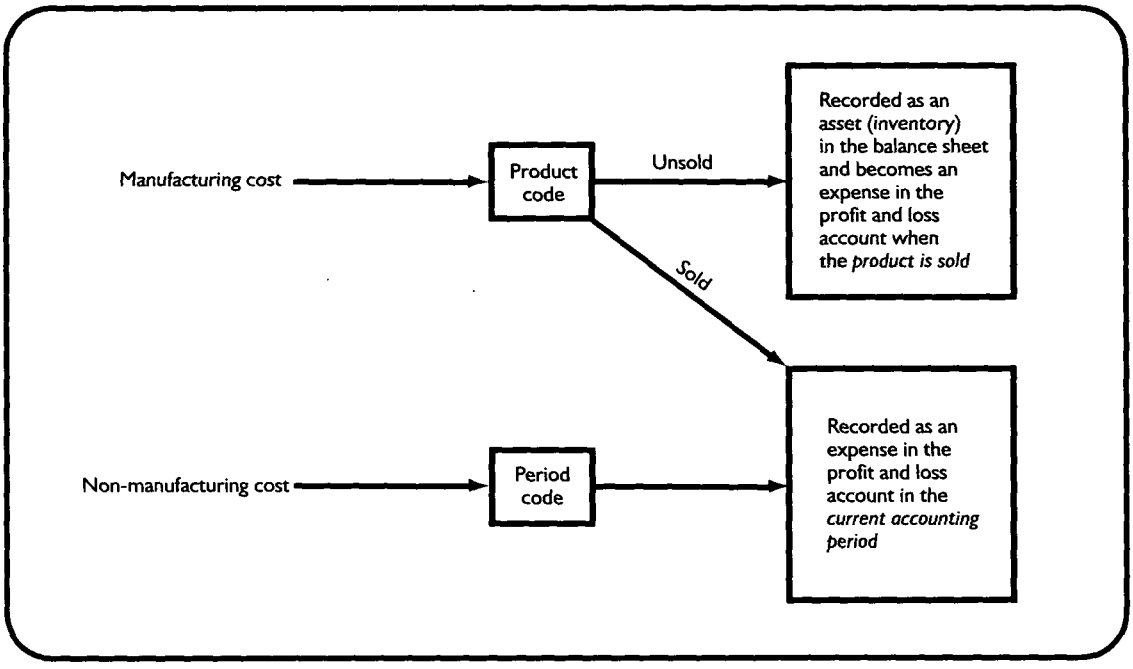
Why are non-manufacturing costs treated as period costs and not included in the inventory valuation? There are two reasons. First, inventories are assets (unsold production) and assets represent resources that have been acquired that are expected to contribute to future revenue. Manufacturing costs incurred in making a product can be expected to generate future revenues to cover the cost of production. There is no guarantee, however, that non-manufacturing costs will generate future revenue, because they do not represent value added to any specific product. Therefore, they are not included in the inventory valuation. Second, many non-manufacturing costs (e.g. distribution costs) are not incurred when the product is being stored. Hence it is inappropriate to include such costs within the inventory valuation.

Cost behaviour

A knowledge of how costs and revenues will vary with different levels of activity (or volume) is essential for decision-making. Activity or volume may be measured in terms of units of production or sales, hours worked, miles travelled, patients seen, students enrolled or any other appropriate measure of the activity of an organization. Examples of decisions that require information on how costs and revenues vary with different levels of activity include the following:

1. What should the planned level of activity be for the next year?
2. Should we reduce the selling price to sell more units?
3. Would it be wiser to pay our sales staff by a straight commission, a straight salary, or by some combination of the two?

FIGURE 2.1 *Treatment of period and product costs.*



4. How do the costs and revenues of a hospital change if one more patient is admitted for a seven-day stay?
5. How do the costs and revenues of a hotel change if a room and meals are provided for two guests for a seven-day stay?

For each of the above decisions management requires estimates of costs and revenues at different levels of activity for the alternative courses of action.

The terms 'variable', 'fixed', 'semi-variable' and 'semi-fixed' have been traditionally used in the management accounting literature to describe how a cost reacts to changes in activity. Short-term variable costs vary in direct proportion to the volume of activity; that is, doubling the level of activity will double the total variable cost. Consequently, *total* variable costs are linear and *unit* variable cost is constant. Figure 2.2 illustrates a variable cost where the variable cost per unit of activity is £10. It is unlikely that variable cost per unit will be constant for all levels of activity. We shall discuss the reasons why accountants normally assume that variable costs are constant per unit of activity in the next chapter. Examples of short-term variable manufacturing costs include piecework labour, direct materials and energy to operate the machines. These costs are assumed to fluctuate directly in proportion to operating activity within a certain range of activity. Examples of non-manufacturing variable costs include sales commissions, which fluctuate with sales value, and petrol, which fluctuates with the number of miles travelled.

Fixed costs remain constant over wide ranges of activity for a specified time period. Examples of fixed costs include depreciation of the factory building, supervisors' salaries and leasing charges for cars used by the salesforce. Figure 2.3 illustrates fixed costs.

You will see that the *total* fixed costs are constant for all levels of activity whereas *unit* fixed costs decrease proportionally with the level of activity. For example, if the total of the fixed costs is £5000 for a month the fixed costs per unit will be as follows:

FIGURE 2.2 *Variable costs: (a) total; (b) unit.*

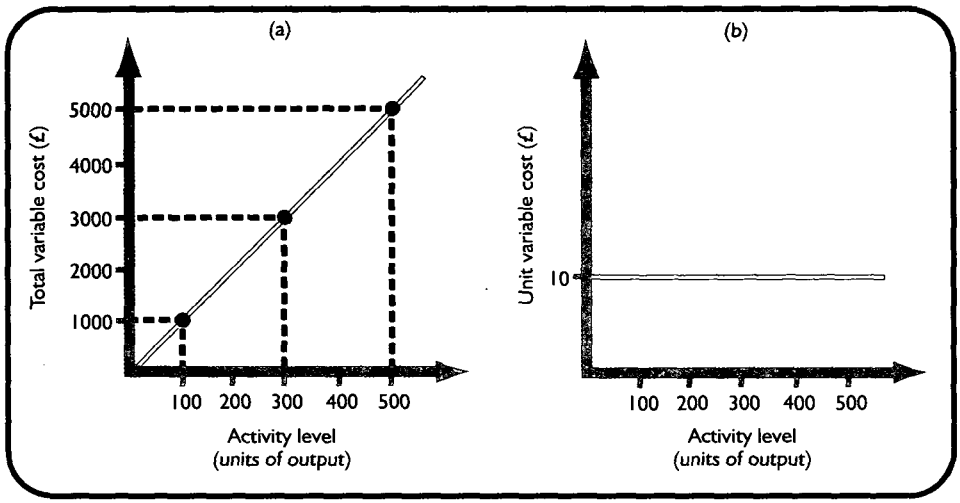
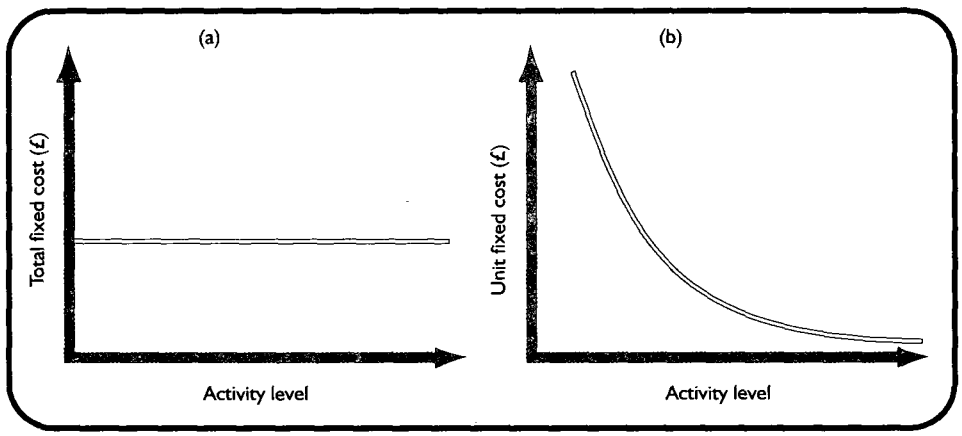


FIGURE 2.3 *Fixed costs: (a) total; (b) unit.*



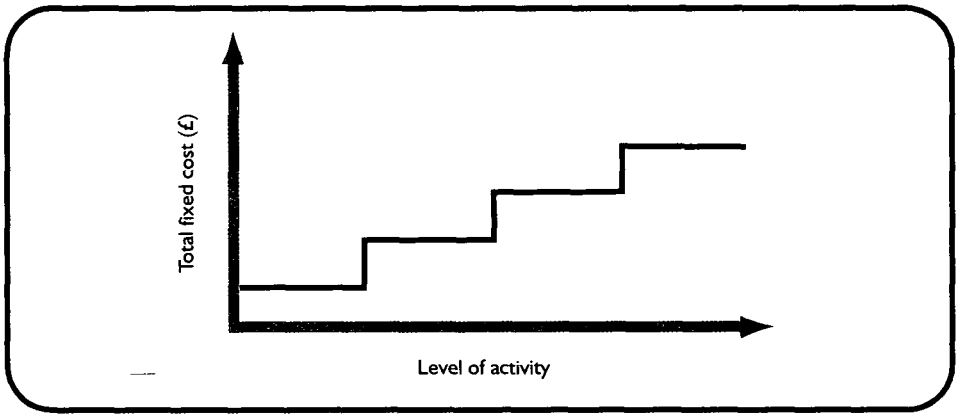
Units produced	Fixed cost per unit (£)
1	5000
10	500
100	50
1000	5

Because unit fixed costs are not constant per unit they must be interpreted with caution. For decision-making, it is better to work with total fixed costs rather than unit costs.

In practice it is unlikely that fixed costs will be constant over the full range of activity. They may increase in steps in the manner depicted in Figure 2.4. We shall discuss the justification for assuming that fixed costs are constant over a wide range of activity in the next chapter.

The distinction between fixed and variable costs must be made relative to the time period under consideration. Over a sufficiently long time period of several years, virtually

FIGURE 2.4 *Step fixed costs.*



all costs are variable. During such a long period of time, contraction in demand will be accompanied by reductions in virtually all categories of costs. For example, senior managers can be released, machinery need not be replaced and even buildings and land can be sold. Similarly, large expansions in activity will eventually cause all categories of costs to increase.

Within shorter time periods, costs will be fixed or variable in relation to changes in activity. The shorter the time period, the greater the probability that a particular cost will be fixed. Consider a time period of one year. The costs of providing the firm's operating capacity such as depreciation and the salaries of senior plant managers are likely to be fixed in relation to changes in activity. Decisions on the firm's intended future potential level of operating capacity will determine the amount of capacity costs to be incurred. These decisions will have been made previously as part of the capital budgeting and long-term planning process. Once these decisions have been made, they cannot easily be reversed in the short term. Plant investment and abandonment decisions should not be based on short-term fluctuations in demand within a particular year. Instead, they should be reviewed periodically as part of the long-term planning process and decisions made based on long-run demand over several years. Thus capacity costs will tend to be fixed in relation to changes of activity within short-term periods such as one year. However, over long-term periods of several years, significant changes in demand will cause capacity costs to change.

Spending on some fixed costs, such as direct labour and supervisory salaries, can be adjusted in the short term to reflect changes in activity. For example, if production activity declines significantly then direct workers and supervisors might continue to be employed in the hope that the decline in demand will be temporary; but if there is no upsurge in demand then staff might eventually be made redundant. If, on the other hand, production capacity expands to some critical level, additional workers might be employed, but the process of recruiting such workers may take several months. Thus within a short-term period, such as one year, labour costs can change in response to changes in demand in a manner similar to that depicted in Figure 2.4. Costs that behave in this manner are described as semi-fixed or step fixed costs. The distinguishing feature of step fixed costs is that within a given time period they are fixed within specified activity levels, but they eventually increase or decrease by a constant amount at various critical activity levels as illustrated in Figure 2.4.

Our discussion so far has assumed a one-year time period. Consider a shorter time period such as one month and the circumstances outlined in the previous paragraph where it takes several months to respond to changes in activity and alter spending levels. Over very short-term periods such as one month, spending on direct labour and supervisory salaries will be fixed in relation to changes in activity.

You should now understand that over a given short-term period, such as one year, costs will be variable, fixed or semi-fixed. Over longer-term time periods of several years, all costs will tend to change in response to large changes in activity (or to changes in the range and variety of products or services marketed), and fixed costs will become semi-fixed and change in the manner depicted in Figure 2.4. Because fixed costs do not remain fixed in the long-term, some writers prefer to describe them as **long-term variable costs**, but we shall continue to use the term 'fixed costs' since this is the term most widely used in the literature.

Note, however, that in the short term, even though fixed costs are normally assumed to remain unchanged in response to changes in the level of activity, they may change in response to other factors. For example, if price levels increase then some fixed costs such as management salaries will increase.

Before concluding our discussion of cost behaviour in relation to volume of activity, we must consider **semi-variable costs**. These include both a fixed and a variable component. The cost of maintenance is a semi-variable cost consisting of planned maintenance that is undertaken whatever the level of activity, and a variable element that is directly related to the level of activity. A further example of semi-variable costs is where sales representatives are paid a fixed salary plus a commission on sales.

Relevant and irrelevant costs and revenues

For decision-making, costs and revenues can be classified according to whether they are relevant to a particular decision. **Relevant costs and revenues** are those *future* costs and revenues that will be changed by a decision, whereas **irrelevant costs and revenues** are those that will not be affected by the decision. For example, if one is faced with a choice of making a journey by car or by public transport, the car tax and insurance costs are irrelevant, since they will remain the same whatever alternative is chosen. However, petrol costs for the car will differ depending on which alternative is chosen, and this cost will be relevant for decision-making.

Let us now consider a further illustration of the classification of relevant and irrelevant costs. Assume a company purchased raw materials a few years ago for £100 and that there appears to be no possibility of selling these materials or using them in future production apart from in connection with an enquiry from a former customer. This customer is prepared to purchase a product that will require the use of all these materials, but he is not prepared to pay more than £250 per unit. The additional costs of converting these materials into the required product are £200. Should the company accept the order for £250? It appears that the cost of the order is £300, consisting of £100 material cost and £200 conversion cost, but this is incorrect because the £100 material cost will remain the same whether the order is accepted or rejected. The material cost is therefore irrelevant for the decision, but if the order is accepted the conversion costs will change by £200, and this conversion cost is a relevant cost. If we compare the revenue of £250 with the relevant cost for the order of £200, it means that the order should be accepted, assuming of course that no higher-priced orders can be obtained elsewhere. The following calculation shows that this is the correct decision.

	Do not accept order (£)	Accept order (£)
Materials	100	100
Conversion costs	—	200
Revenue	—	(250)
Net costs	100	50

The net costs of the company are £50 less, or alternatively the company is £50 better off as a result of accepting the order. This agrees with the £50 advantage which was suggested by the relevant cost method.

In this illustration the sales revenue was relevant to the decision because future revenue changed depending on which alternative was selected; but sales revenue may also be irrelevant for decision-making. Consider a situation where a company can meet its sales demand by purchasing either machine A or machine B. The output of both machines is identical, but the operating costs and purchase costs of the machines are different. In this situation the sales revenue will remain unchanged irrespective of which machine is purchased (assuming of course that the quality of output is identical for both machines). Consequently, sales revenue is irrelevant for this decision; the relevant items are the operating costs and the cost of the machines. We have now established an important principle regarding the classification of cost and revenues for decision-making; namely, that in the short term not all costs and revenues are relevant for decision-making.

Avoidable and unavoidable costs

Sometimes the terms **avoidable** and **unavoidable costs** are used instead of relevant and irrelevant cost. Avoidable costs are those costs that may be saved by not adopting a given alternative, whereas unavoidable costs cannot be saved. Therefore, only avoidable costs are relevant for decision-making purposes. Consider the example that we used to illustrate relevant and irrelevant costs. The material costs of £100 are unavoidable and irrelevant, but the conversion costs of £200 are avoidable and hence relevant. The decision rule is to accept those alternatives that generate revenues in excess of the avoidable costs.

Sunk costs

These costs are the cost of resources already acquired where the total will be unaffected by the choice between various alternatives. They are costs that have been created by a decision made in the past and that cannot be changed by any decision that will be made in the future. The expenditure of £100 on materials that were no longer required, referred to in the preceding section, is an example of a **sunk cost**. Similarly, the written down values of assets previously purchased are sunk costs. For example, if a machine was purchased four years ago for £100 000 with an expected life of five years and nil scrap value then the written down value will be £20 000 if straight line depreciation is used. This written down value will have to be written off, no matter what possible alternative future action might be chosen. If the machine was scrapped, the £20 000 would be written off; if the machine was used for productive purposes, the £20 000 would still have to be written off. This cost cannot be changed by any future decision and is therefore classified as a sunk cost.

Sunk costs are irrelevant for decision-making, but they are distinguished from irrelevant costs because not all irrelevant costs are sunk costs. For example, a comparison of two alternative production methods may result in identical direct material expenditure for both alternatives, so the direct material cost is irrelevant because it will remain the same whichever alternative is chosen, but the material cost is not sunk cost since it will be incurred in the future.

Opportunity costs

Some costs for decision-making cannot normally be collected within the accounting system. Costs that are collected within the accounting system are based on past payments or commitments to pay at some time in the future. Sometimes it is necessary for decision-making to impute costs that will not require cash outlays, and these imputed costs are called opportunity costs. An **opportunity cost** is a cost that measures the opportunity that is lost or sacrificed when the choice of one course of action requires that an alternative course of action be given up. Consider the information presented in Example 2.1.

It is important to note that opportunity costs only apply to the use of scarce resources. Where resources are not scarce, no sacrifice exists from using these resources. In Example 2.1 if machine X was operating at 80% of its potential capacity then the decision to accept the contract would not have resulted in reduced production of product A. Consequently, there would have been no loss of revenue, and the opportunity cost would be zero.

You should now be aware that opportunity costs are of vital importance for decision-making. If no alternative use of resources exist then the opportunity cost is zero, but if resources have an alternative use, and are scarce, then an opportunity cost does exist.

EXAMPLE 2.1

A company has an opportunity to obtain a contract for the production of a special component. This component will require 100 hours of processing on machine X. Machine X is working at full capacity on the production of product A, and the only way in which the contract can be fulfilled is by reducing the output of product A. This will result in a lost profit contribution of £200. The contract will also result in *additional* variable costs of £1000.

If the company takes on the contract, it will sacrifice a profit contribution of £200 from the lost output of product A. This represents an opportunity cost, and should be included as part of the cost when negotiating for the contract. The contract price should at least cover the additional costs of £1000 plus the £200 opportunity cost to ensure that the company will be better off in the short term by accepting the contract.

Incremental and marginal costs

Incremental (also called **differential**) **costs** and revenues are the difference between costs and revenues for the corresponding items under each alternative being considered. For example, the incremental costs of increasing output from 1000 to 1100 units per week are the additional costs of producing an extra 100 units per week. Incremental costs may or

may not include fixed costs. If fixed costs change as a result of a decision, the increase in costs represents an incremental cost. If fixed costs do not change as a result of a decision, the incremental costs will be zero.

Incremental costs and revenues are similar in principle to the economist's concept of **marginal cost** and **marginal revenue**. The main difference is that marginal cost/revenue represents the additional cost/revenue of one extra unit of output whereas incremental cost/revenue represents the additional cost/revenue resulting from a group of additional units of output. The economist normally represents the theoretical relationship between cost/revenue and output in terms of the marginal cost/revenue of single additional units of output. We shall see that the accountant is normally more interested in the incremental cost/revenue of increasing production and sales to whatever extent is contemplated, and this is most unlikely to be a single unit of output.

Job costing and process costing systems

There are two basic types of systems that companies can adopt – job costing and process costing systems. **Job costing** relates to a costing system that is required in organizations where each unit or batch of output of a product or service is unique. This creates the need for the cost of each unit to be calculated separately. The term 'job' thus relates to each unique unit or batch of output. Job costing systems are used in industries that provide customized products or services. For example, accounting firms provide customized services to clients with each client requiring services that consume different quantities of resources. Engineering companies often make machines to meet individual customer specifications. The contracts undertaken by construction and civil engineering companies differ greatly for each customer. In all of these organizations costs must be traced to each individual customer's order.

In contrast, **process costing** relates to those situations where masses of identical units are produced and it is unnecessary to assign costs to individual units of output. Products are produced in the same manner and consume the same amount of direct costs and overheads. It is therefore unnecessary to assign costs to individual units of output. Instead, the average cost per unit of output is calculated by dividing the total costs assigned to a product or service for a period by the number of units of output for that period. Industries where process costing is widely used include chemical processing, oil refining, food processing and brewing.

In practice these two costing systems represent extreme ends of a continuum. The output of many organizations requires a combination of the elements of both job costing and process costing.

Maintaining a cost database

In the previous chapter we noted that a cost and management accounting system should generate information to meet the following requirements:

1. to allocate costs between cost of goods sold and inventories for internal and external profit measurement and inventory valuation;
2. to provide relevant information to help managers make better decisions;
3. to provide information for planning, control and performance measurement.

A database should be maintained, with costs appropriately coded and classified, so that relevant cost information can be extracted to meet each of the above requirements.

A suitable coding system enables costs to be accumulated by the required cost objects (such as products or services, departments, responsibility centres, distribution channels, etc.) and also to be classified by appropriate categories. Typical cost classifications, within the database are by categories of expense (direct materials, direct labour and overheads) and by cost behaviour (fixed and variable). In practice, direct materials will be accumulated by each individual type of material, direct labour by different grades of labour and overhead costs by different categories of indirect expenses (e.g. rent, depreciation, supervision, etc.).

For *inventory valuation* the costs of all partly completed products (work in progress) and unsold finished products can be extracted from the database to ascertain the total cost assigned to inventories. The cost of goods sold that is deducted from sales revenues to compute the profit for the period can also be extracted by summing the manufacturing costs of all those products that have been sold during the period.

The allocation of costs to products is inappropriate for *cost control and performance measurement*, as the manufacture of the product may consist of several different operations, all of which are the responsibility of different individuals. To overcome this problem, costs and revenues must be traced to the individuals who are responsible for incurring them. This system is known as **responsibility accounting**.

Responsibility accounting involves the creation of responsibility centres. A **responsibility centre** may be defined as an organization unit for whose performance a manager is held responsible. Responsibility centres enable accountability for financial results and outcomes to be allocated to individuals throughout the organization. The objective of responsibility accounting is to measure the results of each responsibility centre. It involves accumulating costs and revenues for each individual responsibility centre so that deviations from a performance target (typically the budget) can be attributed to the individual who is accountable for the responsibility centre.

For *cost control and performance measurement* the accountant produces performance reports at regular intervals for each responsibility centre. The reports are generated by extracting from the database costs analysed by responsibility centres and categories of expenses. Actual costs for each item of expense listed on the performance report should be compared with budgeted costs so that those costs that do not conform to plan can be pinpointed and investigated.

Future costs, rather than past costs, are required for *decision-making*. Therefore costs extracted from the database should be adjusted for anticipated price changes. We have noted that classification of costs by cost behaviour is important for evaluating the financial impact of expansion or contraction decisions. Costs, however, are not classified as relevant or irrelevant within the database because relevance depends on the circumstances. Consider a situation where a company is negotiating a contract for the sale of one of its products with a customer in an overseas country which is not part of its normal market. If the company has temporary excess capacity and the contract is for 100 units for one month only, then the direct labour cost will remain the same irrespective of whether or not the contract is undertaken. The direct labour cost will therefore be irrelevant. Let us now assume that the contract is for 100 units per month for three years and the company has excess capacity. For long-term decisions direct labour will be a relevant cost because if the contract is not undertaken direct labour can be redeployed or made redundant. Undertaking the contract will result in additional direct labour costs.

The above example shows that the classification of costs as relevant or irrelevant depends on the circumstances. In one situation a cost may be relevant, but in another the same cost may not be relevant. Costs can only be classified as relevant or irrelevant when the circumstances have been identified relating to a particular decision.

Where a company sells many products or services their profitability should be monitored at regular intervals so that potentially unprofitable products can be highlighted for a more detailed study of their future viability. This information is extracted from the database with costs reported by categories of expenses and divided into their fixed and variable elements. In Chapter 4 we shall focus in more detail on product/segmented profitability analysis. Finally, you should note that when the activities of an organization consist of a series of common or repetitive operations, targets or standard product costs, rather than actual costs, may be recorded in the database. Standard costs are predetermined costs; they are target costs that should be incurred under efficient operating conditions. They should be reviewed and updated at periodic intervals. If product standard costs are recorded in the database there is no need continuously to trace costs to products and therefore a considerable amount of data processing time can be saved. Actual costs, however, will still be traced to responsibility centres for cost control and performance evaluation.

Summary

The term cost has multiple meanings and different types of costs are used in different situations. Therefore a preceding term must be added to clarify the assumptions that underlie a cost measurement. A large terminology has emerged to indicate more clearly which cost meaning is being conveyed. This chapter has described the following basic cost terms that are used in the management accounting literature:

1. direct and indirect costs;
2. period and product costs;
3. cost behaviour in relation to volume of activity;
4. relevant and irrelevant costs;
5. avoidable and unavoidable costs;
6. sunk costs;
7. opportunity costs;
8. incremental and marginal costs.

A cost and management accounting system should generate information to meet the following requirements:

1. to allocate costs between cost of goods sold and inventories for internal and external reporting;
2. to provide relevant information to help managers make better decisions;
3. to provide information for planning, control and performance measurement.

A database should be maintained with costs appropriately coded or classified, so that relevant cost information can be extracted to meet each of the above requirements.

Notes

1 The Statement of Standard Accounting Practice on Stocks and Work in Progress (SSAP 9) requires that all manufacturing costs be regarded as product costs.

Key Terms and Concepts

avoidable cost (p. 29)
cost allocations (p. 23)
cost objects (p. 21)
differential cost (p. 30)
direct cost (p. 22)
direct labour (p. 23)
direct materials (p. 23)
fixed cost (p. 25)
incremental cost (p. 30)
indirect cost (p. 22)
indirect labour (p. 23)
indirect materials (p. 23)
irrelevant cost (p. 28)
job costing (p. 31)
long-term variable costs (p. 28)
manufacturing overhead (p. 23)
marginal cost/revenue (p. 31)
opportunity cost (p. 30)
period costs (p. 24)
prime cost (p. 23)
process costing (p. 31)
product costs (p. 24)
relevant cost (p. 28)
responsibility accounting (p. 32)
responsibility centre (p. 32)
semi-fixed costs (p. 27)
semi-variable costs (p. 28)
step fixed costs (p. 27)
sunk cost (p. 29)
unavoidable cost (p. 29)
variable cost (p. 25)

Review Problems

1. Classify each of the following as being usually fixed (F), variable (V), semi-fixed (SF) or semi-variable (SV):
   (a) direct labour;
   (b) depreciation on machinery;
   (c) factory rental;
   (d) supplies and other indirect materials;
   (e) advertising;
   (f) maintenance of machinery;
   (g) factory manager's salary;
   (h) supervisory personnel;
   (i) royalty payments.

2.

Data	**(£)**
Cost of motor car	5500
Trade-in price after 2 years or 60 000 miles is expected to be	1500
Maintenance – 6-monthly service costing	60
Spares/replacement parts, per 1000 miles	20
Vehicle licence, per annum	80
Insurance, per annum	150
Tyre replacements after 25 000 miles, four at £37.50 each	
Petrol, per gallon	1.90
Average mileage from one gallon is 25 miles.	

(a) From the above data you are required:
   (i) to prepare a schedule to be presented to management showing for the mileages of 5000, 10 000, 15 000 and 30 000 miles per annum:
      (1) total variable cost
      (2) total fixed cost
      (3) total cost
      (4) variable cost per mile (in pence to nearest penny)
      (5) fixed cost per mile (in pence to nearest penny)
      (6) total cost per mile (in pence to nearest penny)
      If, in classifying the costs, you consider that some can be treated as either variable or fixed, state the assumption(s) on which your answer is based together with brief supporting reason(s).
   (ii) on graph paper plot the information given in your answer to (i) above for the costs listed against (1), (2), (3) and (6).
   (iii) to read off from your graph(s) in (ii) and state the approximate total costs applicable to 18 000 miles and 25 000 miles and the total cost per mile at these two mileages.

(b) 'The more miles you travel, the cheaper it becomes.' Comment briefly on this statement.

(25 marks)
CIMA

Solutions to Review Problems

SOLUTION 1

(a) SV (or variable if direct labour can be matched exactly to output)
(b) F

(c) F
(d) V
(e) F (Advertising is a discretionary cost. See Chapter 10 for an explanation of this cost.)
(f) SV
(g) F
(h) SF
(i) V

SOLUTION 2

(a) (i)

Schedule of annual mileage costs

	5000 miles (£)	10 000 miles (£)	15 000 miles (£)	30 000 miles (£)
Variable costs:				
Spares	100	200	300	600
Petrol	380	760	1140	2280
Total variable cost	480	960	1440	2880
Variable cost per mile	0.096	0.096	0.096	0.096
Fixed costs				
Depreciation[a]	2000	2000	2000	2000
Maintenance	120	120	120	120
Vehicle licence	80	80	80	80
Insurance	150	150	150	150
Tyres[b]	–	–	75	150
	2350	2350	2425	2500
Fixed cost per mile	0.47	0.235	0.162	0.083
Total cost	2830	3310	3865	5380
Total cost per mile	0.566	0.331	0.258	0.179

Notes

[a]Annual depreciation

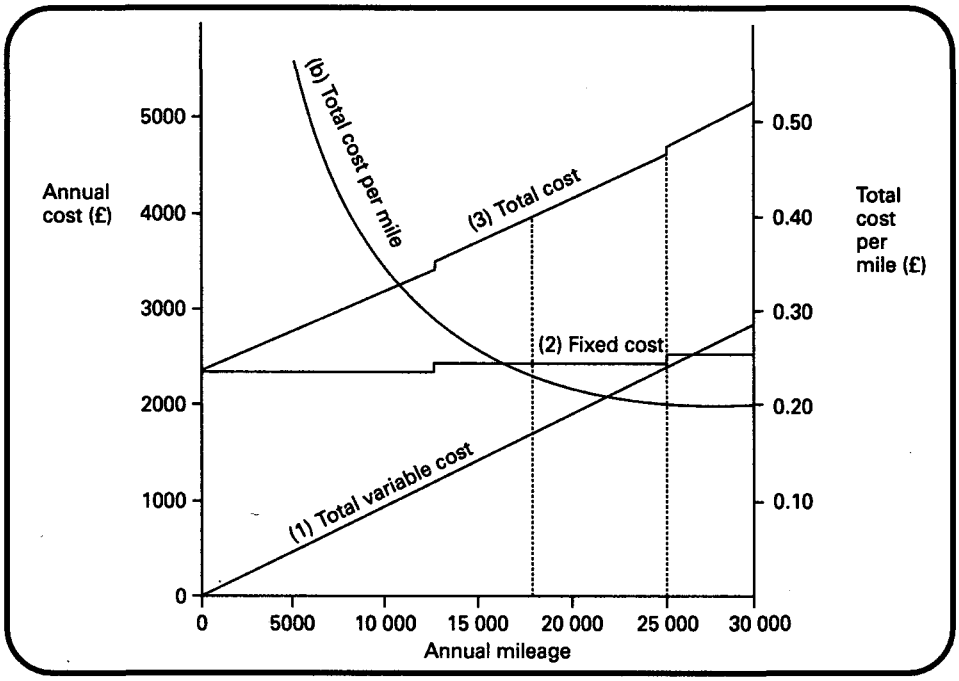
$$= \frac{5500 \text{ (cost)} - 1500 \text{ (trade-in price)}}{2 \text{ years}} = 2000$$

[b]At 15 000 miles per annum tyres will be replaced once during the two-year period at a cost of £150. The average cost per year is £75. At 30 000 miles per annum tyres will be replaced once each year.

Comments

Tyres are a semi-fixed cost. In the above calculations they have been regarded as a step fixed cost. An alternative approach would be to regard the semi-fixed cost as a variable cost by dividing £150 tyre replacement by 25 000 miles. This results in a variable cost per mile of £0.006.

FIGURE 1 *The step increase is fixed cost is assumed to occur at an annual mileage of 12 500 miles and 25 000 miles, because tyres are assumed to be replaced at this mileage.*



(a) (i) CONT. Depreciation and maintenance cost have been classified as fixed costs. They are likely to be semi-variable costs, but in the absence of any additional information they have been classified as fixed costs.

(ii) See Figure 1

(iii) The respective costs can be obtained from the vertical dashed lines in the graph (Figure 1)

(b) The *cost per mile* declines as activity increases. This is because the majority of costs are fixed and do not increase when mileage increases. However, *total costs* will increase with increases in mileage.

Questions

2.1

If actual output is lower than budgeted output, which of the following costs would you expect to be lower than the original budget?

A Total variable costs
B Total fixed costs
C Variable costs per unit
D Fixed costs per unit

ACCA

2.2

The following data relate to two output levels of a department:

Machine hours	17 000	18 500
Overheads	£246 500	£251 750

The variable overhead rate per hour is £3.50. The amount of fixed overheads is:

A £5250
B £59 500
C £187 000
D £246 500

CIMA

2.3

Prime cost is:

A all costs incurred in manufacturing a product;

B the total of direct costs;
C the material cost of a product;
D the cost of operating a department.

CIMA

2.4

A direct cost is a cost which:
A is incurred as a direct consequence of a decision;
B can be economically identified with the item being costed;
C cannot be economically identified with the item being costed;
D is immediately controllable;
E is the responsibility of the board of directors.

CIMA

2.5

Which of the following would be classed as indirect labour?
A assembly workers in a company manufacturing televisions;
B a stores assistant in a factory store;
C plasterers in a construction company;
D an audit clerk in a firm of auditors.

CIMA

2.6

Fixed costs are conventionally deemed to be:
A constant per unit of output;
B constant in total when production volume changes;
C outside the control of management;
D those unaffected by inflation.

CIMA

2.7

Prepare a report for the Managing Director of your company explaining how costs may be classified by their behaviour, with particular reference to the effects both on total and on unit costs. Your report should
(i) say why it is necessary to classify costs by their behaviour, and
(ii) be illustrated by sketch graphs within the body of the report. (15 marks)

CIMA

2.8

Describe three different methods of cost classification and explain the utility of each method.

(11 marks)
ACCA

2.9

Cost classifications used in costing include:
(i) period costs
(ii) product costs
(iii) variable costs
(iv) opportunity costs

Required:
Explain each of these classifications, with examples of the types of costs that may be included.

(17 marks)
ACCA

2.10

(a) Describe the role of the cost accountant in a manufacturing organization.

(8 marks)

(b) Explain whether you agree with each of the following statements:
(i) 'All direct costs are variable.'
(ii) 'Variable costs are controllable and fixed costs are not.'
(iii) 'Sunk costs are irrelevant when providing decision making information.'

(9 marks)
(Total 17 marks)
ACCA

2.11

'Cost may be classified in a variety of ways according to their nature and the information needs of management.' Explain and discuss this statement, illustrating with examples of the classifications required for different purposes.

(22 marks)
ICSA

2.12

It is commonly suggested that a management accounting system should be capable of supplying different measures of cost for different purposes. You are required to set out the main types of purpose for which cost information may be required in a business organization, and to discuss the alternative measures of cost which might be appropriate for each purpose.

ICAEW

2.13

Opportunity cost and *sunk cost* are among the concepts of cost commonly discussed.

You are required:
(i) to define these terms precisely;

(4 marks)

(ii) to suggest for each of them situations in which the concept might be applied;
(4 marks)

(iii) to assess briefly the significance of each of the concepts.
(4 marks)

ICAEW

2.14 Cost classification

For the relevant cost data in items (1)–(7), indicate which of the following is the best classification.

(a) sunk cost
(b) incremental cost
(c) variable cost
(d) fixed cost
(e) semi-variable cost
(f) semi-fixed cost
(g) controllable cost
(h) non-controllable cost
(i) opportunity cost

(1) A company is considering selling an old machine. The machine has a book value of £20 000. In evaluating the decision to sell the machine, the £20 000 is a ...

(2) As an alternative to the old machine, the company can rent a new one. It will cost £3000 a year. In analysing the cost–volume behaviour the rental is a ...

(3) To run the firm's machines, here are two alternative courses of action. One is to pay the operator a base salary plus a small amount per unit produced. This makes the total cost of the operators a ...

(4) As an alternative, the firm can pay the operators a flat salary. It would then use one machine when volume is low, two when it expands, and three during peak periods. This means that the total operator cost would now be a ...

(5) The machine mentioned in (1) could be sold for £8000. If the firm considers retaining and using it, the £8000 is a ...

(6) If the firm wishes to use the machine any longer, it must be repaired. For the decision to retain the machine, the repair cost is a ...

(7) The machine is charged to the foreman of each department at a rate of £3000 a year. In evaluating the foreman, the charge is a ...

2.15 Cost classification

A company manufactures and retails clothing. You are required to group the costs which are listed below and numbered (1)–(20) into the following classifications (each cost is intended to belong to only one classification):

(i) direct materials
(ii) direct labour
(iii) direct expenses
(iv) indirect production overhead
(v) research and development costs
(vi) selling and distribution costs
(vii) administration costs
(viii) finance costs

(1) Lubricant for sewing machines
(2) Floppy disks for general office computer
(3) Maintenance contract for general office photocopying machine
(4) Telephone rental plus metered calls
(5) Interest on bank overdraft
(6) Performing Rights Society charge for music broadcast throughout the factory
(7) Market research undertaken prior to a new product launch
(8) Wages of security guards for factory
(9) Carriage on purchase of basic raw material
(10) Royalty payable on number of units of product XY produced
(11) Road fund licences for delivery vehicles
(12) Parcels sent to customers
(13) Cost of advertising products on television
(14) Audit fees
(15) Chief accountant's salary
(16) Wages of operatives in the cutting department
(17) Cost of painting advertising slogans on delivery vans
(18) Wages of storekeepers in materials store
(19) Wages of fork lift truck drivers who handle raw materials
(20) Developing a new product in the laboratory
(10 marks)

CIMA

2.16 Analysis of costs by behaviour for decision-making

The Northshire Hospital Trust operates two types of specialist X-ray scanning machines, XR1 and XR50. Details for the next period are estimated as follows:

Machine	**XR1**	**XR50**
Running hours	1 100	2 000
	(£)	(£)
Variable running costs (excluding plates)	27 500	64 000
Fixed costs	20 000	97 500

A brain scan is normally carried out on machine type XR1: this task uses special X-ray plates costing £40 each and takes four hours of machine time. Because of the nature of the process, around

10% of the scans produce blurred and therefore useless results.

Required:

(a) Calculate the cost of a satisfactory brain scan on machine type XR1. (7 marks)

(b) Brain scans can also be done on machine type XR50 and would take only 1.8 hours per scan with a reduced reject rate of 6%. However, the cost of the X-ray plates would be £55 per scan.

Required:

Advise which type should be used, assuming sufficient capacity is available on both types of machine. (8 marks)

(Total marks 15)

CIMA

2.17 Sunk and opportunity costs for decision-making

Mrs Johnston has taken out a lease on a shop for a down payment of £5000. Additionally, the rent under the lease amounts to £5000 per annum. If the lease is cancelled, the initial payment of £5000 is forfeit. Mrs Johnston plans to use the shop for the sale of clothing, and has estimated operations for the next twelve months as follows:

	(£)	(£)
Sales	115 000	
Less Value-added tax (VAT)	15 000	
Sales Less VAT		100 000
Cost of goods sold	50 000	
Wages and wage related costs	12 000	
Rent including the down payment	10 000	
Rates, heating, lighting and insurance	13 000	
Audit, legal and general expenses	2 000	
		87 000
Net profit before tax		13 000

In the figures no provision has been made for the cost of Mrs Johnston but it is estimated that one half of her time will be devoted to the business. She is undecided whether to continue with her plans, because she knows that she can sublet the shop to a friend for a monthly rent of £550 if she does not use the shop herself.

You are required to:

(a) (i) explain and identify the 'sunk' and 'opportunity' costs in the situation depicted above;

(ii) state what decision Mrs Johnston should make according to the information given, supporting your conclusion with a financial statement;

(11 marks)

(b) explain the meaning and use of 'notional' (or 'imputed') costs and quote *two* supporting examples.

(4 marks)

(Total 15 marks)

CIMA

2.18 Relevant costs and cost behaviour

(a) Distinguish between 'opportunity cost' and 'out of pocket cost' giving a numerical example of each using your own figures to support your answer.

(6 marks)

(b) Jason travels to work by train to his 5-day week job. Instead of buying daily tickets he finds it cheaper to buy a quarterly season ticket which costs £188 for 13 weeks.

Debbie, an acquaintance, who also makes the same journey, suggests that they both travel in Jason's car and offers to give him £120 each quarter towards his car expenses. Except for weekend travelling and using it for local college attendance near his home on three evenings each week to study for his CIMA Stage 2, the car remains in Jason's garage.

Jason estimates that using his car for work would involve him, each quarter, in the following expenses:

	(£)
Depreciation (proportion of annual figure)	200
Petrol and oil	128
Tyres and miscellaneous	52

You are required to state whether Jason should accept Debbie's offer and to draft a statement to show clearly the monetary effect of your conclusion.

(5 marks)

(c) A company with a financial year 1 September

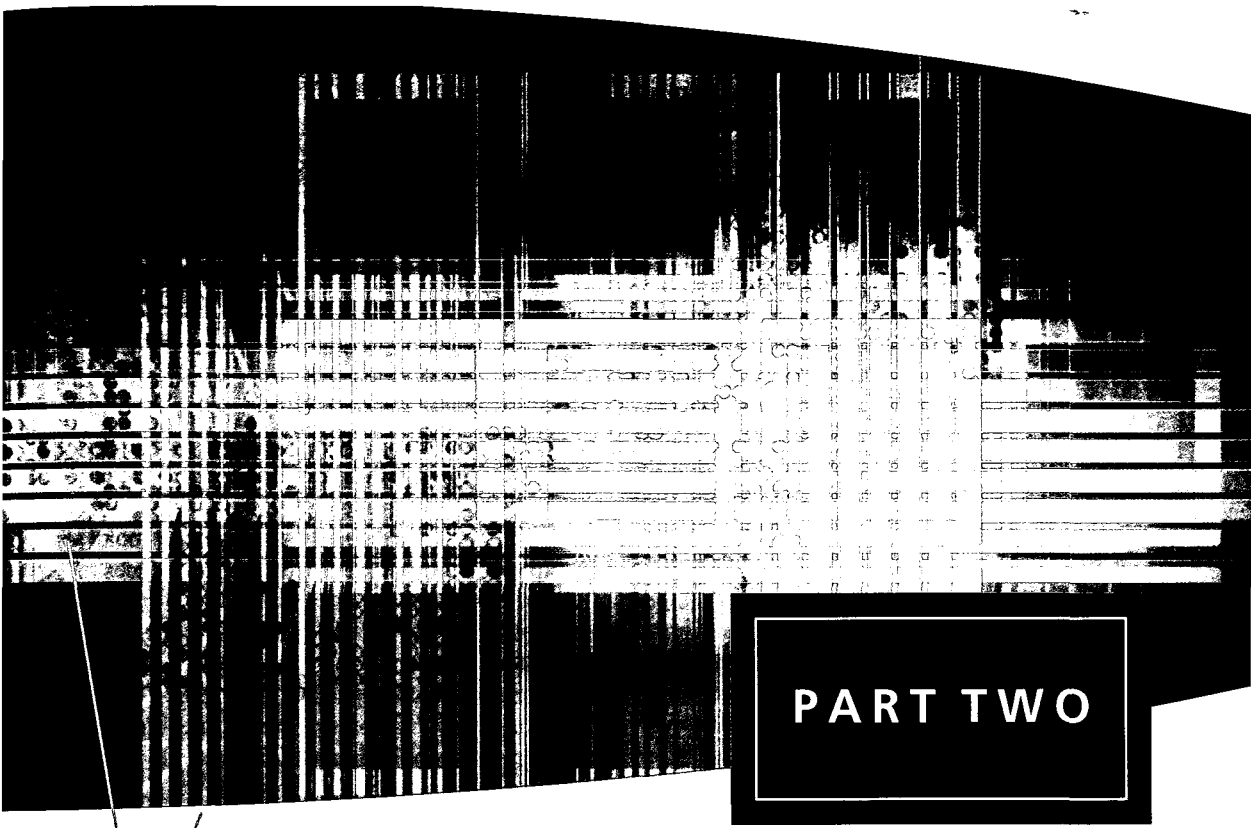
to 31 August prepared a sales budget which resulted in the following cost structure:

		% of sales
Direct materials		32
Direct wages		18
Production overhead:	variable	6
	fixed	24
Administrative and selling costs:	variable	3
	fixed	7
Profit		10

After ten weeks, however, it became obvious that the sales budget was too optimistic and it has now been estimated that because of a reduction in sales volume, for the full year, sales will total £2 560 000 which is only 80% of the previously budgeted figure.

You are required to present a statement for management showing the amended sales and cost structure in £s and percentages, in a marginal costing format.

(4 marks)
(Total 15 marks)
CIMA



PART TWO

Information for Decision-making

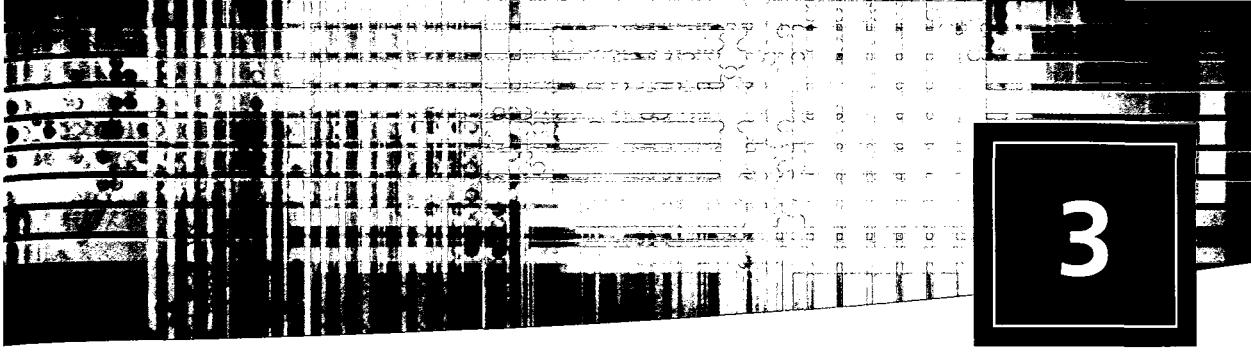
The objective of this Part, which contains seven chapters, is to consider the provision of financial information that will help managers to make better decisions. Chapters 3–8 are concerned mainly with short-term decisions based on the environment of today, and the physical, human and financial resources that are presently available to a firm; these decisions are determined to a considerable extent by the quality of the firm's long-term decisions. An important distinction between the long-term and short-term decisions is that the former cannot easily be reversed whereas the latter can often be changed. The actions that follow short-term decisions are frequently repeated, and it is possible for different actions to be taken in the future. For example, the setting of a particular selling price or product mix can often be changed fairly quickly. With regard to long-term decisions, such as capital investment, which involves, for example, the purchase of new plant and machinery, it is not easy to change a decision in the short term. Resources may only be available for major investments in plant and machinery at lengthy intervals, and it is unlikely that plant replacement decisions will be repeated in the short term.

Chapters 3–8 concentrate mainly on how accounting information can be applied to different forms of short-term decisions. Chapter 3 focuses on what

will happen to the financial results if a specific level of activity or volume fluctuates. This information is required for making optimal short-term output decisions. Chapter 4 examines how costs and revenues should be measured for a range of non-routine short-term and long-term decisions. Chapters 5 and 6 focus on alternative approaches for measuring resources consumed by cost objects. In Chapter 5 traditional product costing systems that were designed primarily for meeting financial accounting and stock valuation and profit measurement requirements are described. The cost information generated by traditional systems may not be sufficiently accurate for decision-making purposes. In Chapter 6 a more refined approach for measuring resources consumed by cost objects is described. This approach is called activity-based costing. Chapter 7 is concerned with profitability analysis and the provision of financial information for pricing decisions. Chapters 3–7 assume a world of certainty, whereas Chapter 8 introduces methods of incorporating uncertainty into the analysis, and the topics covered in Chapters 3–7 are re-examined under conditions of uncertainty.

The final chapter in this part is concerned with long-term decisions. Chapter 9 looks at the techniques that are used for evaluating capital investment decisions, and introduces the concept of the time value of money.

CHAPTER 3 COST–VOLUME–PROFIT ANALYSIS
CHAPTER 4 MEASURING RELEVANT COSTS AND REVENUES FOR DECISION-MAKING
CHAPTER 5 COST ASSIGNMENT
CHAPTER 6 ACTIVITY-BASED COSTING
CHAPTER 7 PRICING DECISIONS AND PROFITABILITY ANALYSIS
CHAPTER 8 DECISION-MAKING UNDER CONDITIONS OF RISK AND UNCERTAINTY
CHAPTER 9 CAPITAL INVESTMENT DECISIONS



3

Cost–volume–profit analysis

In this chapter we consider how management accounting information can be of assistance in providing answers to questions about the consequences of following particular courses of action. Such questions might include 'How many units must be sold to break-even?' 'What would be the effect on profits if we reduce our selling price and sell more units?' 'What sales volume is required to meet the additional fixed charges arising from an advertising campaign?' 'Should we pay our sales people on the basis of a salary only, or on the basis of a commission only, or by a combination of the two?' These and other questions can be answered using cost–volume–profit (CVP) analysis.

This is a systematic method of examining the relationship between changes in activity (i.e. output) and changes in total sales revenue, expenses and net profit. As a model of these relationships CVP analysis simplifies the real-world conditions that a firm will face. Like most models, which are abstractions from reality, CVP analysis is subject to a number of underlying assumptions and limitations, which will be discussed later in this chapter; nevertheless, it is a powerful tool for decision-making in certain situations.

This objective of CVP analysis is to establish what will happen to the financial results if a specified level of activity or volume fluctuates. This information is vital to management, since one of the most important variables influencing total sales revenue, total costs and profits is output or volume. For this reason output is given special attention, since knowledge of this relationship will enable management to identify the critical output levels, such as the level at which neither a profit nor a loss will occur (i.e. the break-even point).

CVP analysis is based on the relationship between volume and sales revenue, costs and profit in the short run, the short run normally being a period of one year, or less, in which the output of a firm is restricted to that available from the current operating capacity. In the short run, some inputs can be increased, but others cannot. For example, additional supplies of materials and unskilled labour may be obtained at short notice, but it takes time to expand the capacity of plant and machinery. Thus output is

Learning objectives

After studying this chapter, you should be able to:

- describe the differences between the accountant's and the economist's model of cost–volume–profit analysis;
- justify the use of linear cost and revenue functions in the accountant's model;
- apply the mathematical approach to answer questions similar to those listed in Example 3.1;
- construct break-even, contribution and profit–volume graphs;
- calculate break-even points for multi-product situations;
- identify and explain the assumptions on which cost–volume–profit analysis is based.

limited in the short run because plant facilities cannot be expanded. It also takes time to reduce capacity, and therefore in the short run a firm must operate on a relatively constant stock of production resources. Furthermore, most of the costs and prices of a firm's products will have already been determined, and the major area of uncertainty will be sales volume. Short-run profitability will therefore be most sensitive to sales volume. CVP analysis thus highlights the effects of changes in sales volume on the level of profits in the short run.

The theoretical relationship between total sales revenue, costs and profits with volume has been developed by economists. We therefore begin this chapter by describing the economist's model of CVP analysis.

The economist's model

An economist's model of CVP behaviour is presented in Figure 3.1. You will see that the total-revenue line is assumed to be curvilinear, which indicates that the firm is only able to sell increasing quantities of output by reducing the selling price per unit; thus the total revenue line does not increase proportionately with output. To increase the quantity of sales, it is necessary to reduce the unit selling price, which results in the total revenue line rising less steeply, and eventually beginning to decline. This is because the adverse effect of price reductions outweighs the benefits of increased sales volume.

The total cost line AD shows that, between points A and B, total costs rise steeply at first as the firm operates at the lower levels of the volume range. This reflects the difficulties of efficiently operating a plant designed for much larger volume levels. Between points B and C, the total cost line begins to level out and rise less steeply because the firm is now able to operate the plant within the efficient operating range and can take advantage of specialization of labour, and smooth production schedules. In the upper portion of the volume range the total cost line between points C and D rises more and more steeply as the cost per unit increases. This is because the output per direct labour hour declines when the plant is operated beyond the activity level for which it was designed: bottlenecks develop, production schedules become more complex, and plant breakdowns begin to occur. The overall effect is that the cost per unit of output increases and causes the total cost line to rise steeply.

The dashed horizontal line from point A represents the cost of providing the basic operating capacity, and is the economist's interpretation of the total fixed costs of the firm. Note also from Figure 3.1 that the shape of the total revenue line is such that it crosses the total cost line at two points. In other words, there are two output levels at which the total costs are equal to the total revenues; or more simply, there are two break-even points.

It is the shape of the variable cost function in the economist's model that has the most significant influence on the total cost function; this is illustrated in Figure 3.2. The economist assumes that the average *unit* variable cost declines initially, reflecting the fact that, as output expands, a firm is able to obtain bulk discounts on the purchase of raw

FIGURE 3.1 *Economist's cost–volume graph.*

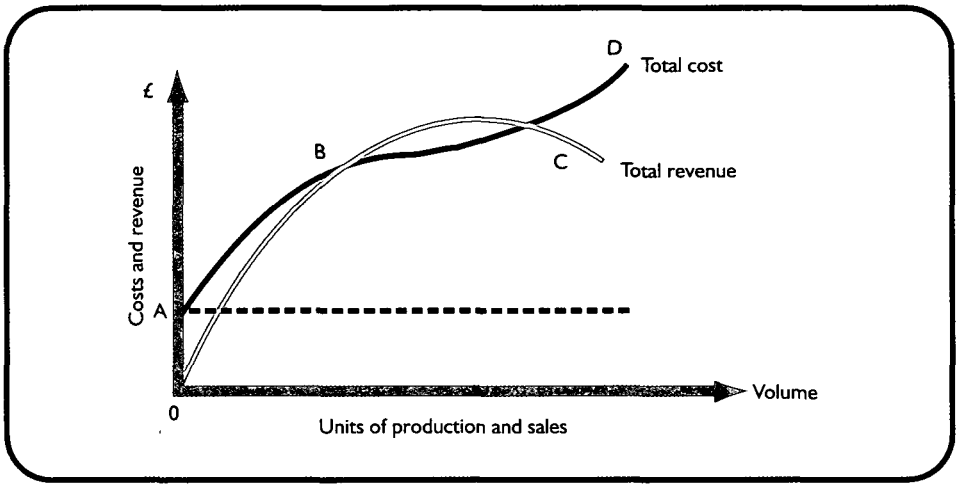
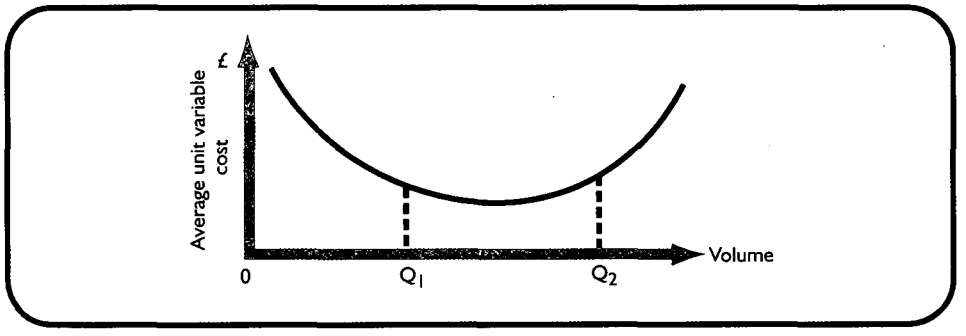


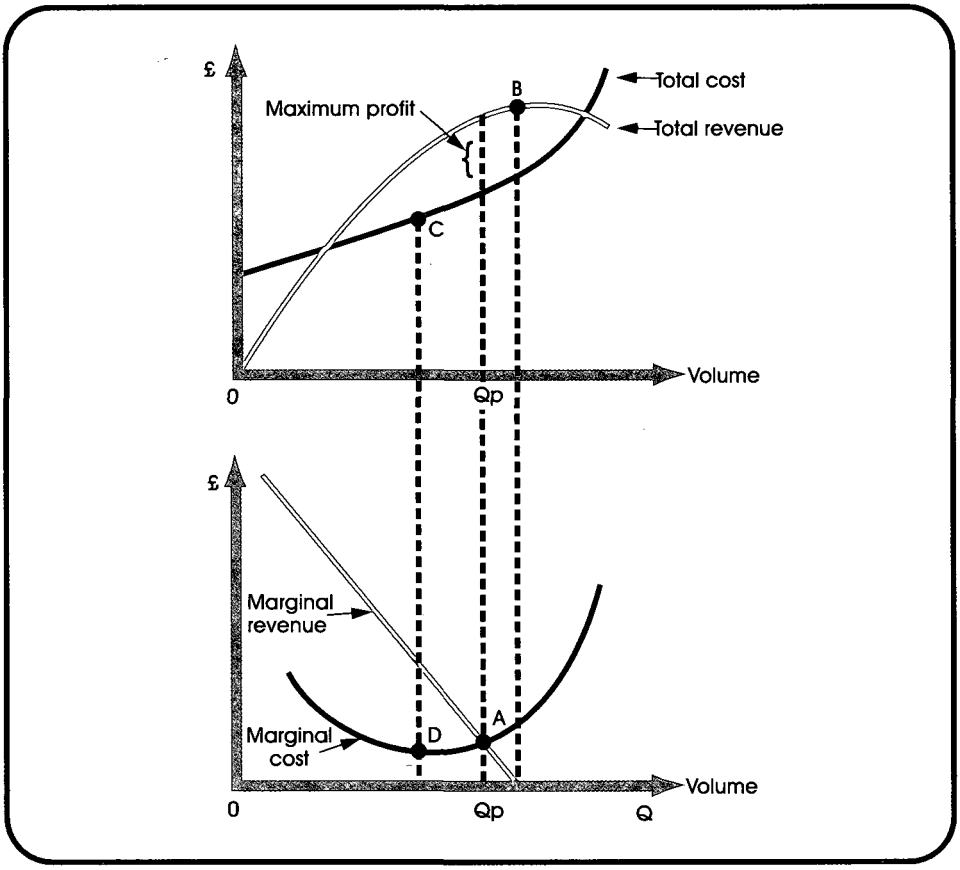
FIGURE 3.2 *Economist's variable cost function.*



materials and can benefit from the division of labour; this results in the labour cost per unit being reduced. The economist refers to this situation as **increasing returns to scale**. The fact that *unit* variable cost is higher at lower levels of activity causes the total cost line between points A and B in Figure 3.1 to rise steeply. From Figure 3.2 you can see that the *unit* variable cost levels out between output levels Q_1 and Q_2 and then gradually begins to rise. This is because the firm is operating at its most efficient output level, and further economies of scale are not possible in the short term. However, beyond output level Q_2, the plant is being operated at a higher level than that for which it was intended, and bottlenecks and plant breakdowns occur. The effect of this is that output per direct labour hour declines, and causes the variable cost per unit to increase. The economist describes this situation as **decreasing returns to scale**.

It is the shape of the variable cost function that causes the total cost line to behave in the manner indicated in Figure 3.1. Between points B and C, the total cost line rises less steeply, indicating that the firm is operating in the range where unit variable cost is at its

FIGURE 3.3 *Economist's marginal revenue and marginal costs diagrams, and total revenue and total costs diagrams.*



lowest. Between points C and D, the total cost line rises more steeply, since the variable cost per unit is increasing owing to decreasing returns to scale.

MARGINAL REVENUE AND MARGINAL COST PRESENTATION

The normal presentation of the economist's model is in terms of the marginal revenue and marginal cost curves. Marginal revenue represents the increase in total revenue from the sale of one additional unit. Figure 3.3 is in two parts, with the lower diagram presenting the traditional marginal revenue and marginal cost diagram; the top diagram repeats Figure 3.1. A comparison of the two diagrams in Figure 3.3 enables us to reconcile the traditional marginal revenue and marginal cost diagram with the total cost and total revenue presentation. Economic theory states that the profit maximizing output level is the point at which marginal cost equals marginal revenue. This occurs at Point A on the lower diagram, at output level Q_p. Note that in the top diagram this is the point at which the difference between the total revenue and total cost lines is the greatest. The point where total revenue reaches a maximum, point B, is where marginal revenue is equal to zero. Also note that the marginal cost curve reaches a minimum at point D, where the total cost curve (at point C) changes from concave downwards to concave upwards. Let us now compare the accountant's CVP diagram, or break-even model as it is sometimes called, with the economist's model.

The accountant's cost–volume–profit model

The diagram for the accountant's model is presented in Figure 3.4. Note that the dashed line represents the economist's total cost function, which enables a comparison to be made with the accountant's total cost function. The accountant's diagram assumes a variable cost and a selling price that are constant per unit; this results in a linear relationship (i.e. a straight line) for total revenue and total cost as volume changes. The effect is that there is only one **break-even point** in the diagram, and the profit area widens as volume increases. The most profitable output is therefore at maximum practical capacity. Clearly, the economist's model appears to be more realistic, since it assumes that the total cost curve is non-linear.

RELEVANT RANGE

How can we justify the accountants' assumption of linear cost and revenue functions? The answer is that the accountants' diagram is not intended to provide an accurate representation of total cost and total revenue throughout all ranges of output. The objective is to represent the behaviour of total cost and revenue over the range of output at which a firm expects to be operating within a short-term planning horizon. This range of output is represented by the output range between points X and Y in Figure 3.4. The term **relevant range** is used to refer to the output range at which the firm expects to be operating within a short-term planning horizon. This relevant range also broadly represents the output levels which the firm has had experience of operating in the past and for which cost information is available.

You can see from Figure 3.4 that, between points X and Y, the shape of the accountant's total cost line is very similar to that of the economist's. This is because the total cost line is only intended to provide a good approximation within the relevant range. Within this range, the accountant assumes that the variable cost per unit is the same throughout the entire range of output, and the total cost line is therefore linear. Note that the cost function is approximately linear within this output range. It would be unwise, however, to make this assumption for production levels outside the relevant range. It would be more appropriate if the accountant's total cost line was presented for the relevant range of output only, and not extended to the vertical axis or to the output levels beyond Y in Figure 3.4.

FIXED COST FUNCTION

Note also that the accountant's fixed cost function in Figure 3.4 meets the vertical axis at a different point to that at which the economist's total cost line meets the vertical axis. The reason for this can be explained from Figure 3.5. The fixed cost level of 0A may be applicable to, say, activity level Q_2 to Q_3, but if there were to be a prolonged economic recession then output might fall below Q_1, and this could result in redundancies and shutdowns. Therefore fixed costs may be reduced to 0B if there is a prolonged and a significant decline in sales demand. Alternatively, additional fixed costs will be incurred if long-term sales volume is expected to be greater than Q_3. Over a longer-term time horizon, the fixed cost line will consist of a series of step functions rather than the horizontal straight line depicted in Figure 3.4. However, since within its short-term planning horizon the firm expects to be operating between output levels Q_2 and Q_3, it will be committed, in the short term, to fixed costs of 0A; but you should remember that if there was a prolonged economic recession then in the longer term fixed costs may be reduced to 0B.

FIGURE 3.4 *Accountant's cost–volume–profit diagram.*

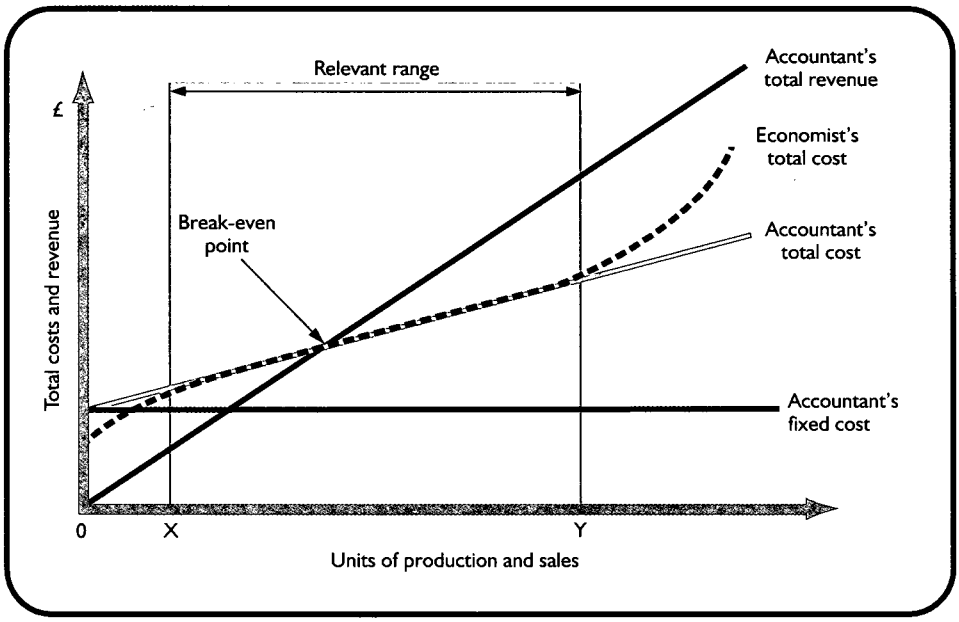
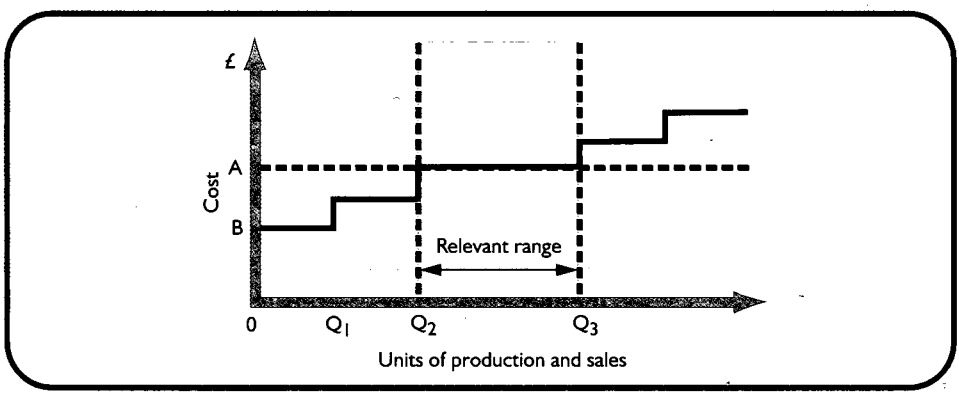


FIGURE 3.5 *Accountant's fixed costs.*

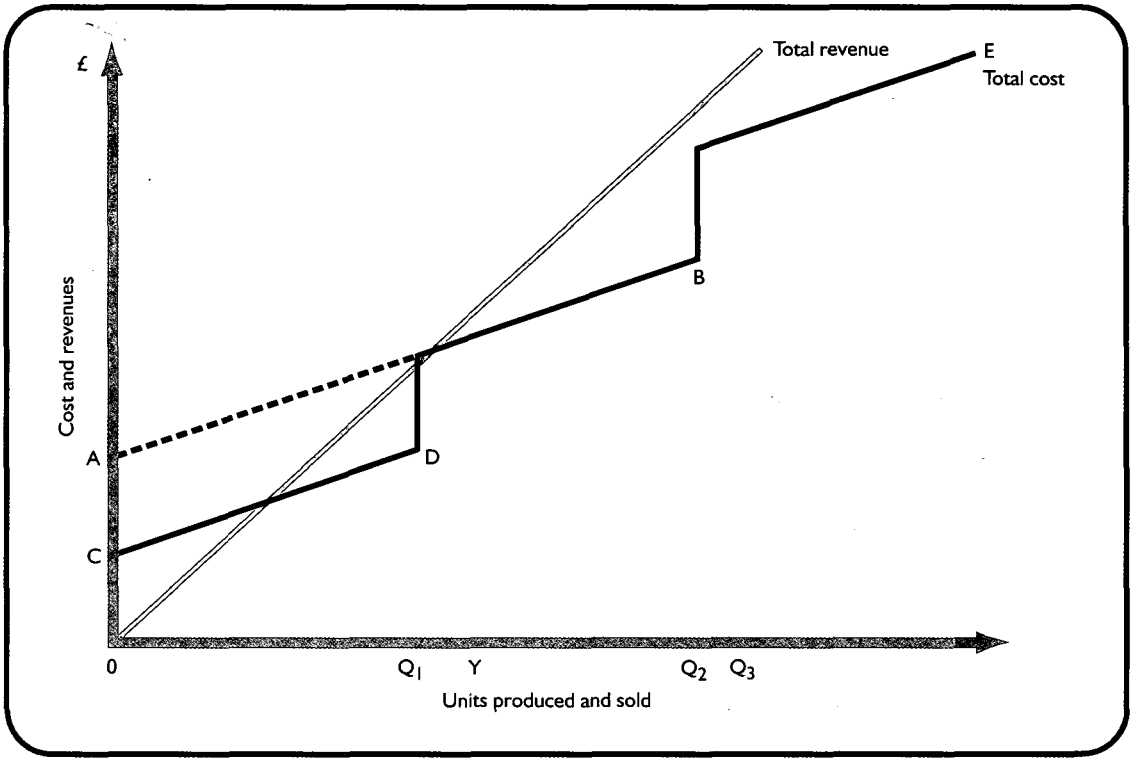


The fixed cost line for output levels below Q_1 (i.e. 0B) represents the cost of providing the basic operating capacity, and this line is the equivalent to the point where the economist's total cost line meets the vertical axis in Figure 3.4. Because the accountant assumes that in the short term the firm will operate in the relevant range between Q_2 and Q_3, the accountant's fixed cost line 0A in Figure 3.5 represents the fixed costs for the relevant output range only, which the firm is committed to in the current period and does not represent the fixed costs that would be incurred at the extreme levels of output beyond the shaded area in Figure 3.5.

TOTAL REVENUE FUNCTION

Let us now compare the total revenue line for the accountant and the economist. We have seen that the accountant assumes that selling price is constant over the relevant range of output, and therefore the total revenue line is a straight line. The accountant's assumption

FIGURE 3.6 *Increase in fixed costs.*



about the revenue line is a realistic one in those firms that operate in industries where selling prices tend to be fixed in the short term. A further factor reinforcing the assumption of a fixed selling price is that competition may take the form of non-price rather than price competition. Moreover, beyond the relevant range, increases in output may only be possible by offering substantial reductions in price. As it is not the intention of firms to operate outside the relevant range, the accountant makes no attempt to produce accurate revenue functions outside this range. It might be more meaningful in Figure 3.4 if the total revenue line was presented for output levels X and Y within the relevant range, instead of being extended to the left and right of these points.

Application to longer-term time horizons

CVP analysis becomes more complex and questionable if we extend our application to a longer term time horizon. Consider a capacity expansion decision. The expansion of output beyond certain points may require increments of fixed costs such as additional supervision and machinery, the appointment of additional sales persons and the expansion of the firm's distribution facilities. Such increases are incorporated in Figure 3.6. Note from this figure that if the current output level is OQ_1 then additional facilities are required, thus increasing fixed costs, if output is to be increased beyond this level. Similarly, additional fixed costs must be incurred to expand output beyond OQ_2.

At this point, for a capacity expansion decision, we are moving from beyond the short term to a longer term application of CVP analysis. In the longer term, other factors besides volume are likely to be important. For example, to utilize the additional capacity

reductions in selling prices and alternative advertising strategies may be considered. Also consideration may be given to expanding the product range and mix. Therefore, for longer-term decisions other variables besides volume are likely to have an impact on total costs, total revenues and profits. These additional variables cannot be easily incorporated into the CVP analysis. Hence, the CVP analysis presented in Figure 3.6 is unlikely to be appropriate for long-term decisions because other variables, that are not captured by the CVP analysis, are unlikely to remain unchanged. CVP analysis is only appropriate if all variables, other than volume, remain unchanged.

Let us now assume that management has undertaken a detailed analysis, without using CVP analysis, that incorporates all of these other variables and has concluded that extra fixed costs should be incurred to expand output to a maximum level of OQ_2 as shown in Figure 3.6. For simplicity we shall also assume that the total cost functions are the same as those described in Figure 3.6.

Once a decision has been made to provide productive capacity equal to a maximum of OQ_2, a separate graph may be presented with a total cost function represented by line AB and maximum output of OQ_2. In this revised graph the step increases in fixed costs will not be included, since management has already made a decision to aim to operate within the output range Q_1 to Q_2. Assuming that the total revenue is the same as that depicted in Figure 3.6 the revised graph can now be used as a short-term planning tool to demonstrate the impact that short-term output decisions have on profits. It is this revised graph that was used as a basis for comparing the accountant's and the economist's CVP presentation earlier in this chapter.

A mathematical approach to cost–volume–profit analysis

Instead of using a diagram to present CVP information, we can use mathematical relationships. The mathematical approach is a quicker and more flexible method of producing the appropriate information than the graphical approach, and is a particularly appropriate form of input to a computer financial model.

When developing a mathematical formula for producing CVP information, you should note that one is assuming that selling price and costs remain constant per unit of output. Such an assumption may be valid for unit selling price and variable cost, but remember that in Chapter 2 we noted that in the short run fixed costs are a constant *total* amount whereas *unit* cost changes with output levels. As a result, profit per *unit* also changes with volume. For example, if fixed costs are £10 000 for a period and output is 10 000 units, the fixed cost will be £1 per unit. Alternatively, if output is 5000 units, the fixed cost will be £2 per unit. Profit per unit will not therefore be constant over varying output levels and it is incorrect to unitize fixed costs for CVP decisions.

We can develop a mathematical formula from the following relationship:

$$\text{net profit} = (\text{units sold} \times \text{unit selling price}) - [(\text{units sold} \times \text{unit variable cost}) + \text{total fixed costs}]$$

The following symbols can be used to represent the various items in the above equation:

NP = net profit
x = units sold
P = selling price
b = unit variable cost
a = total fixed costs

EXAMPLE 3.1

Norvik Enterprises operate in the leisure and entertainment industry and one of its activities is to promote concerts at locations throughout Europe. The company is examining the viability of a concert in Stockholm. Estimated fixed costs are £60 000. These include the fees paid to perfomers, the hire of the venue and advertising costs. Variable costs consist of the cost of a pre-packed buffet which will be provided by a firm of caterers at a price, which is currently being negotiated, but it is likely to be in the region of £10 per ticket sold. The proposed price for the sale of a ticket is £20. The management of Norvic have requested the following information:

1. The number of tickets that must be sold to break-even (that is, the point at which there is neither a profit or loss).
2. How many tickets must be sold to earn £30 000 target profit?
3. What profit would result if 8000 tickets were sold?
4. What selling price would have to be charged to give a profit of £30 000 on sales of 8000 tickets, fixed costs of £60 000 and variable costs of £10 per ticket?
5. How many additional tickets must be sold to cover the extra cost of television advertising of £8000?

The equation can now be expressed in mathematical terms as

$$NP = Px - (a + bx) \tag{3.1}$$

You should now refer to Example 3.1. This example will be used to illustrate the application of the mathematical approach to CVP analysis.

Let us now provide the information requested in Example 3.1.

1. BREAK-EVEN POINT IN UNITS (I.E. NUMBER OF TICKETS SOLD)

Since $NP = Px - (a + bx)$, the break-even point is at a level of output (x) where

$$a + bx = Px - NP$$

Substituting the information in Example 3.1, we have

$$\begin{aligned} 60\,000 + 10x &= 20x - 0 \\ 60\,000 &= 10x \end{aligned}$$

and so $x = 6000$ tickets (or £120 000 total sales at £20 per ticket).

An alternative method, called the **contribution margin** approach, can also be used. Contribution margin is equal to sales minus variable expenses. Because the variable cost per unit and the selling price per unit are assumed to be constant the contribution margin per unit is also assumed to be constant. In Example 3.1 note that each ticket sold generates a contribution of £10, which is available to cover fixed costs and, after they are covered, to

contribute to profit. When we have obtained sufficient total contribution to cover fixed costs, the break-even point is achieved, and the alternative formula is

$$\text{break-even point in units} = \frac{\text{fixed costs}}{\text{contribution per unit}}$$

The contribution margin approach can be related to the mathematical formula approach. Consider the penultimate line of the formula approach; it reads

$$£60\,000 = 10x$$

and so

$$x = \frac{£60\,000}{£10}$$

giving the contribution margin formula

$$\frac{\text{fixed costs}}{\text{contribution per unit}}$$

The contribution margin approach is therefore a restatement of the mathematical formula, and either technique can be used; it is a matter of personal preference.

2. UNITS TO BE SOLD TO OBTAIN A £30 000 TARGET PROFIT

Using the equation $NP = Px - (a + bx)$ and substituting the information in Example 3.1, we have

$$£30\,000 = £20x - (£60\,000 + £10x)$$
$$£90\,000 = £10x$$

and so

$$x = 9000 \text{ tickets}$$

If we apply the contribution margin approach and wish to achieve the desired profit, we must obtain sufficient contribution to cover the fixed costs (i.e. the break-even point) plus a further contribution to cover the target profit. Hence we simply add the target profit to the fixed costs so that the equation using the contribution margin approach is

$$\text{units sold for desired profit} = \frac{\text{fixed costs + target profit}}{\text{contribution per unit}}$$

This is merely a restatement of the penultimate line of the mathematical formula, which reads

$$£90\,000 = £10x$$

and so

$$x = \frac{£90\,000}{£10}$$

3. PROFIT FROM THE SALE OF 8000 TICKETS

Substituting in the equation $NP = Px - (a + bx)$, we have

$$NP = £20 \times 8000 - (£60\,000 + £10 \times 8000)$$
$$= £160\,000 - (£60\,000 + £80\,000)$$

and so

$$NP = £20\,000$$

Let us now assume that we wish to ascertain the impact on profit if a further 1000 tickets are sold so that sales volume increases from 8000 to 9000 tickets. Assuming that fixed

costs remain unchanged, the impact on a firm's profits resulting from a change in the number of units sold can be determined by multiplying the unit contribution margin by the change in units sold. Therefore the increase in profits will be £10 000 (1000 units times a unit contribution margin of £10).

4. SELLING PRICE TO BE CHARGED TO SHOW A PROFIT OF £30 000 ON SALES OF 8000 UNITS

Applying the formula for net profit (i.e. Equation 3.1)

$$£30\,000 = 8000P - (£60\,000 + (£10 \times 8000))$$
$$= 8000P - £140\,000$$

giving $8000P = £170\,000$

and $P = £21.25$ (i.e. an increase of £1.25 per ticket)

5. ADDITIONAL SALES VOLUME TO MEET £8000 ADDITIONAL FIXED ADVERTISING CHARGES

The contribution per unit is £10 and fixed costs will increase by £8000. Therefore an extra 800 tickets must be sold to cover the additional fixed costs of £8000.

THE PROFIT–VOLUME RATIO

The **profit–volume ratio** (also known as the **contribution margin ratio**) is the contribution divided by sales. It represents the proportion of each £1 sales available to cover fixed costs and provide for profit. In Example 3.1 the contribution is £10 per unit and the selling price is £20 per unit; the profit–volume ratio is 0.5. This means that for each £1 sale a contribution of £0.50 is earned. Because we assume that selling price and contribution per unit are constant, the profit–volume ratio is also assumed to be constant. Therefore the profit–volume ratio can be computed using either unit figures or total figures. Given an estimate of total sales revenue, it is possible to use the profit–volume ratio to estimate total contribution. For example, if total sales revenue is estimated to be £200 000, the total contribution will be £100 000 (£200 000 × 0.5). To calculate the profit, we deduct fixed costs of £60 000; thus a profit of £40 000 will be obtained from total sales revenue of £200 000.

Expressing the above computations in mathematical terms:

$$\text{NP} = (\text{Sales revenue} \times \text{PV ratio}) - \text{Fixed costs}$$
$$\text{NP} + \text{Fixed cost} = \text{Sales revenue} \times \text{PV ratio}$$

Therefore the break-even sales revenue (where NP = 0) = Fixed costs/PV ratio.

RELEVANT RANGE

It is vital to remember that, as with the mathematical approach, the formulae method can only be used for decisions that result in outcomes within the relevant range. Outside this range the unit selling price and the variable cost are no longer deemed to be constant per unit, and any results obtained from the formulae that fall outside the relevant range will be incorrect. The concept of the relevant range is more appropriate for production settings but

it can apply within non-production settings. Returning to Norvic Enterprises in Example 3.1, let us assume that the caterers will charge a higher price up to 4000 tickets sold but reductions will apply for sales volumes in excess of 12 000 tickets. Thus, the £10 variable cost relates only to a sales volume within a range of 4000 – 12 000 tickets. Outside this range other costs apply. Also the number of seats made available at the venue is flexible and the hire cost will be reduced for sales of less than 4000 tickets and increased for sales beyond 12 000 tickets. In other words, we will assume that the relevant range is a sales volume of 4000–12 000 tickets and outside this range the results of our CVP analysis do not apply.

Margin of safety

The **margin of safety** indicates by how much sales may decrease before a loss occurs. Using Example 3.1, where unit selling price and variable cost were £20 and £10 respectively and fixed costs were £60 000, we noted that the break-even point was 6000 tickets or £120 000 sales value. If sales are expected to be 8000 tickets or £160 000, the margin of safety will be 2000 tickets or £40 000. Alternatively, we can express the margin of safety in a percentage form based on the following ratio:

$$\text{percentage margin of safety} = \frac{\text{expected sales} - \text{break-even sales}}{\text{expected sales}}$$

$$= \frac{£160\,000 - £120\,000}{£160\,000} = 25\%$$

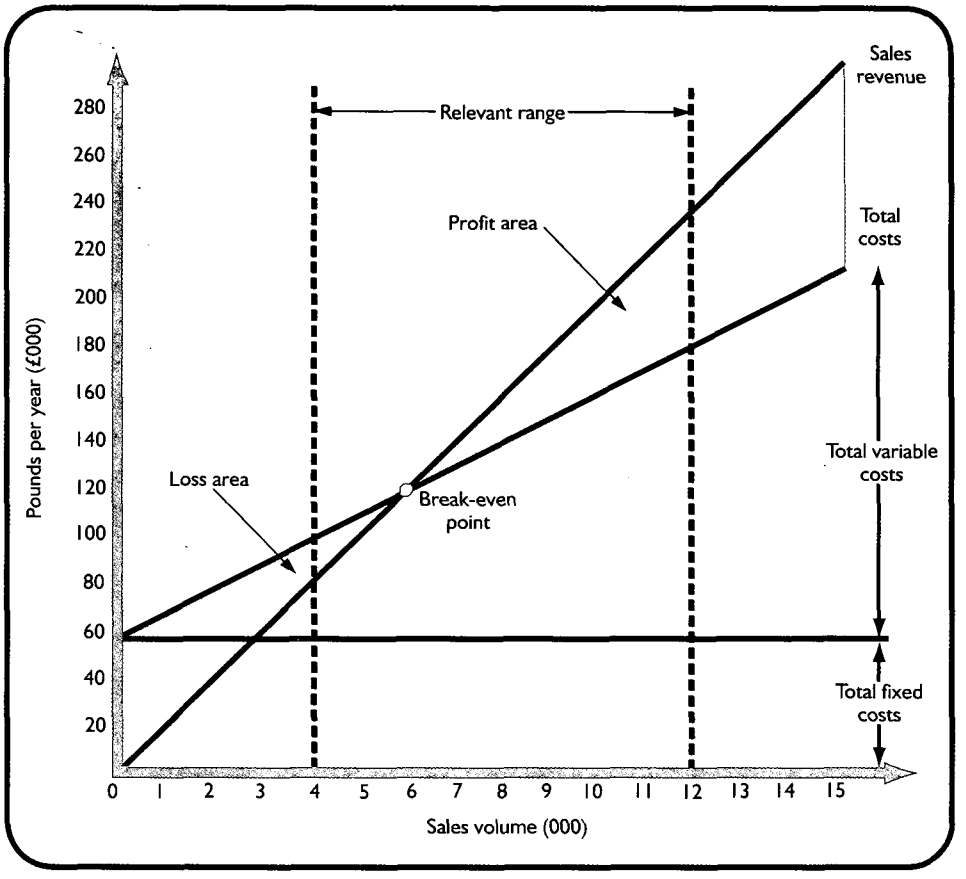
Constructing the break-even chart

Managers may obtain a clearer understanding of cash–volume–analysis if the information is presented in a graphical format.

Using the data in Example 3.1, we can construct the **break-even chart** for Norvik Enterprises (Figure 3.7). In constructing the graph, the fixed costs are plotted as a single horizontal line at the £60 000 level. Variable costs at the rate of £10 per unit of volume are added to the fixed costs to enable the total cost line to be plotted. At least two points must be plotted to insert the total cost line. At zero sales volume total cost will be equal to the fixed costs (£60 000). At 12 000 units sales volume total costs will be £180 000 consisting of £120 000 variable cost plus £60 000 fixed costs. The total revenue line is plotted at the rate of £20 per unit of volume. The constraints of the relevant range consisting of two vertical lines are then added to the graph: beyond these lines we have little assurance that the CVP relationships are valid.

The point at which the total sales revenue line cuts the total cost line is the point where the concert makes neither a profit nor a loss. This is the break-even point and is 6000 tickets or £120 000 total sales revenue. The distance between the total sales revenue line and the total cost line at a volume below the break-even point represents losses that will occur for various sales levels below 6000 tickets. Similarly, if the company operates at a sales volume above the break-even point, the difference between the total revenue and the total cost lines represents the profit that results from sales levels above 6000 tickets.

FIGURE 3.7 *Break-even chart for Example 3.1.*

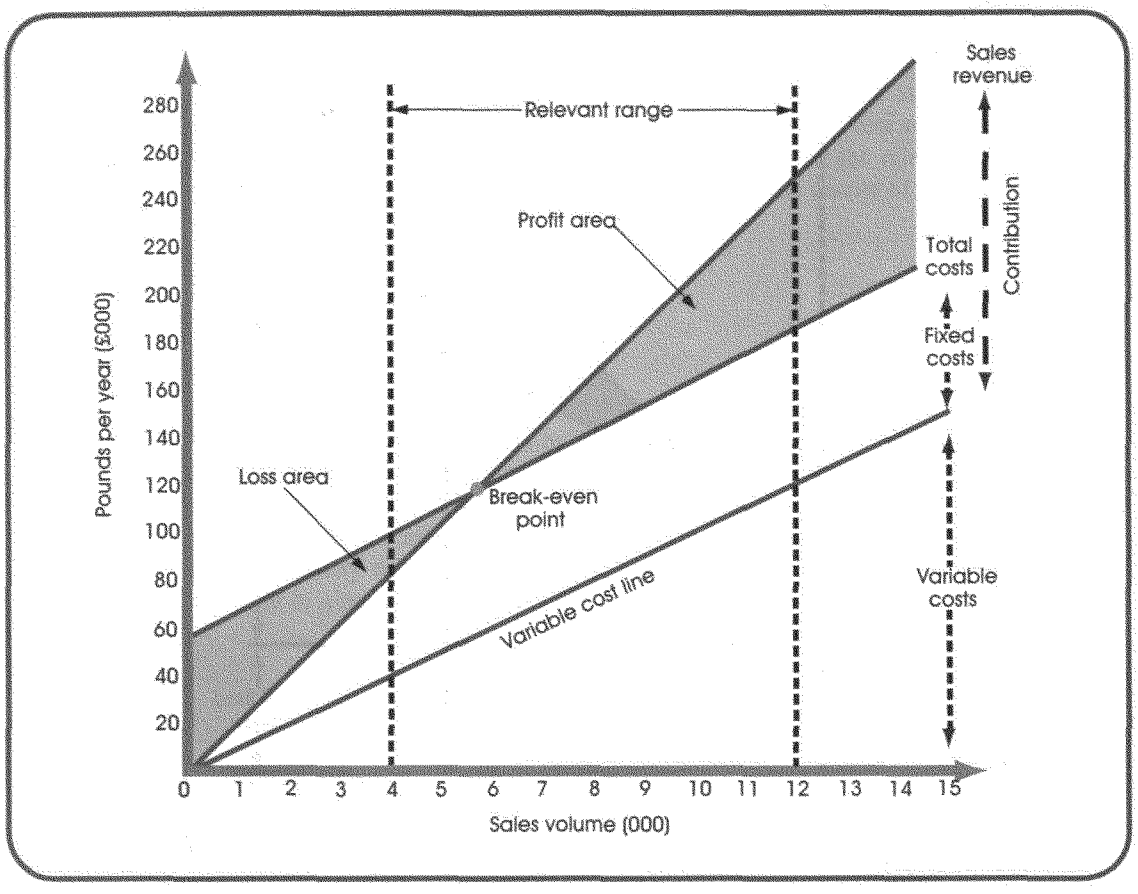


Alternative presentation of cost–volume–profit analysis

CONTRIBUTION GRAPH

In Figure 3.7 the fixed cost line is drawn parallel to the horizontal axis, and the variable cost is the difference between the total cost line and the fixed cost line. An alternative to Figure 3.7 for the data contained in Example 3.1 is illustrated in Figure 3.8. This alternative presentation is called a **contribution graph**. In Figure 3.8 the variable cost line is drawn first at £10 per unit of volume. The fixed costs are represented by the difference between the total cost line and the variable cost line. Because fixed costs are assumed to be a constant sum throughout the entire output range, a constant sum of £60 000 for fixed costs is added to the variable cost line, which results in the total cost line being drawn parallel to the variable cost line. The advantage of this form of presentation is that the total contribution is emphasized in the graph, and is represented by the difference between the total sales revenue line and the total variable cost line.

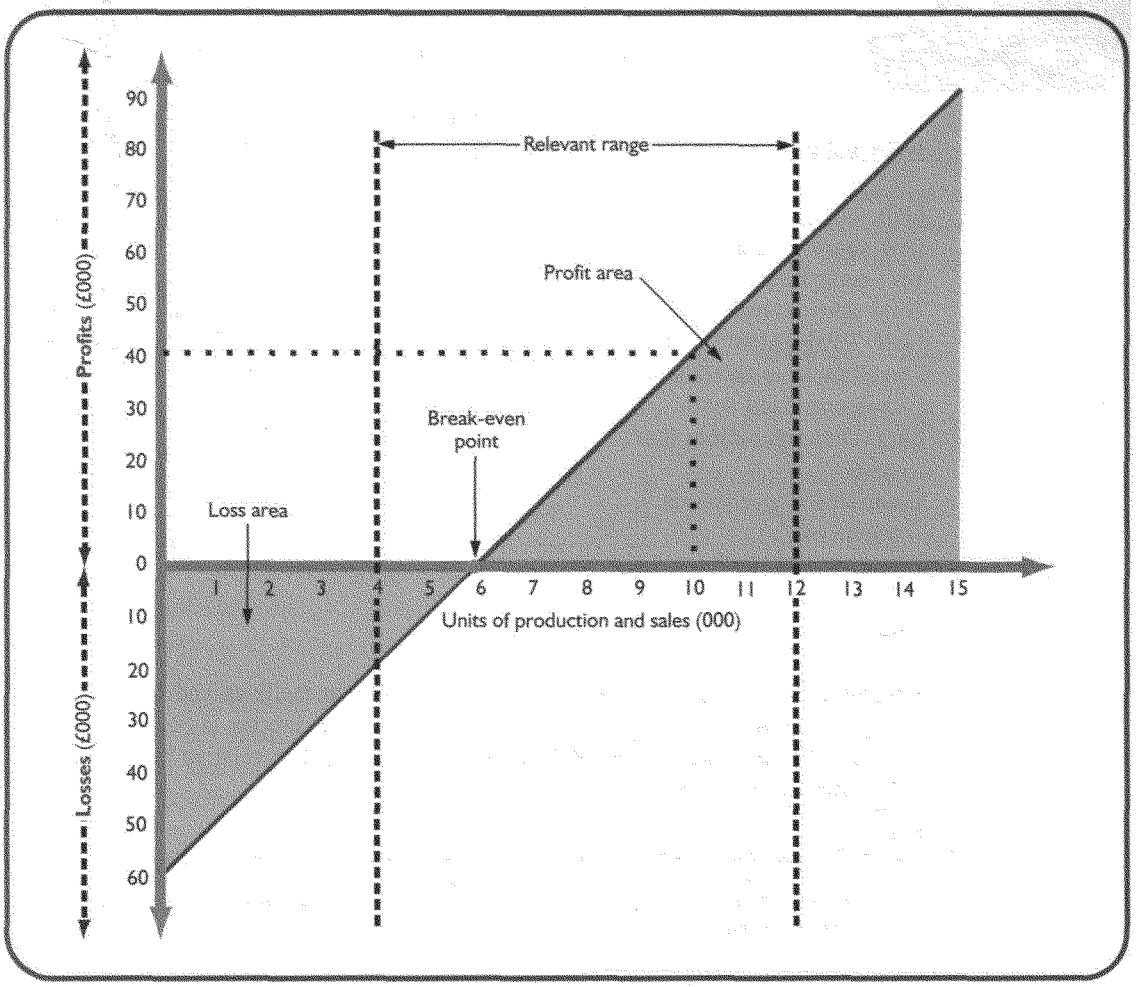
FIGURE 3.8 *Contribution chart for Example 3.1.*



PROFIT–VOLUME GRAPH

The break-even and contribution charts do not highlight the profit or loss at different volume levels. To ascertain the profit or loss figures from a break-even chart, it is necessary to determine the difference between the total-cost and total-revenue lines. The **profit–volume graph** is a more convenient method of showing the impact of changes in volume on profit. Such a graph is illustrated in Figure 3.9. The horizontal axis represents the various levels of sales volume, and the profits and losses for the period are recorded on the vertical scale. You will see from Figure 3.9 that profits or losses are plotted for each of the various sales levels, and these points are connected by a profit line. Two points are required to plot the profit line. When units sold are zero a loss equal to the amount of the fixed costs (£60 000) will be reported. At the break-even point (zero profits) sales volume is 6000 tickets. Therefore the break-even point is plotted at the point where the profit line intersects the horizontal line at a sales volume of 6000 tickets. The profit line is drawn between these two points. With each unit sold, a contribution of £10 is obtained towards the fixed costs, and the break-even point is at 6000 tickets, when the total contribution exactly equals the total of the fixed costs. With each additional unit sold beyond 6000 tickets, a surplus of £10 per ticket is obtained. If 10 000 tickets are sold, the profit will be £40 000 (4000 tickets at £10 contribution). You can see this relationship between sales and profit at 10 000 tickets from the dotted lines in Figure 3.9.

FIGURE 3.9 *Profit–volume graph for Example 3.1.*



Multi-product cost–volume–profit analysis

Our analysis so far has assumed a single-product setting. However, most firms produce and sell many products or services. In this section we shall consider how we can adapt the analysis used for a single-product setting to a multi-product setting. Consider the situation presented in Example 3.2. You will see that the company sells two products so that there are two unit contribution margins. We can apply the same approach as that used for a single product if all of the fixed costs are directly attributable to products (i.e. there are no common fixed costs) or our analysis focuses only on the contribution to common fixed costs, rather than operating profit. We simply apply the analysis separately to each product as follows:

De-luxe washing machine break-even point = Direct fixed costs (£90 000)/Unit contribution (£150)
= 600 units

Standard washing machine break-even point = Direct fixed costs (£27 000)/Unit contribution (£90)
= 300 units

EXAMPLE 3.2

The Super Bright Company sells two types of washing machines – a de-luxe model and a standard model. The financial controller has prepared the following information based on the sales forecast for the period:

	De-luxe machine	Standard machine	Total
Sales volume (units)	**1200**	**600**	
	£	**£**	**£**
Unit selling price	300	200	
Unit variable cost	150	110	
Unit contribution	150	90	
Total sales revenues	360 000	120 000	480 000
Less: Total variable cost	180 000	66 000	246 000
Contribution to direct and common fixed costs[a]	180 000	54 000	234 000
Less: Direct avoidable fixed costs	90 000	27 000	117 000
Contribution to common fixed costs[a]	90 000	27 000	117 000
Less common (indirect) fixed costs			39 000
Operating profit			78 000

The common fixed costs relate to the costs of common facilities and can only be avoided if neither of the products is sold. The managing director is concerned that sales may be less than forecast and has requested information relating to the break-even point for the activities for the period.

Note

[a]Contribution was defined earlier in this chapter as sales less variable costs. Where fixed costs are divided into direct and common (indirect) fixed costs it is possible to identify two separate contribution categories. The first is described as contribution to direct and common fixed costs and this is identical to the conventional definition, being equivalent to sales less variable costs. The second is after a further deduction of direct fixed costs and is described as 'Contribution to common or indirect fixed costs'.

However, selling 600 de-luxe and 300 standard washing machines will generate a contribution that only covers direct fixed costs; the common fixed costs will not be covered. A loss equal to the common fixed costs will be reported. The break-even point for the firm as a whole has not been ascertained.

You may think that the break-even point for the firm as a whole can be derived if we allocate the common fixed costs to each individual product but this approach is inappropriate because the allocation will be arbitrary. The common fixed costs cannot be specifically identified with either of the products since they can only be avoided if *both* products are not sold. The solution to our problem is to convert the sales volume measure of the individual products into standard batches of products based on the planned sales mix. You will from see from Example 3.2 that Super Bright plans to sell 1200 de-luxe and 600 standard machines giving a sales mix of 1200:600. Reducing this sales mix to the smallest whole number gives a mix of 2:1. In other words, for the sale of every two de-luxe machines one standard machine is expected to be sold. We therefore define our standard batch of products as comprising two de-luxe and one standard machine giving a contribution of £390 per batch (two de-luxe machines at a contribution of £150 per unit sold plus and one standard machine at a contribution of £90).

The break-even point in standard batches can be calculated by using the same break-even equation that we used for a single product so that:

Break-even number of batches = Total fixed costs (£156 000)/Contribution margin per batch (£390)
= 400 batches

The sales mix used to define a standard batch (2:1) can be now be used to convert the break-even point (measured in standard batches) into a break-even point expressed in terms of the required combination of individual products sold. Thus, 800 de-luxe machines (2 × 400) and 400 (1 × 400) standard machines must be sold to break-even. The following profit statement verifies this outcome:

	De-luxe machine	**Standard machine**	**Total**
Units sold	800	400	
	£	£	£
Unit contribution margin	150	90	
Contribution to direct and common fixed costs	120 000	36 000	156 000
Less: Direct fixed costs	90 000	27 000	117 000
Contribution to common fixed costs	30 000	9 000	39 000
Less: Common fixed costs			39 000
Operating profit			0

Let us now assume that the actual sales volume for the period was 1200 units, the same total volume as the break-even volume, but consisting of a sales mix of 600 units of each machine. Thus, the actual sales mix is 1:1 compared with a planned sales mix of 2:1. The total contribution to direct and common fixed costs will be £114 000 ([£150 × 600] + [£90 × 600]) and a loss of £42 000 (£114 000 contribution − £156 000 total fixed costs) will occur. It should now be apparent to you that the break-even point (or the sales volumes required to achieve a target profit) is not a unique number: it varies depending upon the composition of the sales mix. Because the actual sales mix differs from the planned sales mix, the sales mix used to define a standard batch has changed from 2:1 to 1:1 so that the contribution per batch changes from £390 to £240 ([1 × £150] + [1 × £90]). Therefore the revised break-even point will be 650 batches (£156 000 total fixed costs/£240 contribution per batch) which converts to a sales volume of 650 units of each machine based on a 1:1 sales mix. Generally, an increase in the proportion of sales of higher contribution margin products will decrease the break-even point whereas increases in sales of the lower margin products will increase the break-even point.

If the sales mix for the coming period is likely to be uncertain it will be necessary to look at several different mixes. This will enable management to gain some insight into the possible outcomes that the firm might face. In our example we assumed a sales mix comprising of just two products but firms are likely to sell considerably more than two products or services. Where a firm sells many products or services the same approach can be applied using computer models but, in these circumstances, it is preferable to base the analysis on sales revenues rather than units sold.

You should be able to recall from our earlier discussion that the profit–volume ratio was defined as the ratio of contribution to sales and that the break-even point in sales revenues can be computed by dividing the total fixed costs by the profit–volume ratio. If you now refer to Example 3.2 you will find that, based on the planned sales mix, the profit–volume ratio is 0.4875 (£234 000/£480 000). Alternatively, the planned standard batch can be used to derive the profit–volume ratio. Based on a sales mix of 2:1 we calculated that the contribution per standard batch was £390 and the sales revenue per standard batch was

£800 ([2 × £300] + [1 × £200]) giving a profit–volume ratio of 0.4875 (£390/£800) so that:

Break-even sales revenues = Total fixed costs (£156 000)/Profit-volume ratio (0.4875)
= £320 000

We can verify that the above calculation agrees with our earlier computation, based on units sold, by analysing the break-even sales revenues by products based on the planned sales mix expressed in sales revenues. You will see from Example 3.2 that the planned sales mix for sales revenues is £360 000:£120 000 (or 3:1 expressed in the smallest whole number). Therefore, the break-even sales mix will consist of sales revenues of £240 000 for the de-luxe machines and £80 000 for the standard machine. Dividing by the selling prices shown in Example 3.2 this converts to unit sales volume of 800 de-luxe machines (£240 000/£300) and 400 standard machines (£80 000/£200), the same as our earlier calculation based on units sold.

For complex multi-product situations where firms sell hundreds of products the planned profit–volume ratio can be derived directly from the budgeted profit statement by expressing estimated total contribution as a ratio of estimated total sales. Also expressing the break-even point in sales revenues enables the total sales volume to be expressed in a common measurement unit. In addition, no knowledge of individual product data is needed so the requirement of establishing a standard batch is avoided. Information relating to individual product performance, however, is sacrificed. Finally, it is important to remember that information derived from a multi-product CVP analysis is only applicable for outcomes that approximate the planned sales mix. Any CVP analysis must therefore be interpreted carefully if the initial product mix assumptions do not hold.

Cost–volume–profit analysis assumptions

It is essential that anyone preparing or interpreting CVP information is aware of the underlying assumptions on which the information has been prepared. If these assumptions are not recognized, serious errors may result and incorrect conclusions may be drawn from the analysis. We shall now consider these important assumptions. They are as follows:

1. All other variables remain constant.
2. A single product or constant sales mix.
3. Total costs and total revenue are linear functions of output.
4. The analysis applies to the relevant range only.
5. Costs can be accurately divided into their fixed and variable elements.
6. The analysis applies only to a short-term time horizon.
7. Complexity-related fixed costs do not change.

1. ALL OTHER VARIABLES REMAIN CONSTANT

It has been assumed that all variables other than the particular one under consideration have remained constant throughout the analysis. In other words, it is assumed that volume is the only factor that will cause costs and revenues to change. However, changes in other variables such as production efficiency, sales mix, price levels and production methods can have an important influence on sales revenue and costs. If significant changes in these other variables occur the CVP analysis presentation will be incorrect.

2. SINGLE PRODUCT OR CONSTANT SALES MIX

CVP analysis assumes that either a single product is sold or, if a range of products is sold, that sales will be in accordance with a predetermined sales mix. When a predetermined sales mix is used, it can be depicted in the CVP analysis by measuring sales volume using standard batch sizes based on a planned sales mix or expressing sales volume in terms of total sales revenues. Any CVP analysis must be interpreted carefully if the initial product mix assumptions do not hold.

3. TOTAL COSTS AND TOTAL REVENUE ARE LINEAR FUNCTIONS OF OUTPUT

The analysis assumes that unit variable cost and selling price are constant. This assumption is only likely to be valid within the relevant range of production described on page 49.

4. ANALYSIS APPLIES TO RELEVANT RANGE ONLY

Earlier in this chapter we noted that CVP analysis is appropriate only for decisions taken within the relevant production range, and that it is incorrect to project cost and revenue figures beyond the relevant range.

5. COSTS CAN BE ACCURATELY DIVIDED INTO THEIR FIXED AND VARIABLE ELEMENTS

CVP analysis assumes that costs can be accurately analysed into their fixed and variable elements. The separation of semi-variable costs into their fixed and variable elements is extremely difficult in practice. Nevertheless a reasonably accurate analysis is necessary if CVP analysis is to provide relevant information for decision-making. For a description of the methods of analysing costs into their fixed and variable elements you should refer to Drury (2000, ch. 24).

6. THE ANALYSIS APPLIES ONLY TO A SHORT-TERM TIME HORIZON

At the beginning of this chapter we noted that CVP analysis is based on the relationship between volume and sales revenue, costs and profits in the short term, the short term being typically a period of one year. In the short term the costs of providing a firm's operating capacity, such as property taxes and the salaries of senior managers, are likely to be fixed in relation to changes in activity. Decisions on the firm's intended future potential level of operating capacity will determine the amount of capacity costs to be incurred. These decisions will have been made previously as part of the long-term planning process. Once these decisions have been made, they cannot easily be reversed in the short-term. It takes time to significantly expand the capacity of plant and machinery or reduce capacity. Furthermore, plant investment and abandonment decisions should not be based on short-term fluctuations in demand within a particular year. Instead, they should be reviewed periodically as part of the long-term planning process and decisions based on predictions of long-run demand over several years. Thus capacity costs will tend to be fixed in relation to changes of activity within

short-term periods such as one year. However, over long-term periods significant changes in volume or product complexity will cause fixed costs to change.

It is therefore assumed that in the short term some costs will be fixed and unaffected by changes in volume whereas other (variable) costs will vary with changes in volume. In the short-run volume is the most important variable influencing total revenue, costs and profit. For this reason volume is given special attention in the form of CVP analysis. You should note, however, that in the long term other variables, besides volume, will cause costs to change. Therefore, the long-term analysis should incorporate other variables, besides volume, and recognize that fixed costs will increase or decrease in steps in response to changes in the explanatory variables.

7. COMPLEXITY-RELATED FIXED COSTS DO NOT CHANGE

CVP analysis assumes that complexity-related costs will remain unchanged. Cooper and Kaplan (1987) illustrate how complexity-related fixed costs can increase as a result of changes in the range of items produced, even though volume remains unchanged. They illustrate the relationship with an example of two identical plants. One plant produces one million units of product A. The second plant produces 100 000 units of A and 900 000 similar units of 199 similar products. The first plant has a simple production environment and requires limited manufacturing support facilities. Set-ups, expediting, inventory movements and schedule activities are minimal. The other plant has a much more complex production management environment. The 200 products must be scheduled through the plant, and this requires frequent set-ups, inventory movements, purchase receipts and inspections. To handle this complexity, the support departments' fixed costs must be larger.

Cooper and Kaplan use the above example to illustrate that many so-called fixed costs vary not with the volume of items manufactured but with range of items produced (i.e. the complexity of the production process). Complexity-related costs do not normally vary significantly in the short term with the volume of production. If a change in volume does not alter the range of products then it is likely that complexity-related fixed costs will not alter, but if volume stays constant and the range of items produced changes then support department fixed costs will eventually change because of the increase or decrease in product complexity.

CVP analysis assumptions will be violated if a firm seeks to enhance profitability by product proliferation; that is, by introducing new variants of products based on short-term contribution margins. The CVP analysis will show that profits will increase as sales volume increases and fixed costs remain constant in the short term. The increased product diversity, however, will cause complexity-related fixed costs to increase in future periods, and there is a danger that long-term profits may decline as a result of product proliferation. The CVP analysis incorporates the fixed costs required to handle the diversity and complexity within the current product range, but the costs will remain fixed only if diversity and complexity are not increased further. Thus CVP will not capture the changes in complexity-related costs arising from changes in the range of items produced.

Cost–volume–profit analysis and computer applications

The output from a CVP model is only as good as the input. The analysis will include assumptions about sales mix, production efficiency, price levels, total fixed costs, variable

costs and selling price per unit. Obviously, our estimates regarding these variables will be subject to varying degrees of uncertainty.

Sensitivity analysis is one approach for coping with changes in the values of the variables. Sensitivity analysis focuses on how a result will be changed if the original estimates or the underlying assumptions change. With regard to CVP analysis, sensitivity analysis answers questions such as the following:

1. What will the profit be if the sales mix changes from that originally predicted?
2. What will the profit be if fixed costs increase by 10% and variable costs decline by 5%?

The widespread use of spreadsheet packages has enabled management accountants to develop CVP computerized models. Managers can now consider alternative plans by keying the information into a computer, which can quickly show changes both graphically and numerically. Thus managers can study various combinations of changes in selling prices, fixed costs, variable costs and product mix, and can react quickly without waiting for formal reports from the management accountant.

Summary

CVP analysis has been a core topic in the management accounting education process for over 50 years. It would also appear to be widely used in practice with a recent survey indicating that 86% of Australian firms had adopted the technique (Chenhall and Langfield-Smith, 1998).

CVP analysis is concerned with examining the relationship between changes in volume and changes in total revenue and costs in the short term. In this chapter we have compared the economist's and accountant's models of CVP behaviour. The major differences are that the total cost and total revenue functions are curvilinear in the economist's model, whereas the accountant's model assumes linear relationships. However, we have noted that the accountant's model was intended to predict CVP behaviour only within the relevant range, where a firm is likely to be operating on constant returns to sale. A comparison of the two models suggested that, within the relevant production range, the total costs and revenue functions are fairly similar.

We have seen that for decision-making a numerical presentation provides more precise information than a graphical one. Given that the cost and revenue functions will already have been determined at the decision-making stage, the major area of uncertainty relates to the actual level of output. The graphical approach provides a useful representation of how costs, revenues and profits will behave for the many possible output levels that may actually materialize.

It is essential when interpreting CVP information that you are aware of the following important assumptions on which the analysis is based:

1. All other variables remain constant.
2. The analysis is based on a single product or constant sales mix.
3. Total costs and revenues are a linear function of output.
4. The analysis applies to the relevant range only.
5. Costs can be accurately divided into their fixed and variable elements.
6. The analysis applies only to a short-term time horizon.
7. Complexity-related costs do not change.

Key Terms and Concepts

break-even chart (p. 56)
break-even point (p. 49)
complexity-related costs (p. 64)
contribution graph (p. 57)
contribution margin (p. 53)
contribution margin ratio (p. 55)
decreasing returns to scale (p. 47)
increasing returns to scale (p. 47)
margin of safety (p. 56)
profit–volume graph (p. 58)
profit–volume ratio (p. 55)
relevant range (p. 49)
sensitivity analysis (p. 65)

Review Problems

1. Tweed Ltd is a company engaged solely in the manufacture of jumpers, which are bought mainly for sporting activities. Present sales are direct to retailers, but in recent years there has been a steady decline in output because of increased foreign competition. In the last trading year (2001) the accounting report indicated that the company produced the lowest profit for 10 years. The forecast for 2002 indicates that the present deterioration in profits is likely to continue. The company considers that a profit of £80 000 should be achieved to provide an adequate return on capital. The managing director has asked that a review be made of the present pricing and marketing policies. The marketing director has completed this review, and passes the proposals on to you for evaluation and recommendation, together with the profit and loss account for year ending 31 December 2001.

Tweed Ltd profit and loss account for year ending 31 December 2001

	(£)	(£)	(£)
Sales revenue			
(100 000 jumpers at £10)			1 000 000
Factory cost of goods sold:			
Direct materials	100 000		
Direct labour	350 000		
Variable factory overheads	60 000		
Fixed factory overheads	220 000	730 000	
Administration overhead		140 000	
Selling and distribution overhead			
Sales commission (2% of sales)	20 000		
Delivery costs (variable per unit sold)	50 000		
Fixed costs	40 000	110 000	980 000
Profit			20 000

The information to be submitted to the managing director includes the following three proposals:

(i) To proceed on the basis of analyses of market research studies which indicate that the demand for the jumpers is such that 10% reduction in selling price would increase demand by 40%.

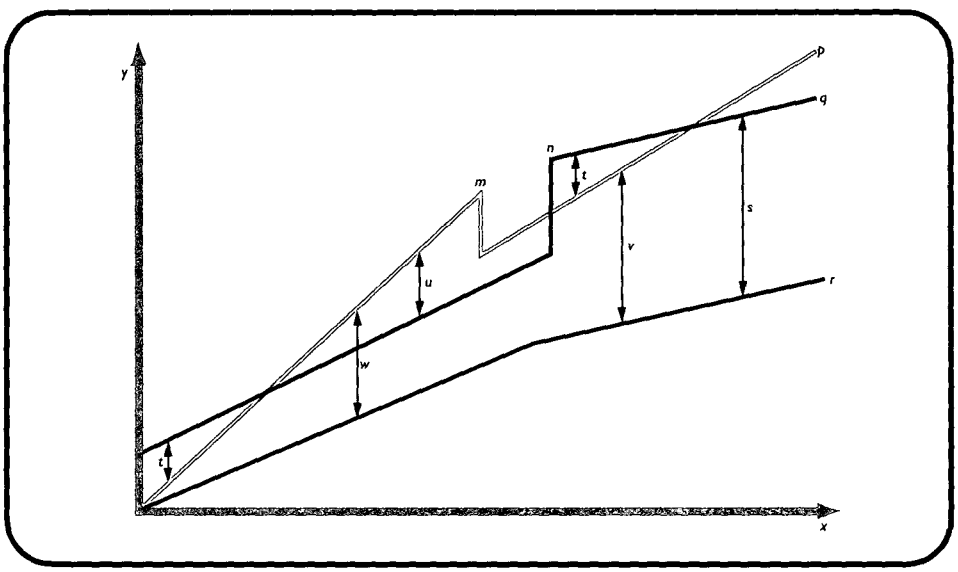
(ii) To proceed with an enquiry that the marketing director has had from a mail order company about the possibility of purchasing 50 000 units annually if the selling price is right. The mail order company would transport the jumpers from Tweed Ltd to its own warehouse, and no sales commission would be paid on these sales by Tweed Ltd. However, if an acceptable price can be negotiated, Tweed Ltd would be expected to contribute £60 000 per annum towards the cost of producing the mail order catalogue. It would also be necessary for Tweed Ltd to provide special additional packaging at a cost of £0.50 per jumper. The marketing director considers that in 2002 the sales from existing business would remain unchanged at 100 000 units, based on a selling price of £10 if the mail order contract is undertaken.

(iii) To proceed on the basis of a view by the marketing director that a 10% price reduction, together with a national advertising campaign costing £30 000 may increase sales to the maximum capacity of 160 000 jumpers.

Required:

(a) The calculation of break-even sales value based on the 2001 accounts.
(b) A financial evaluation of proposal (i) and a calculation of the number of units Tweed Ltd would require to sell at £9 each to earn the target profit of £80 000.
(c) A calculation of the minimum prices that would have to be quoted to the mail order company, first, to ensure that Tweed Ltd would, at least, break even on the mail order contract, secondly, to ensure that the same overall profit is earned as proposal (i) and, thirdly, to ensure that the overall target profit is earned.
(d) A financial evaluation of proposal (iii).

2. (a) A break-even chart is shown below for Windhurst Ltd.



You are required:

(i) to identify the components of the break-even chart labelled *p, q, r, s, t, u, v, w, x* and *y*; (5 marks)
(ii) to suggest what events are represented at the values of *x* that are labelled *m* and *n* on the chart; (3 marks)
(iii) to assess the usefulness of break-even analysis to senior management of a small company. (7 marks)

(b) Hackett Ltd produces gudgeons and bludgeons. The company's budget for 2000 includes the following data:

	Gudgeons	**Bludgeons**
Unit selling price (£)	10	5
Contribution margin ratio (%)	40	60

The budget is designed to show a figure of profit or loss for each product, after apportioning joint fixed costs of £100 000 in proportion to the number of units of each product sold.

For 2000 gudgeons are budgeted to show a profit of £14 000, and bludgeons a loss of £2000. The number of units of each product sold is expected to be equal.

You are required to write a report to the managing director of Hackett Ltd advising him on the basis of the information given whether to implement any of the following three proposals:

(i) to increase the price of bludgeons by 25%, in the expectation that the price elasticity of demand over this range of prices will be unity; (4 marks)

(ii) to make changes to the production process that would reduce the joint fixed costs by 12.5% and increase the variable costs of each product by 10%; (3 marks)

(iii) to introduce both of the above changes. (3 marks)

ICAEW

Solutions to Review Problems

SOLUTION 1

(a)

$$\text{BEP} = \frac{\text{£400 000 (fixed costs)} \times \text{£1 000 000 (sales)}}{\text{£420 000 (contribution)}}$$

$$= \underline{\underline{\text{£952 380}}}$$

(b) (i)

	(£)	(£)
Revised selling price		9.00
Less variable costs:		
Direct materials	1.00	
Direct labour	3.50	
Variable overhead	0.60	
Delivery expenses	0.50	
Sales commission (2% of selling price)	0.18	5.78
	Contribution per unit	3.22

Number of units sold	140 000
Total contribution (140 000 × £3.22)	£450 800
Fixed costs	£400 000
Profit from proposal (i)	£50 800

(ii)

Desired contribution	= £480 000
Contribution per unit for present proposal	= £3.22
Required units to earn target profit	= £149 068

(c) (i) The variable cost of selling to the mail order firm is:

	(£)
Direct material	1.00
Direct labour	3.50
Variable overhead	0.60
Delivery expenses	nil
Sales commission	nil
Additional package cost	0.50
	5.60

To break even, a contribution of £1.20 is required $\left(\frac{\text{60 000 fixed cost}}{\text{50 000 units sold}}\right)$.

Therefore selling price to break even is £6.80 (£5.60 + £1.20).

(ii) To earn £50 800 profit, a contribution of £110 800 (£60 000 + £50 800) is required.

That is, a contribution of £2.22 per unit is required. Therefore required selling price is £7.82 (£5.60 + £2.22).

(iii) To earn the target profit of £80 000, a contribution of £140 000 is required. That is, £2.80 per unit. Therefore required selling price = £8.40 (£5.60 + £2.80).

(d) Contribution per unit is £3.22 per (B)

Unit sold	160 000
Total contribution	£515 200
Fixed costs	£430 000
Profit	£ 85 200

SOLUTION 2

(a) (i) P Total sales revenue
q Total cost (fixed cost + variable cost)
r Total variable cost
s Fixed costs at the specific level of activity
t Total loss at the specific level of activity
u Total profit at that level of activity
v Total contribution at the specific level of activity
W Total contribution at a lower level of activity
X Level of activity of output sales
Y Monetary value of cost and revenue function for level of activity

(ii) At event M the selling price per *unit* decreases, but it remains constant. Note that P is a straight line, but with a lower gradient above m compared with below m.

At event n there is an increase in fixed costs equal to the dotted line. This is probably due to an increase in capital expenditure in order to expand output beyond this point. Also note that at this point the variable cost per unit declines as reflected by the gradient of the variable cost line. This might be due to more efficient production methods associated with increased investment in capital equipment.

(iii) Break-even analysis is of limited use in a multi-product company, but the analysis can be a useful aid to the management of a small single product company. The following are some of the main benefits:

(a) Break-even analysis forces management to consider the functional relationship between costs, revenue and activity, and gives an insight into how costs and revenue change with changes in the level of activity.

(b) Break-even analysis forces management to consider the fixed costs at various levels of activity and the selling price that will be required to achieve various levels of output.

For more specific uses of break-even analysis see Chapter 3. Break-even analysis can be a useful tool, but it is subject to a number of assumptions that restrict its usefulness (see 'Cost–volume–profit analysis assumptions' in Chapter 3).

(b) *Preliminary workings*

Gudgeon unit contribution = £4 (40% × £10)

Bludgeon unit contribution = £3 (60% × £5)

Let x = output and sales volume of each product. Then

$$4x + 3x - 100\,000 = 14\,000 - 2000$$

$$\text{giving } 7x = 112\,000$$

$$\text{and } x = 16\,000$$

Budgeted sales of both products are 16 000 units.

Proposal 1
It is assumed that, because the price elasticity of demand is unity, total revenue will be unchanged.

Budgeted revenue = £80 000 (16 000 units × £5)

So revised demand volume = 12 800 units (£80 000/£6.25 selling price)

Total revised contribution = £54 400 (12 800 units at (6.25 − £2))

Existing budgeted contribution = £48 000 (16 000 units × £3)

Increase in contribution = £6400

Proposal 2
Revised variable costs: Gudgeons £6.60 (£6 + 10%)
Bludgeons £2.20 (£2 + 10%)

Revised budgeted profit:

	(£)
Gudgeon contribution	54 400 (16 000 × (£10 − £6.60))
Bludgeon contribution	44 800 (16 000 × (£5 − £2.20))
Total contribution	99 200
Less revised fixed costs	87 500
Revised profit	11 700
Budgeted profit	12 000

Therefore profits will decline by £300

Proposal 3
Revised budgeted profit:

	(£)
Gudgeon contribution	54 400 (As proposal 2)
Bludgeon contribution	51 840 (12 800 units × £6.25 − £2.20)
Total contribution	106 240
Less fixed costs	87 500
Revised profit	18 740
Budgeted profit	12 000

Therefore profits will increase by £6740, and the greatest improvement in profits occurs from implementing this proposal.

Questions

3.1
A company manufactures and sells two products, X and Y. Forecast data for a year are:

	Product X	Product Y
Sales (units)	80 000	20 000
Sales price (per unit)	£12	£8
Variable cost (per unit)	£8	£3

Annual fixed costs are estimated at £273 000.
What is the break-even point in sales revenue with the current sales mix?

A £570 000
B £606 667
C £679 467
D £728 000

ACCA

3.2

H Limited manufactures and sells two products, J and K. Annual sales are expected to be in the ratio of J:1, K:3. Total annual sales are planned to be £420 000. Product J has a contribution to sales ratio of 40%, whereas that of product K is 50%. Annual fixed costs are estimated to be £120 000.

The budgeted break-even sales value (to the nearest £1000):

A £196 000
B £200 000
C £253 000
D £255 000
E cannot be determined from the above data.

CIMA

3.3

The following details relate to product R:

Level of activity (units)	**1000 (£/unit)**	**2000 (£/unit)**
Direct materials	4.00	4.00
Direct labour	3.00	3.00
Production overhead	3.50	2.50
Selling overhead	1.00	0.50
	11.50	10.00

The total fixed cost and variable cost per unit are:

	Total fixed cost (£)	**Variable cost per unit (£)**
A	2000	1.50
B	2000	7.00
C	2000	8.50
D	3000	7.00
E	3000	8.50

CIMA

3.4

Z plc currently sells products Aye, Bee and Cee in equal quantities and at the same selling price per unit. The contribution to sales ratio for product Aye is 40%; for product Bee it is 50% and the total is 48%. If fixed costs are unaffected by mix and are currently 20% of sales, the effect of changing the product mix to:

Aye	40%
Bee	25%
Cee	35%

is that the total contribution/total sales ratio changes to:

A 27.4%
B 45.3%
C 47.4%
D 48.4%
E 68.4%

CIMA

3.5

E plc operates a marginal costing system. For the forthcoming year, variable costs are budgeted to be 60% of sales value and fixed costs are budgeted to be 10% of sales value.

If E plc increases its selling prices by 10%, but if fixed costs, variable costs per unit and sales volume remain unchanged, the effect on E plc's contribution would be:

A a decrease of 2%
B an increase of 5%
C an increase of 10%
D an increase of 25%
E an increase of $66\frac{2}{3}$%.

CIMA

3.6

A Limited has fixed costs of £60 000 per annum. It manufactures a single product which it sells for £20 per unit. Its contribution to sales ratio is 40%.

A Limited's breakeven point in units is:

A 1200
B 1800
C 3000
D 5000
E 7500

CIMA

3.7

The following data relate to the overhead expenditure of a contract cleaners at two activity levels:

Square metres cleaned	12 750	15 100
Overheads	£73 950	£83 585

What is the estimate of the overheads if 16 200 square metres are to be cleaned?

A £88 095
B £89 674
C £93 960
D £98 095

CIMA

3.8

Z plc makes a single product which it sells for £16 per unit. Fixed costs are £76 800 per month and the product has a contribution to sales ratio of 40%.

In a period when actual sales were £224 000, Z plc's margin of safety, in units, was

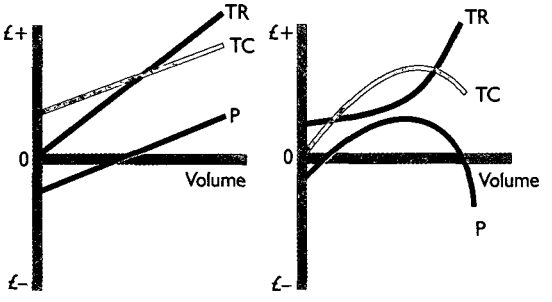
A 2000
B 6000
C 8000
D 12 000
E 14 000

CIMA

3.9

The graphs shown below show cost–volume–profit relationships as they are typically represented in (i) management accounting and (ii) economic theory. In each graph TR = total revenue, TC = total cost, and P = profit. You are required to compare these different representations of cost–volume–profit relationships, identifying, explaining and commenting on points of similarity and also differences. (15 marks)

ICAEW



(i) Management accounting (ii) Economic theory

3.10

'A break-even chart must be interpreted in the light of the limitations of its underlying assumptions . . .' (From *Cost Accounting: A Managerial Emphasis*, by C.T. Horngren.)

Required:

(a) Discuss the extent to which the above statement is valid and both describe and briefly appraise the reasons for *five* of the most important underlying assumptions of break-even analysis. (c. 14 marks)

(b) For any *three* of the underlying assumptions provided in answer to (a) above, give an example of circumstances in which that assumption is violated. Indicate the nature of the violation and the extent to which the break-even chart can be adapted to allow for this violation. (c. 6 marks)

(Total 20 marks)

ACCA

3.11 Break-even, contribution and profit–volume graph

(a) From the following information you are required to construct:

(i) a break-even chart, showing the break-even point and the margin of safety;

(ii) a chart displaying the contribution level and the profit level;

(iii) a profit–volume chart.

Sales	6000 units at £12 per unit = £72 000
Variable costs	6000 units at £7 per unit = £42 000
Fixed costs	= £20 000

(9 marks)

(b) State the purposes of each of the three charts in (a) above. (6 marks)

(c) Outline the limitations of break-even analysis. (5 marks)

(d) What are the advantages of graphical presentation of financial data to executives? (2 marks)

(Total 22 marks)

AAT

3.12 Break-even chart with increases in fixed costs

(a) Identify and discuss briefly *five* assumptions underlying cost–volume–profit analysis. (10 marks)

(b) A local authority, whose area includes a holiday resort situated on the east coast, operates, for 30 weeks each year, a holiday home which is let to visiting parties of children in care from other authorities. The children are accompanied by their own house mothers who supervise them throughout their holiday. From six to fifteen guests are accepted on terms of £100 per person per week. No differential charges exist for adults and children.

Weekly costs incurred by the host authority are:

	(£ per guest)
Food	25
Electricity for heating and cooking	3
Domestic (laundry, cleaning etc.) expenses	5
Use of minibus	10

Seasonal staff supervise and carry out the necessary duties at the home at a cost of £11 000 for the 30-week period. This provides staffing sufficient for six to ten guests per week but if eleven or more guests are to be accommodated, additional staff at a total cost of £200 per week are engaged for the whole of the 30-week period.

Rent, including rates for the property, is £4000 per annum and the garden of the home is maintained by the council's recreation department which charges a nominal fee of £1000 per annum.

You are required to:

(i) tabulate the appropriate figures in such a way as to show the break-even point(s) and to comment on your figures; (8 marks)

(ii) prepare a chart to illustrate your answer to (b)(i) above. (7 marks)

(Total 25 marks)

CIMA

3.13 Non-graphical CVP analysis and calculation of margin of safety

Z Ltd manufactures and sells three products with the following selling prices and variable costs:

	Product A (£/unit)	Product B (£/unit)	Product C (£/unit)
Selling price	3.00	2.45	4.00
Variable cost	1.20	1.67	2.60

The company is considering expenditure on advertising and promotion of Product A. It is hoped that such expenditure, together with a reduction in the selling price of the product, would increase sales.

Existing annual sales volume of the three products is:

Product A	460 000 units
Product B	1 000 000 units
Product C	380 000 units

If £60 000 per annum was to be invested in advertising and sales promotion, sales of Product A at reduced selling prices would be expected to be:

590 000 units at £2.75 per unit
or 650 000 units at £2.55 per unit

Annual fixed costs are currently £1 710 000 per annum.

Required:

(a) Calculate the current break-even sales revenue of the business. (8 marks)

(b) Advise the management of Z Ltd as to whether the expenditure on advertising and promotion, together with selling price reduction, should be introduced on Product A. (6 marks)

(c) Calculate the required unit sales of Product A, at a selling price of £2.75 per unit, in order to justify the expenditure on advertising and promotion. (5 marks)

(d) Explain the term 'margin of safety', with particular reference to the circumstances of Z Ltd. (6 marks)

(Total 25 marks)

ACCA

3.14 Non-graphical CVP analysis and the acceptance of a special order

Video Technology Plc was established in 1987 to assemble video cassette recorders (VCRs). There is now increased competition in its markets and the company expects to find it difficult to make an acceptable profit next year. You have been appointed as an accounting technician at the company, and have been given a copy of the draft budget for the next financial year.

Draft budget for 12 months to 30 November 2001

	(£m)	(£m)
Sales income		960.0
Cost of sales:		
Variable assembly materials	374.4	
Variable labour	192.0	
Factory overheads – variable	172.8	
– fixed	43.0	(782.2)
		177.8
Gross profit		
Selling overheads – commission	38.4	
– fixed	108.0	
Administration overheads – fixed	20.0	(166.4)
Net profit		11.4

The following information is also supplied to you by the company's financial controller, Edward Davies:

1 planned sales for the draft budget in the year to 30 November 2001 are expected to be 25% less than the total of 3.2 million VCR units sold in the year to 30 November 2000;
2 the company operates a Just-In-Time stock control system, which means it holds no stocks of any kind;
3 if more than 3 million VCR units are made and sold, the unit cost of material falls by £4 per unit;
4 sales commission is based on the number of units sold and not on turnover;
5 the draft budget assumes that the factory will only be working at two-thirds of maximum capacity;
6 sales above maximum capacity are not possible.

Edward Davies explains that the Board is not happy with the profit projected in the draft budget, and that the sales director, Anne Williams, has produced three proposals to try and improve matters.

1 Proposal A involves launching an aggressive marketing campaign:
   (i) this would involve a single additional fixed cost of £14 million for advertising;
   (ii) there would be a revised commission payment of £18 per unit sold;
   (iii) sales volume would be expected to increase by 10% above the level projected in the draft budget, with no change in the unit selling price.
2 Proposal B involves a 5% reduction in the unit selling price:
   (i) this is estimated to bring the sales volume back to the level in the year to 30 November 2000.
3 Proposal C involves a 10% reduction in the unit selling price.
   (i) fixed selling overheads would also be reduced by £45 million;
   (ii) if proposal C is accepted, the sales director believes sales volume will be 3.8 million units.

Task 1

(a) For each of the three proposals, calculate the:
   (i) change in profits compared with the draft budget;
   (ii) break-even point in units and turnover.
(b) Recommend which proposal, if any, should be accepted on financial grounds.
(c) Identify *three* non-financial issues to be considered before a final decision is made.

Edward Davies now tells you that the company is considering a new export order with a proposed selling price of £3 million. He provides you with the following information:

1 The order will require two types of material:
   (i) material A is in regular use by the company.
   The amount in stock originally cost £0.85 million, but its standard cost is £0.9 million. The amount in stock is sufficient for the order. The current market price of material A to be used in the order is £0.8 million;
   (ii) material B is no longer used by the company and cannot be used elsewhere if not used on the order.
   The amount in stock originally cost £0.2 million although its current purchase price is £0.3 million. The amount of material B in stock is only half the amount required on the order. If not used on the order, the amount in stock could be sold for £0.1 million;
2 direct labour of £1.0 million will be charged to the order. This includes £0.2 million for idle time, as a result of insufficient orders to keep the workforce fully employed. The company has a policy of no redundancies,

and spreads the resulting cost of idle time across all orders;

3 variable factory overheads are expected to be £0.9 million;

4 fixed factory overheads are apportioned against the order at the rate of 50% of variable factory overheads;

5 no sales commission will be paid.

Task 2

Prepare a memo for Edward Davies:

(a) showing whether or not the order should be accepted at the proposed selling price;

(b) identifying the technique(s) you have used in reaching this conclusion.

AAT

3.15 Changes in sales mix

XYZ Ltd produces two products and the following budget applies for 2001:

	Product X (£)	Product Y (£)
Selling price	6	12
Variable costs	2	4
Contribution margin	4	8
Fixed costs apportioned	£100 000	£200 000
Units sold	70 000	30 000

You are required to calculate the break-even points for each product and the company as a whole and comment on your findings.

3.16 Calculation of break-even points based on different sales mix assumptions and a product abandonment decision

M Ltd manufactures three products which have the following revenue and costs (£ per unit).

	Product 1	2	3
Selling price	2.92	1.35	2.83
Variable costs	1.61	0.72	0.96
Fixed costs:			
Product specific	0.49	0.35	0.62
General	0.46	0.46	0.46

Unit fixed costs are based upon the following annual sales and production volumes (thousand units):

Product 1	2	3
98.2	42.1	111.8

Required:

(a) Calculate:

(i) the break-even point sales (to the nearest £ hundred) of M Ltd based on the current product mix (9 marks)

(ii) the number of units of Product 2 (to the nearest hundred) at the break-even point determined in (i) above. (3 marks)

(b) Comment upon the viability of Product 2. (8 marks)

(Total 20 marks)

ACCA

3.17 Calculation of break-even points and limiting factor decision-making

You are employed as an accounting technician by Smith, Williams and Jones, a small firm of accountants and registered auditors. One of your clients is Winter plc, a large department store. Judith Howarth, the purchasing director for Winter plc, has gained considerable knowledge about bedding and soft furnishings and is considering acquiring her own business.

She has recently written to you requesting a meeting to discuss the possible purchase of Brita Beds Ltd. Brita Beds has one outlet in Mytown, a small town 100 miles from where Judith works. Enclosed with her letter was Brita Beds' latest profit and loss account. This is reproduced below.

Brita Beds Ltd

Profit and loss account – year to 31 May

Sales	(units)	(£)
Model A	1620	336 960
Model B	2160	758 160
Model C	1620	1 010 880
Turnover		2 106 000
Expenses	(£)	
Cost of beds	1 620 000	
Commission	210 600	
Transport	216 000	
Rates and insurance	8 450	
Light heat and power	10 000	
Assistants' salaries	40 000	
Manager's salary	40 000	2 145 050
Loss for year		39 050

Also included in the letter was the following information:

1 Brita Beds sells three types of bed, models A to C inclusive.
2 Selling prices are determined by adding 30% to the cost of beds.
3 Sales assistants receive a commission of 10% of the selling price for each bed sold.
4 The beds are delivered in consignments of 10 beds at a cost of £400 per delivery. This expense is shown as 'Transport' in the profit and loss account.
5 All other expenses are annual amounts.
6 The mix of models sold is likely to remain constant irrespective of overall sales volume.

Task 1

In preparation for your meeting with Judith Howarth, you are asked to calculate:

(a) the minimum number of beds to be sold if Brita Beds is to avoid making a loss;
(b) the minimum turnover required if Brita Beds it to avoid making a loss.

At the meeting, Judith Howarth provides you with further information:

1 The purchase price of the business is £300 000.
2 Judith has savings of £300 000 currently earning 5% interest per annum, which she can use to aquire Beta Beds.
3 Her current salary is £36 550.

To reduce costs, Judith suggests that she should take over the role of manager as the current one is about to retire. However, she does not want to take a reduction in income. Judith also tells you that she has been carrying out some market research. The results of this are as follows:

1 The number of households in Mytown is currently 44 880
2 Brita Beds Ltd is the only outlet selling beds in Mytown.
3 According to a recent survey, 10% of households change their beds every 9 years, 60% every 10 years and 30% every 11 years.
4 The survey also suggested that there is an average of 2.1 beds per household.

Task 2

Write a letter to Judith Howarth. Your letter should:

(a) identify the profit required to compensate for the loss of salary and interest;
(b) show the number of beds to be sold to achieve that profit;
(c) calculate the likely maximum number of beds that Brita Beds would sell in a year;
(d) use your answers in (a) to (c) to justify whether or not Judith Howarth should purchase the company and become its manager;
(e) give *two* possible reasons why your estimate of the maximum annual sales volume may prove inaccurate.

On receiving your letter, Judith Howarth decides she would prefer to remain as the purchasing director for Winter plc rather than acquire Brita Beds Ltd. Shortly afterwards, you receive a telephone call from her. Judith explains that Winter plc is redeveloping its premises and that she is concerned about the appropriate sales policy for Winter's bed department while the redevelopment takes place. Although she has a statement of unit profitability, this had been prepared before the start of the redevelopment and had assumed that there would be in excess of 800 square metres of storage space available to the bed department. Storage space is critical as customers demand immediate delivery and are not prepared to wait until the new stock arrives.

The next day, Judith Howarth sends you a letter containing a copy of the original statement of profitability. This is reproduced below:

Model	**A**	**B**	**C**
Monthly demand (beds)	**35**	**45**	**20**
	(£)	**(£)**	**(£)**
Unit selling price	240.00	448.00	672.00
Unit cost per bed	130.00	310.00	550.00
Carriage inwards	20.00	20.00	20.00
Staff costs	21.60	40.32	60.48
Department fixed overheads	20.00	20.00	20.00
General fixed overheads	25.20	25.20	25.20
Unit profit	23.20	32.48	(3.68)
Storage required per bed (square metres)	3	4	5

In her letter she asks for your help in preparing a marketing plan which will maximize the profitability of Winter's bed department while the redevelopment takes place. To help you, she has provided you with the following additional information:

1 Currently storage space available totals 300 square metres.
2 Staff costs represent the salaries of the sales staff in the bed department. Their total cost of £3780 per month is apportioned to units on the basis of planned turnover.
3 Departmental fixed overhead of £2000 per month is directly attributable to the department and is apportioned on the number of beds planned to be sold.
4 General fixed overheads of £2520 are also apportioned on the number of beds planned to be sold. The directors of Winter plc believe this to be a fair apportionment of the store's central fixed overheads.
5 The cost of carriage inwards and the cost of beds vary directly with the number of beds purchased.

Task 3

(a) Prepare a recommended monthly sales schedule in units which will maximize the profitability of Winter plc's bed department.
(b) Calculate the profit that will be reported per month if your recommendation is implemented.

AAT

3.18 Decision-making and non-graphical CVP analysis

Fosterjohn Press Ltd is considering launching a new monthly magazine at a selling price of £1 per copy. Sales of the magazine are expected to be 500 000 copies per month, but it is possible that the actual sales could differ quite significantly from this estimate.

Two different methods of producing the magazine are being considered and neither would involve any additional capital expenditure. The estimated production costs for each of the two methods of manufacture, together with the additional marketing and distribution costs of selling the new magazine, are summarized below:

	Method A	Method B
Variable costs	£0.55 per copy	£0.50 per copy
Specific fixed costs	£80 000 per month	£120 000 per month
Semi-variable costs:		
350 000 copies	£55 000 per month	£47 500 per month
450 000 copies	£65 000 per month	£52 500 per month
650 000 copies	£85 000 per month	£62 500 per month

It may be assumed that the fixed cost content of the semi-variable costs will remain constant throughout the range of activity shown.

The company currently sells a magazine covering related topics to those that will be included in the new publication and consequently it is anticipated that sales of this existing magazine will be adversely affected. It is estimated that for every ten copies sold of the new publication, sales of the existing magazine will be reduced by one copy.

Sales and cost data of the existing magazine are shown below:

Sales	220 000 copies per month
Selling price	£0.85 per copy
Variable costs	£0.35 per copy
Specific fixed costs	£80 000 per month

Required:

(a) Calculate, for each production method, the net increase in company profits which will result from the introduction of the new magazine, at each of the following levels of activity:
500 000 copies per month
400 000 copies per month
600 000 copies per month (12 marks)
(b) Calculate, for each production method, the amount by which sales volume of the new magazine could decline from the anticipated 500 000 copies per month, before the company makes no additional profit from the introduction of the new publication. (6 marks)
(c) Briefly identify any conclusions which may be drawn from your calculations. (4 marks)

(Total 22 marks)

ACCA

3.19 Decision-making and non-graphical CVP analysis

Mr Belle has recently developed a new improved video cassette and shown below is a summary of a report by a firm of management consultants on the

sales potential and production costs of the new cassette.

Sales potential: The sales volume is difficult to predict and will vary with the price, but it is reasonable to assume that at a selling price of £10 per cassette, sales would be between 7500 and 10 000 units per month. Alternatively, if the selling price was reduced to £9 per cassette, sales would be between 12 000 and 18 000 units per month.

Production costs: If production is maintained at or below 10 000 units per month, then variable manufacturing costs would be approximately £8.25 per cassette and fixed costs £12 125 per month. However, if production is planned to exceed 10 000 units per month, then variable costs would be reduced to £7.75 per cassette, but the fixed costs would increase to £16 125 per month.

Mr Belle has been charged £2000 for the report by the management consultants and, in addition, he has incurred £3000 development costs on the new cassette.

If Mr Belle decides to produce and sell the new cassette it will be necessary for him to use factory premises which he owns, but are leased to a colleague for a rental of £400 per month. Also he will resign from his current post in an electronics firm where he is earning a salary of £1000 per month.

Required:

(a) Identify in the question an example of
  (i) an opportunity cost,
  (ii) a sunk cost. (3 marks)

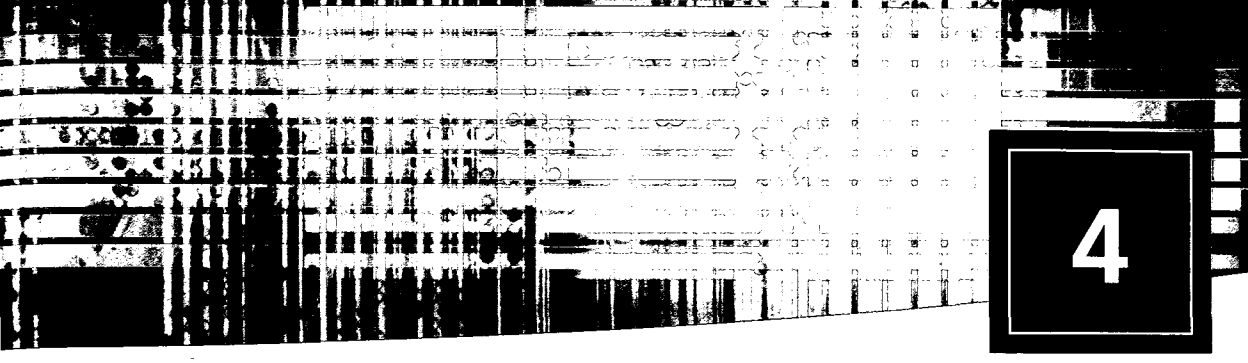
(b) Making whatever calculations you consider appropriate, analyse the report from the consultants and advise Mr Belle of the potential profitability of the alternatives shown in the report.

  Any assumptions considered necessary or matters which may require further investigation or comment should be clearly stated.

(19 marks)

(Total 22 marks)

ACCA



4

Measuring relevant costs and revenues for decision-making

In this chapter we are going to focus on measuring costs and benefits for non-routine decisions. The term 'special studies' is sometimes used to refer to decisions that are not routinely made at frequent intervals. In other words, special studies are undertaken whenever a decision needs to be taken; such as discontinuing a product or a channel of distribution, making a component within the company or buying from an outside supplier, introducing a new product and replacing existing equipment. Special studies require only those costs and revenues that are relevant to the specific alternative courses of action to be reported. The term 'decision-relevant approach' is used to describe the specific costs and benefits that should be reported for special studies. We shall assume that the objective when examining alternative courses of action is to maximize the present value of future net cash inflows. The calculations of present values will be explained in Chapter 9. We also assume for this chapter that future costs and benefits are known with certainty; decision-making under conditions of uncertainty will be considered in Chapter 8. In Chapter 9 we shall concentrate on the special studies required for capital investment decisions.

It is important that you note at this stage that a decision-relevant approach adopts whichever planning time horizon the decision maker considers appropriate for a given situation. However, it is important not to focus excessively on the short term, since the objective is to maximize long-term net cash inflows. We begin by introducing the concept of relevant cost and applying this principle to special studies relating to the following:

1. special selling price decisions;
2. product-mix decisions when capacity constraints exist;
3. decisions on replacement of equipment;
4. outsourcing (make or buy) decisions;
5. discontinuation decisions.

Learning objectives

After studying this chapter, you should be able to:

- define relevant and irrelevant costs and revenues;
- explain the importance of qualitative factors;
- distinguish between the relevant and irrelevant costs and revenues for the five decision-making problems described;
- explain why the book value of equipment is irrelevant when making equipment replacement decisions;
- describe the opportunity cost concept.

We shall then consider in more detail the specific problems that arise in assessing the relevant costs of materials and labour, and conclude with a comprehensive decision-making problem that consolidates the various aspects of financial information required for decision-making.

The aim of this chapter is to provide you with an understanding of the principles that should be used to identify relevant costs and revenues. It is assumed that relevant costs can be easily measured but, in reality, some indirect relevant costs can be difficult to measure. The measurement of indirect relevant costs for decision-making using activity-based-costing techniques will be examined in Chapter 6.

The meaning of relevance

The **relevant costs** and benefits required for decision-making are only those that will be affected by the decision. Costs and benefits that are independent of a decision are obviously not relevant and need not be considered when making that decision. The relevant financial inputs for decision-making purposes are therefore *future* cash flows, which will differ between the various alternatives being considered. In other words, only **differential** (or **incremental**) **cash flows** should be taken into account, and cash flows that will be the same for all alternatives are irrelevant. Since decision-making is concerned with choosing between future alternative courses of action, and nothing can be done to alter the past, then past costs (also known as sunk costs, see Chapter 2) are not relevant for decision-making. Consider a situation where an individual is uncertain as to whether he or she should purchase a monthly rail ticket to travel to work or use their car. Assuming that the individual will keep the car, whether or not he or she travels to work by train, the cost of the road fund licence and insurance will be irrelevant, since these costs remain the same irrespective of the mode of travel. The cost of petrol will, however, be relevant, since this cost will vary depending on which method of transport is chosen.

You will see that both depreciation and the allocation of common fixed costs are irrelevant for decision-making. Both are sunk costs. Depreciation represents the allocation of past costs to future periods. The original cost is unavoidable and common to all alternatives. Therefore it is irrelevant. Similarly, any allocation of common fixed costs will be irrelevant for decision-making since the choice of allocation method does not affect the level of cost to the company. It merely results in a redistribution of the same sunk cost between cost objects (e.g. products or locations within the organization).

Importance of qualitative factors

In many situations it is difficult to quantify in monetary terms all the important elements of a decision. Those factors that cannot be expressed in monetary terms are classified as **qualitative factors**. A decline in employee morale that results from redundancies arising from a closure decision is an example of a qualitative factor. It is essential that qualitative factors be brought to the attention of management during the decision-making process, since otherwise there may be a danger that a wrong decision will be made. For example,

the cost of manufacturing a component internally may be more expensive than purchasing from an outside supplier. However, the decision to purchase from an outside supplier could result in the closing down of the company's facilities for manufacturing the component. The effect of such a decision might lead to redundancies and a decline in employees' morale, which could affect future output. In addition, the company will now be at the mercy of the supplier who might seek to increase prices on subsequent contracts and/or may not always deliver on time. The company may not then be in a position to meet customers' requirements. In turn, this could result in a loss of customer goodwill and a decline in future sales.

It may not be possible to quantify in monetary terms the effect of a decline in employees' morale or loss of customer goodwill, but the accountant in such circumstances should present the relevant quantifiable financial information and draw attention to those qualitative items that may have an impact on future profitability. In circumstances such as those given in the above example management must estimate the likelihood of the supplier failing to meet the company's demand for future supplies and the likely effect on customer goodwill if there is a delay in meeting orders. If the component can be obtained from many suppliers and repeat orders for the company's products are unlikely then the company may give little weighting to these qualitative factors. Alternatively, if the component can be obtained from only one supplier and the company relies heavily on repeat sales to existing customers then the qualitative factors will be of considerable importance. In the latter situation the company may consider that the quantifiable cost savings from purchasing the component from an outside supplier are insufficient to cover the risk of the qualitative factors occurring.

If it is possible qualitative factors should be expressed in quantitative non-financial terms. For example, the increase in percentage of on-time deliveries from a new production process, the reduction in customer waiting time from a decision to invest in additional cash dispensing machines and the reduction in the number of units of defective output delivered to customers arising from an investment in quality inspection are all examples of qualitative factors that can be expressed in non-financial numerical terms.

Let us now move on to apply the relevant cost approach to a variety of decision-making problems. We shall concentrate on measuring the financial outcomes but do remember that they do not always provide the full story. Qualitative factors should also be taken into account in the decision-making process.

Special pricing decisions

Special pricing decisions relate to pricing decisions outside the main market. Typically they involve one-time only orders or orders at a price below the prevailing market price. Consider the information presented in Example 4.1.

At first glance it looks as if the order should be rejected since the proposed selling price is less than the total cost of £33. A study of the cost estimates, however, indicates that during the next quarter, the direct labour, manufacturing (i.e. non-variable) fixed overheads and the marketing and distribution costs will remain the same irrespective of whether or not the order is accepted. These costs are therefore irrelevant for this decision. The direct material costs, variable manufacturing overheads and the cost of adding the leisure company's logo will be different if the order is accepted. Hence they are relevant for making the decision. The financial information required for the decision is shown in Exhibit 4.1.

You can see from Exhibit 4.1 that different approaches can be used for presenting relevant cost and revenue information. Cost information can be presented that includes

EXAMPLE 4.1

The Caledonian Company is a manufacturer of clothing that sells its output directly to clothing retailers. One of its departments manufactures jumpers. The department has a production capacity of 50 000 jumpers per month. Because of the liquidation of one of its major customers the company has excess capacity. For the next quarter current monthly production and sales volume is expected to be 35 000 jumpers at a selling price of £40 per jumper. Expected costs and revenues for the next month at an activity level of 35 000 jumpers are as follows:

	(£)	(£)
Direct labour	420 000	12
Direct materials	280 000	8
Variable manufacturing overheads	70 000	2
Manufacturing non-variable overheads	280 000	8
Marketing and distribution costs	105 000	3
Total costs	1 155 000	33
Sales	1 400 000	40
Profit	245 000	7

Caledonian is expecting an upsurge in demand and considers that the excess capacity is temporary. A company in the leisure industry has offered to buy for its staff 3000 jumpers each month for the next three months at a price of £20 per jumper. The company would collect the jumpers from Caledonian's factory and thus no marketing and distribution costs will be incurred. No subsequent sales to this customer are anticipated. The company would require its company logo inserting on the jumper and Caledonian has predicted that this will cost £1 per jumper. Should Caledonian accept the offer from the company?

both relevant and irrelevant costs or revenues for all alternatives under consideration. If this approach is adopted the *same* amount for the irrelevant items (i.e. those items that remain unchanged as a result of the decision which are direct labour, manufacturing non-variable overheads and the marketing and distribution costs in our example) are included for all alternatives, thus making them irrelevant to the decision. This information is presented in columns (1) and (2) in Exhibit 4.1. Alternatively, you can present cost information in columns (1) and (2) that excludes the irrelevant costs and revenues because they are identical for both alternatives. A third alternative is to present only the relevant (differential) costs. This approach is shown in column (3) of Exhibit 4.1. Note that column (3) represents the difference between columns (1) and (2). All of the methods show that the company is better off by £27 000 *per month* if the order is accepted.

Four important factors must be considered before recommending acceptance of the order. Most of these relate to the assumption that there are no long-run implications from accepting the offer at a selling price of £20 per jumper. First, it is assumed that the future selling price will not be affected by selling some of the output at a price below the going market price. If this assumption is incorrect then competitors may engage in similar practices of reducing their selling prices in an attempt to unload spare capacity. This may lead to a fall in the market price, which in turn would lead to a fall in profits from future sales. The loss of future profits may be greater than the short-term gain obtained from accepting special orders at prices below the existing market price. Given that Caledonian

EXHIBIT 4.1

Evaluation of three month order from the company in the leisure industry

has found a customer in a different market from its normal market it is unlikely that the market price would be affected. However, if the customer had been within Caledonian's normal retail market there would be a real danger that the market price would be affected. Secondly, the decision to accept the order prevents the company from accepting other orders that may be

	(1) Do not accept order (£ per month)	(2) Accept order (£ per month)	(3) Difference (relevant costs) (£ per month)
Direct labour	420 000	420 000	
Direct materials	280 000	304 000	24 000
Variable manufacturing overheads	70 000	76 000	6 000
Manufacturing non-variable overheads	280 000	280 000	
Inserting company logo		3 000	3 000
Marketing and distribution costs	105 000	105 000	
Total costs	1 155 000	1 188 000	33 000
Sales	1 400 000	1 460 000	60 000
Profit per month	245 000	272 000	27 000

obtained during the period at the going price. In other words, it is assumed that no better opportunities will present themselves during the period. Thirdly, it is assumed that the company has unused resources that have no alternative uses that will yield a contribution to profits in excess of £27 000 *per month*. Finally, it is assumed that the fixed costs are unavoidable for the period under consideration. In other words, we assume that the direct labour force and the fixed overheads cannot be reduced in the short term, or that they are to be retained for an upsurge in demand, which is expected to occur in the longer term.

It is important that great care is taken in presenting financial information for decision-making. For stock valuation external financial reporting regulations require that the jumpers must be valued at their manufacturing cost of £30. Using this cost would lead to the incorrect decision being taken. For decision-making purposes only future costs that will be relevant to the decision should be included. Costs that have been computed for meeting stock valuation requirements must not therefore be used for decision-making purposes.

When you are trying to establish which costs are relevant to a particular decision you may find that some costs will be relevant in one situation but irrelevant in another. In Example 4.1 we assumed that direct labour was not a relevant cost. The company wishes to retain the direct labour for an expected upsurge in demand and therefore the direct labour cost will be same whether or not the offer is accepted. Alternatively, Caledonian may have had an agreement with its workforce that entitled them to at least three months notice in the event of any redundancies. Therefore, even if Caledonian was not expecting an upsurge in demand direct labour would have been a fixed cost within the three month time horizon. But now let us consider what the relevant cost would be if direct labour consisted of casual labour who are hired on a daily basis. In this situation direct labour will be a relevant cost, since the labour costs will not be incurred if the order is not accepted.

The identification of relevant costs depends on the circumstances. In one situation a cost may be relevant, but in another the same cost may not be relevant. It is not therefore possible to provide a list of costs that would be relevant in particular situations. In each situation you should follow the principle that the relevant costs are future costs that differ among alternatives. The important question to ask when determining the relevant cost is: What difference will it make? The accountant must be aware of all the issues relating to a decision and ascertain full details of the changes that will result, and then proceed to select the relevant financial information to present to management.

EVALUATION OF A LONGER-TERM ORDER

In Example 4.1 we focused on a short-term time horizon of three months. Capacity cannot easily be altered in the short term and therefore direct labour and fixed costs are likely to be irrelevant costs with respect to short-term decisions. In the longer-term, however, it may be possible to reduce capacity and spending on fixed costs and direct labour. Let us now assume that for Example 4.1 that Caledonian's assumption about an expected upsurge in the market proved to be incorrect and that it estimates that demand in the foreseeable future will remain at 35 000 jumpers *per month*. Given that it has a productive capacity of 50 000 jumpers it has sought to develop a long-term market for the unutilized capacity of 15 000 jumpers. As a result of its experience with the one-time special order with the company in the leisure industry, Caledonian has sought to develop a market with other companies operating in the leisure industry. Assume that this process has resulted in potential customers that are prepared to enter into a contractual agreement for a three year period for a supply of 15 000 jumpers *per month* at an agreed price of £25 per jumper. The cost of inserting the insignia required by each customer would remain unchanged at £1 per jumper. No marketing and distribution costs would be incurred with any of the orders. Caledonian considers that it has investigated all other possibilities to develop a market for the excess capacity. Should it enter into contractual agreements with the suppliers at £25 per jumper?

If Caledonian does not enter into contractual agreement with the suppliers the direct labour required will be made redundant. No redundancy costs will be involved. Further investigations indicate that manufacturing non-variable costs of £70 000 *per month* could be saved if a decision was made to reduce capacity by 15 000 jumpers per month. For example, the rental contracts for some of the machinery will not be renewed. Also some savings will be made in supervisory labour and support costs. Savings in marketing and distribution costs would be £20 000 *per month*. Assume also that if the capacity was reduced factory rearrangements would result in part of the facilities being rented out at £25 000 *per month*. Note that because variable costs vary directly with changes in volume direct materials and variable manufacturing overheads will decline by 30% if capacity is reduced by 30%.

We are now faced with a longer-term decision where some of the costs that were fixed in the short term can be changed in the longer term. The appropriate financial data for the analysis is shown in Exhibit 4.2. Note that in Exhibit 4.2 the information for an activity of 35 000 jumpers incorporates the changes arising from the capacity reduction whereas the information presented for the same activity level in Exhibit 4.1 is based on the assumption that capacity will be maintained at 50 000 jumpers. Therefore the direct labour cost in Exhibit 4.1 is £420 000 because it represents the labour required to meet demand at full capacity. If capacity is permanently reduced from 50 000 to 35 000 jumpers (i.e. a 30% reduction) it is assumed that direct labour costs will be reduced by 30% from £420 000 to £294 000. This is the amount shown in Exhibit 4.2.

A comparison of the monthly outcomes reported in columns (1) and (2) of Exhibit 4.2 indicates that the company is better off by £31 000 *per month* if it reduces capacity to

EXHIBIT 4.2

Evaluation of orders for the unutilized capacity over a three year time horizon

35 000 jumpers, assuming that there are no qualitative factors. Instead of presenting the data in columns (1) and (2) you can present only the differential (relevant) costs and revenues shown in column (3). This approach also indicates that the company is better off by £31 000 per month. Note that the entry in column (3) of £25 000 is the lost revenues from the rent of

Monthly sales and production in units	**(1) Do not accept orders 35 000 (£)**	**(2) Accept the orders 50 000 (£)**	**(3) Difference (relevant costs) 15 000 (£)**
Direct labour	294 000	420 000	126 000
Direct materials	280 000	400 000	120 000
Variable manufacturing overheads	70 000	100 000	30 000
Manufacturing non-variable overheads	210 000	280 000	70 000
Inserting company logo		15 000	15 000
Marketing and distribution costs	85 000	105 000	20 000
Total costs	939 000	1 320 000	381 000
Revenues from rental of facilities	25 000		25 000
Sales revenues	1 400 000	1 775 000	(375 000)
Profit per month	486 000	455 000	31 000

the unutilized capacity if the company accepts the orders. This represents the opportunity cost of accepting the orders. Where the choice of one course of action requires that an alternative course of action is given up, the financial benefits that are forgone or sacrificed are known as **opportunity costs**. In other words, opportunity costs represent the lost contribution to profits arising from the best use of the alternative forgone. Opportunity costs only arise when resources are scarce and have alternative uses. Thus, in our illustration the capacity allocated to producing 15 000 jumpers results in an opportunity cost (i.e. the lost revenues from the rent of the capacity) of £15 000 per month.

In Exhibit 4.2 all of the costs and revenues are relevant to the decision because some of the costs that were fixed in the short term could be changed in the longer term. Therefore whether or not a cost is relevant often depends on the time horizon under consideration. Thus it is important that the information presented for decision-making relates to the appropriate time horizon. If inappropriate time horizons are selected there is a danger that misleading information will be presented. Remember that our aim should always be to maximize *long-term* net cash inflows.

DANGERS OF FOCUSING EXCESSIVELY ON A SHORT-RUN TIME HORIZON

The problems arising from not taking into account the long-term consequences of accepting business that covers short-term incremental costs have been discussed by Kaplan (1990). He illustrates a situation where a company that makes pens has excess capacity, and a salesperson negotiates an order for 20 000 purple pens (a variation to the

pens that are currently being made) at a price in excess of the incremental cost. In response to the question 'Should the order be accepted?' Kaplan states:

> take the order. The economics of making the purple pen with the excess capacity are overwhelming. There's no question that if you have excess capacity, the workers are all hired, the technology exists, and you have the product designed, and someone says, let's get an order for 20 000 purple pens, then the relevant consideration is price less the material cost of the purple pens. Don't even worry about the labour cost because you're going to pay them anyway. The second thing we tell them, however, is that they are never to ask us this question again ... Suppose that every month managers see that they have excess capacity to make 20 000 more pens, and salespeople are calling in special orders for turquoise pens, for purple pens with red caps, and other such customised products. Why not accept all these orders based on short-run contribution margin? The answer is that if they do, then costs that appear fixed in the short-term will start to increase, or expenses currently being incurred will be incapable of being reduced (p. 14).

Kaplan stresses that by utilizing the unused capacity to increase the range of products produced (i.e. different variations of pens in the above example), the production process becomes more complex and consequently the fixed costs of managing the additional complexity will eventually increase. Long-term considerations should therefore always be taken into account when special pricing decisions are being evaluated. In particular, there is a danger that a series of special orders will be evaluated independently as short-term decisions. Consequently, those resources that cannot be adjusted in the short term will be treated as irrelevant for each decision. However, the effect of accepting a series of consecutive special orders over several periods constitutes a long-term decision. If special orders are always evaluated as short-term decisions a situation can arise whereby the decision to reduce capacity is continually deferred. If demand from normal business is considered to be permanently insufficient to utilize existing capacity then a long-term capacity decision is required. This should be based on the long-term approach as illustrated in Exhibit 4.2 and not the short-term approach illustrated in Exhibit 4.1. In other words, this decision should be based on a comparison of the relevant revenues and costs arising from using the excess capacity for special orders with the capacity costs that can be eliminated if the capacity is reduced.

Product-mix decisions when capacity constraints exist

In the short term sales demand may be in excess of current productivity capacity. For example, output may be restricted by a shortage of skilled labour, materials, equipment or space. When sales demand is in excess of a company's productive capacity, the resources responsible for limiting the output should be identified. These scarce resources are known as **limiting factors**. Within a short-term time period it is unlikely that production constraints can be removed and additional resources acquired. Where limiting factors apply, profit is maximized when the greatest possible contribution to profit is obtained each time the scarce or limiting factor is used. Consider Example 4.2.

In this situation the company's ability to increase its output and profits/net cash inflows is limited in the short term by the availability of machine capacity. You may think, when first looking at the available information, that the company should give top priority to

EXAMPLE 4.2

Rhine Autos is a major European producer of automobiles. A department within one of its divisions supplies component parts to firms operating within the automobile industry. The following information is provided relating to the anticipated demand and the productive capacity for the next quarter in respect of three components that are manufactured within the department:

	Component X	Component Y	Component Z
Contribution per unit of output	£12	£10	£6
Machine hours required per unit of output	6 hours	2 hours	1 hour
Estimated sales demand	2 000 units	2000 units	2000 units
Required machine hours for the quarter	12 000 hours	4000 hours	2000 hours

Because of the breakdown of one of its special purpose machines capacity is limited to 12 000 machine hours for the period, and this is insufficient to meet total sales demand. You have been asked to advise on the mix of products that should be produced during the period.

producing component X, since this yields the highest contribution per unit sold, but this assumption would be incorrect. To produce each unit of component X, 6 scarce machine hours are required, whereas components Y and Z use only 2 hours and 1 hour respectively of scarce machine hours. By concentrating on producing components Y and Z, the company can sell 2000 units of each component and still have some machine capacity left to make component X. If the company concentrates on producing component X it will only be able to meet the maximum sales demand of component X, and will have no machine capacity left to make components Y or Z. The way in which you should determine the optimum production plan is to calculate the contribution per limiting factor for each component and then to rank the components in order of profitability based on this calculation.

Using the figures in the present example the result would be as follows:

	Component X	Component Y	Component Z
Contribution per unit	£12	£10	£6
Machine hours required	6 hours	2 hours	1 hour
Contribution per machine hour	£2	£5	£6
Ranking	3	2	1

The company can now allocate the 12 000 scarce machine hours in accordance with the above rankings. The first choice should be to produce as much as possible of component Z. The maximum sales are 2000 units, and production of this quantity will result in the use of 2000 machine hours, thus leaving 10 000 unused hours. The second choice should be to

produce as much of component Y as possible. The maximum sales of 2000 units will result in the use of 4000 machine hours. Production of both components Z and Y require 6000 machine hours, leaving a balance of 6000 hours for the production of component X, which will enable 1000 units of component X to be produced.

We can now summarize the allocation of the scarce machine hours:

Production	Machine hours used	Balance of machine hours available
2000 units of Z	2000	10 000
2000 units of Y	4000	6 000
1000 units of X	6000	—

This production programme results in the following total contribution:

	(£)
2000 units of Z at £6 per unit contribution	12 000
2000 units of Y at £10 per unit contribution	20 000
1000 units of X at £12 per unit contribution	12 000
Total contribution	44 000

Always remember that it is necessary to consider other qualitative factors before the production programme is determined. For example, customer goodwill may be lost causing a fall in future sales if the company is unable to supply all three products to, say, 150 of its regular customers. Difficulties may arise in applying this procedure when there is more than one scarce resource. It could not be applied if, for example, labour hours were also scarce and the contribution per labour hour resulted in component Y being ranked first, followed by components X and Z. In this type of situation, where more than one resource is scarce, it is necessary to resort to linear programming methods in order to determine the optimal production programme. For an explanation of how linear programming can be applied to decision-making, when there are several scarce resources, you should refer to Drury (2000. ch. 26).

The approach described above can also be applied in non-manufacturing organizations. For example, in a major UK retail store display space is the limiting factor. The store maximizes its short-term profits by allocating shelving space on the basis of contribution per metre of shelving space. For an illustration of a product-mix decision with a capacity constraint within an agricultural setting you should refer to the self-assessment question and answer at the end of this chapter.

The approach outlined in this section applies only to those situations where capacity constraints cannot be removed in the short term. In the longer term additional resources should be acquired if the contribution from the extra capacity exceeds the cost of acquisition.

Replacement of equipment – the irrelevance of past costs

Replacement of equipment is a capital investment or long-term decision that requires the use of discounted cash flow procedures. These procedures are discussed in detail in Chapter 9, but one aspect of asset replacement decisions which we will consider at this

EXAMPLE 4.3

A division within Rhine Autos purchased a machine three years ago for £180 000. Depreciation using the straight line basis, assuming a life of six years and with no salvage value, has been recorded each year in the financial accounts. The present written-down value of the equipment is £90 000 and it has a remaining life of three years. Management is considering replacing this machine with a new machine that will reduce the variable operating costs. The new machine will cost £70 000 and will have an expected life of three years with no scrap value. The variable operating costs are £3 per unit of output for the old machine and £2 per unit for the new machine. It is expected that both machines will be operated at a capacity of 20 000 units per annum. The sales revenues from the output of both machines will therefore be identical. The current disposal or sale value of the old machine is £40 000 and it will be zero in three years time.

stage is how to deal with the book value (i.e. the written-down value) of old equipment. This is a problem that has been known to cause difficulty, but the correct approach is to apply relevant cost principles (i.e. past or sunk costs are irrelevant for decision-making). We shall now use Example 4.3 to illustrate the irrelevance of the book value of old equipment in a replacement decision. To avoid any possible confusion, it will be assumed here that £1 of cash inflow or outflow in year 1 is equivalent to £1 of cash inflow or outflow in, say, year 3. Such an assumption would in reality be incorrect and you will see why this is so in Chapter 9, but by adopting this assumption at this stage, the replacement problem can be simplified and we can focus our attention on the treatment of the book value of the old equipment in the replacement decision.

You can see from an examination of Example 4.3 that the total costs over a period of three years for each of the alternatives are as follows:

	(1) Retain present machine (£)	(2) Buy replacement machine (£)	(3) Difference (relevant costs/ revenues) (£)
Variable/incremental operating costs:			
20 000 units at £3 per unit for 3 years	180 000		
20 000 units at £2 per unit for 3 years		120 000	(60 000)
Old machine book value:			
3-year annual depreciation charge	90 000		
Lump sum write-off		90 000	
Old machine disposal value		(40 000)	(40 000)
Initial purchase price of new machine		70 000	70 000
Total cost	270 000	240 000	30 000

You can see from the above analysis that the £90 000 book value of the old machine is irrelevant to the decision. Book values are not relevant costs because they are past or sunk costs and are therefore the same for all potential courses of action. If the present machine is

retained, three years' depreciation at £30 000 per annum will be written off annually whereas if the new machine is purchased the £90 000 will be written off as a lump sum if it is replaced. Note that depreciation charges for the new machine are not included in the analysis since the cost of purchasing the machine is already included in the analysis. The sum of the annual depreciation charges are equivalent to the purchase cost. Thus, including both items would amount to double counting.

The above analysis shows that the costs of operating the replacement machine are £30 000 less than the costs of operating the existing machine over the three year period. Again there are several different methods of presenting the information. They all show a £30 000 advantage in favour of replacing the machine. You can present the information shown in columns (1) and (2) above, as long as you ensure that the same amount for the irrelevant items is included for all alternatives. Instead, you can present columns (1) and (2) with the irrelevant item (i.e. the £90 000) omitted or you can present the differential items listed in column (3). However, if you adopt the latter approach you will probably find it more meaningful to restate column (3) as follows:

	(£)
Savings on variable operating costs (3 years)	60 000
Sale proceeds of existing machine	40 000
	100 000
Less purchase cost of replacement machine	70 000
Savings on purchasing replacement machine	30 000

Outsourcing and make or buy decisions

Outsourcing is the process of obtaining goods or services from outside suppliers instead of producing the same goods or providing the same services within the organization. Decisions on whether to produce components or provide services within the organization or to acquire them from outside suppliers are called outsourcing or make or buy decisions. Many organizations outsource some of their activities such as their payroll and purchasing functions or the purchase of speciality components. Increasingly municipal local services such as waste disposal, highways and property maintenance are being outsourced. Consider the information presented in Example 4.4 (case A).

At first glance it appears that the component should be outsourced since the purchase price of £30 is less than the current total unit cost of manufacturing. However, the unit costs include some costs that will be unchanged whether or not the components are outsourced. These costs are therefore not relevant to the decision. Assume also that there are no alternative uses of the released capacity if the components are outsourced. The appropriate cost information is presented in Exhibit 4.3 (Section A). Alternative approaches to presenting relevant cost and revenue information are presented. In columns (1) and (2) of Exhibit 4.3 cost information is presented that includes both relevant and irrelevant costs for both alternatives under consideration. The same amount for non-manufacturing overheads, which are irrelevant, is included for both alternatives. By including the same amount in both columns the cost is made irrelevant. Alternatively, you can present cost information in columns (1) and (2) that excludes any irrelevant costs and revenues because they are identical for both alternatives. Adopting either approach will result in a difference of £60 000 in favour of making component A.

The third approach is to list only the relevant costs, cost savings and any relevant revenues. This approach is shown in column (3) of Exhibit 4.3. This column represents the differential costs or revenues and it is derived from the differences between columns (1)

EXAMPLE 4.4

CASE A

One of the divisions within Rhine Autos is currently negotiating with another supplier regarding outsourcing component A that it manufactures. The division currently manufactures 10 000 units per annum of the component. The costs currently assigned to the components are as follows:

	Total costs of producing 10 000 components (£)	Unit cost (£)
Direct materials	120 000	12
Direct labour	100 000	10
Variable manufacturing overhead costs (power and utilities)	10 000	1
Fixed manufacturing overhead costs	80 000	8
Share of non-manufacturing overheads	50 000	5
Total costs	360 000	36

The above costs are expected to remain unchanged in the foreseeable future if the Rhine Autos division continues to manufacture the components. The supplier has offered to supply 10 000 components per annum at price of £30 per unit guaranteed for a minimum of three years. If Rhine Autos outsources component A the direct labour force currently employed in producing the components will be made redundant. No redundancy costs will be incurred. Direct materials and variable overheads are avoidable if component A is outsourced. Fixed manufacturing overhead costs would be reduced by £10 000 per annum but non-manufacturing costs would remain unchanged. Assume initially that the capacity that is required for component A has no alternative use. Should the Division of Rhine Autos make or buy the component?

CASE B

Assume now that the extra capacity that will be made available from outsourcing component A can be used to manufacture and sell 10 000 units of part B at a price of £34 per unit. All of the labour force required to manufacture component A would be used to make part B. The variable manufacturing overheads, the fixed manufacturing overheads and non-manufacturing overheads would be the same as the costs incurred for manufacturing component A. The materials required to manufacture component A would not be required but additional materials required for making part B would cost £13 per unit. Should Rhine Autos outsource component A?

and (2). In column (3) only the information that is relevant to the decision is presented. You will see that this approach compares the relevant costs of making directly against outsourcing. It indicates that the additional costs of making component A are £240 000 but this enables purchasing costs of £300 000 to be saved. Therefore the company makes a net saving of £60 000 from making the components compared with outsourcing.

However, you will probably find column (3) easier to interpret if it is restated as two separate alternatives as shown in Exhibit 4.3. All of the approaches described in this and the preceding paragraph yield identical results. You can adopt any of them. It is a matter of personal preference.

Let us now re-examine the situation when the extra capacity created from not producing component A has an alternative use. Consider the information presented in Example 4.4 (Case B). The management of Rhine Autos now have three alternatives. They are:

1. Make component A and do not make part B.
2. Outsource component A and do not make part B.
3. Outsource component A and make and sell part B.

EXHIBIT 4.3

Evaluating a make or buy decision

It is assumed there is insufficient capacity to make both component A and part B. The appropriate financial information is presented in Exhibit 4.3 (Section B).

Section A – Assuming there is no alternative use of the released capacity

	Total cost of continuing to make 10 000 components (1) (£ per annum)	**Total cost of buying 10 000 components (2) (£ per annum)**	**Difference (relevant) (cost) (3) (£ per annum)**
Direct materials	120 000		120 000
Direct labour	100 000		100 000
Variable manufacturing overhead costs (power and utilities)	10 000		10 000
Fixed manufacturing overhead costs	80 000	70 000	-10 000
Non-manufacturing overheads	50 000	50 000	
Outside purchase cost incurred/(saved)		300 000	(300 000)
Total costs incurred/(saved) per annum	360 000	420 000	(60 000)

Column 3 is easier to interpret if it is restated as two separate alternatives as follows:

	Relevant cost of making component A (£ per annum)	**Relevant cost of outsourcing component A (£ per annum)**
Direct materials	120 000	
Direct labour	100 000	
Variable manufacturing overhead costs	10 000	
Fixed manufacturing overhead costs	10 000	
Outside purchase cost incurred		300 000
	240 000	300 000

(Exhibit 4.3 continued)

Section B – Assuming the released capacity has alternative uses

	(1) Make component A and do not make part B (£ per annum)	(2) Buy component A and do not make part B (£ per annum)	(3) Buy component A and make part B (£ per annum)
Direct materials	120 000		130 000
Direct labour	100 000		100 000
Variable manufacturing overhead costs	10 000		10 000
Fixed manufacturing overhead costs	80 000	70 000	80 000
Non-manufacturing overheads	50 000	50 000	50 000
Outside purchase cost incurred		300 000	300 000
Revenues from sales of part B			(340 000)
Total net costs	360 000	420 000	330 000

You will see that, with the exception of non-manufacturing costs, all of the items differ between the alternatives and are therefore relevant to the decision. Again we can omit the non-manufacturing costs from the analysis or include the same amount for all alternatives. Either approach makes them irrelevant. The first two alternatives that do not involve making and selling part B are identical to the alternatives considered in Case A so the information presented in columns (1) and (2) in sections A and B of Exhibit 4.3 are identical. In column 3 of section B the costs incurred in making part B in respect of direct labour, variable and fixed manufacturing overheads and non-manufacturing overheads are identical to the costs incurred in making component A. Therefore the same costs for these items are entered in column 3. However, different materials are required to make part B and the cost of these (10 000 units at £13) are entered in column 3. In addition, the revenues from the sales of part B are entered in column 3. Comparing the three columns in Section B of Exhibit 4.3 indicates that buying component A and using the extra capacity that is created to make part B is the preferred alternative.

The incremental costs of outsourcing are £60 000 more than making component B (see Section A of Exhibit 4.3) but the extra capacity released from outsourcing component A enables Rhine Autos to obtain a profit contribution of £90 000 (£340 000 incremental sales from part B less £250 000 incremental/relevant costs of making part B). The overall outcome is a £30 000 net benefit from outsourcing. Note that the relevant costs of making part B are the same as those of making component A, apart from direct materials, which cost £130 000. In other words, the relevant (incremental) costs of making part B are as follows:

	(£)
Direct materials	130 000
Direct labour	100 000
Variable manufacturing overhead costs	10 000
Fixed manufacturing overhead costs	10 000
	250 000

Discontinuation decisions

Most organizations periodically analyse profits by one or more cost objects, such as products or services, customers and locations. Periodic profitability analysis provides attention-directing information that highlights those unprofitable activities that require a more detailed appraisal (sometimes referred to as a special study) to ascertain whether or not they should be discontinued. In this section we shall illustrate how the principle of relevant costs can be applied to discontinuation decisions. Consider Example 4.5. You will see that it focuses on a decision whether to discontinue operating a sales territory, but the same principles can also be applied to discontinuing products, services or customers.

In Example 4.5 Euro Company analyses profits by locations. Profits are analysed by regions which are then further analysed by sales territories within each region. It is apparent from Example 4.5 that the Scandinavian region is profitable but the profitability analysis suggests that the Helsinki sales territory is unprofitable. A more detailed study is required to ascertain whether it should be discontinued. Let us assume that this study indicates that:

1. Discontinuing the Helsinki sales territory will eliminate cost of goods sold, salespersons salaries, sales office rent and regional and headquarters expenses arising from cause-and-effect cost allocations.
2. Discontinuing the Helsinki sales territory will have no effect on depreciation of sales office equipment, warehouse rent, depreciation of warehouse equipment and regional and headquarters expenses arising from arbitrary cost allocations. The same costs will be incurred by the company for all of these items even if the sales territory is discontinued.

Note that in the event of discontinuation the sales office will not be required and the rental will be eliminated whereas the warehouse rent relates to the warehouse for the region as a whole and, unless the company moves to a smaller warehouse, the rental will remain unchanged. It is therefore not a relevant cost. Discontinuation will result in the creation of additional space and if the extra space remains unused there are no financial consequences to take into account. However, if the additional space can be sub-let to generate rental income the income would be incorporated as an opportunity cost for the alternative of keeping the Helsinki territory.

Exhibit 4.4. shows the relevant cost computations. Column (1) shows the costs incurred by the company if the sales territory is kept open and column (2) shows the costs that would be incurred if a decision was taken to drop the sales territory. Therefore in column (2) only those costs that would be eliminated (i.e. those items listed in item (1) above) are deducted from column (1). You can see that the company will continue to incur some of the costs (i.e. those items listed in item (2) above) even if the Helsinki territory is closed and these costs are therefore irrelevant to the decision. Again you can either include, or exclude, the irrelevant costs in columns (1) and (2) as long as you ensure that the same amount of irrelevant costs is included for both alternatives if you adopt the first approach. Both approaches will show that future profits will decline by £154 000 if the Helsinki territory is closed. Alternatively, you can present just the relevant costs and revenues shown in column (3). This approach indicates that keeping the sales territory open results in additional sales revenues of £1 700 000 but additional costs of £1 546 000 are incurred giving a contribution of £154 000 towards fixed costs and profits.

You will have noted that we have assumed that the regional and headquarters costs assigned to the sales territories on the basis of cause-and-effect allocations can be eliminated if the Helsinki territory is discontinued. These are indirect costs that fluctuate in the longer-term according to the demand for them and it is assumed that the selected

EXAMPLE 4.5

The Euro Company is a wholesaler who sells its products to retailers throughout Europe. Euro's headquarters is in Brussels. The company has adopted a regional structure with each region consisting of 3–5 sales territories. Each region has its own regional office and a warehouse which distributes the goods directly to the customers. Each sales territory also has an office where the marketing staff are located. The Scandinavian region consists of three sales territories with offices located in Stockholm, Oslo and Helsinki. The budgeted results for the next quarter are as follows:

	Stockholm (£000's)	Oslo (£000's)	Helsinki (£000's)	Total (£000's)
Cost of goods sold	800	850	1000	2650
Salespersons salaries	160	200	240	600
Sales office rent	60	90	120	270
Depreciation of sales office equipment	20	30	40	90
Apportionment of warehouse rent	24	24	24	72
Depreciation of warehouse equipment	20	16	22	58
Regional and headquarters costs				
Cause-and-effect allocations	120	152	186	458
Arbitrary apportionments	360	400	340	1100
Total costs assigned to each location	1564	1762	1972	5298
Reported profit/(loss)	236	238	(272)	202
Sales	1800	2000	1700	5500

Assuming that the above results are likely to be typical of future quarterly performance should the Helsinki territory be discontinued?

allocation base, or cost driver, provides a reasonably accurate measure of resources consumed by the sales territories. Cause-and-effect allocation bases assume that if the cause is eliminated or reduced, the effect (i.e. the costs) will be eliminated or reduced. If cost drivers are selected that result in allocations that are inaccurate measures of resources consumed by cost objects (i.e. sales territories) the relevant costs derived from these allocations will be incorrect and incorrect decisions may be made. We shall explore this issue in some detail in Chapter 6 when we look at activity-based costing.

Determining the relevant costs of direct materials

So far in this chapter we have assumed, when considering various decisions, that any materials required would not be taken from existing stocks but would be purchased at a later date, and so the estimated purchase price would be the relevant material cost. Where materials are taken from existing stock do remember that the original purchase price represents a past or sunk cost and is therefore irrelevant for decision-making. If the materials are to be replaced then using the materials for a particular activity will necessitate their replacement. Thus, the decision to use the materials on an activity will result in additional acquisition costs compared with the situation if the materials were not used on that particular activity. Therefore the future replacement cost represents the relevant cost of the materials.

EXHIBIT 4.4

Relevant cost analysis relating to the discontinuation of the Helsinki territory

Consider now the situation where the materials have no further use apart from being used on a particular activity. If the materials have some realizable value, the use of the materials will result in lost sales revenues, and this lost sales revenue will represent an opportunity cost that must be assigned to the activity. Alternatively, if the materials have no realizable value the relevant cost of the materials will be zero.

	Total costs and revenues to be assigned		
	(1) Keep Helsinki territory open (£000's)	**(2) Discontinue Helsinki territory (£000's)**	**(3) Difference incremental costs and revenues (£000's)**
Cost of goods sold	2650	1650	1000
Salespersons salaries	600	360	240
Sales office rent	270	150	120
Depreciation of sales office equipment	90	90	
Apportionment of warehouse rent	72	72	
Depreciation of warehouse equipment	58	58	
Regional and headquarters costs			
Cause-and-effect allocations	458	272	186
Arbitrary apportionments	1100	1100	
Total costs to be assigned	5298	3752	1546
Reported profit	202	48	154
Sales	5500	3800	1700

Determining the relevant costs of direct labour

Determining the direct labour costs that are relevant to short-term decisions depends on the circumstances. Where a company has temporary spare capacity and the labour force is to be maintained in the short term, the direct labour cost incurred will remain the same for all alternative decisions. The direct labour cost will therefore be irrelevant for short-term decision-making purposes. Consider now a situation where casual labour is used and where workers can be hired on a daily basis; a company may then adjust the employment of labour to exactly the amount required to meet the production requirements. The labour cost will increase if the company accepts additional work, and will decrease if production is reduced. In this situation the labour cost will be a relevant cost for decision-making purposes.

In a situation where full capacity exists and additional labour supplies are unavailable in the short term, and where no further overtime working is possible, the only way that labour resources could then be obtained for a specific order would be to reduce existing production. This would release labour for the order, but the reduced production would result in a lost contribution, and this lost contribution must be taken into account when ascertaining the relevant cost for the specific order. The relevant labour cost per hour where full capacity exists is therefore the hourly labour rate plus an opportunity cost consisting of the contribution per hour that is lost by accepting the order.

A comprehensive example

We shall now conclude this chapter with a comprehensive decision-making problem (Example 4.6) that will enable you to consolidate the various items that have been considered so far. The answer is presented in Exhibit 4.5 adopting an approach that excludes all irrelevant costs and revenues.

EXAMPLE 4.6

Brown Ltd is a company that has in stock some materials of type XY that cost £75 000 but that are now obsolete and have a scrap value of only £21 000. Other than selling the material for scrap, there are only two alternative uses for them.

Alternative 1: Converting the obsolete materials into a specialized product, which would require the following additional work and materials:

Material A	600 units
Material B	1 000 units
Direct labour:	
5000 hours unskilled	
5000 hours semi-skilled	
5000 hours highly skilled	15 000 hours
Extra selling and delivery expenses	£27 000
Extra advertising	£18 000

The conversion would produce 900 units of saleable product, and these could be sold for £400 per unit.

Material A is already in stock and is widely used within the firm. Although present stocks together with orders already planned will be sufficient to facilitate normal activity, any extra material used by adopting this alternative will necessitate such materials being replaced immediately. Material B is also in stock, but it is unlikely that any additional supplies can be obtained for some considerable time because of an industrial dispute. At the present time material B is normally used in the production of product Z, which sells at £390 per unit and incurs total variable cost (excluding material B) of £210 per unit. Each unit of product Z uses four units of material B.

(Example 4.6 continued)

The details of materials A and B are as follows:

	Material A (£)	Material B (£)
Acquisition cost at time of purchase	100 per unit	10 per unit
Net realizable value	85 per unit	18 per unit
Replacement cost	90 per unit	—

Alternative 2: Adapting the obsolete materials for use as a substitute for a sub-assembly that is regularly used within the firm. Details of the extra work and materials required are as follows:

Material C	1000 units
Direct labour:	
4000 hours unskilled	
1000 hours semi-skilled	
4000 hours highly skilled	9000 hours

1200 units of the sub-assembly are regularly used per quarter, at a cost of £900 per unit. The adaptation of material XY would reduce the quantity of the sub-assembly purchased from outside the firm to 900 units for the next quarter only. However, since the volume purchased would be reduced, some discount would be lost, and the price of those purchased from outside would increase to £950 per unit for that quarter.

Material C is not available externally, but is manufactured by Brown Ltd. The 1000 units required would be available from stocks, but would be produced as extra production. The standard cost per unit of material C would be as follows:

	(£)
Direct labour, 6 hours unskilled labour	36
Raw materials	13
Variable overhead, 6 hours at £1	6
Fixed overhead, 6 hours at £3	18
	73

The wage rates and overhead recovery rates for Brown Ltd are:

Variable overhead	£1 per direct labour hour
Fixed overhead	£3 per direct labour hour
Unskilled labour	£6 per direct labour hour
Semi-skilled labour	£8 per direct labour hour
Highly skilled labour	£10 per direct labour hour

The unskilled labour is employed on a casual basis and sufficient labour can be acquired to exactly meet the production requirements. Semi-skilled labour is part of the permanent labour force, but the company has temporary excess supply of this

type of labour at the present time. Highly skilled labour is in short supply and cannot be increased significantly in the short term; this labour is presently engaged in meeting the demand for product L, which requires 4 hours of highly skilled labour. The contribution (sales less direct labour and material costs and variable overheads) from the sale of one unit of product L is £24.

Given this information, you are required to present cost information advising whether the stocks of material XY should be sold, converted into a specialized product (alternative 1) or adapted for use as a substitute for a sub-assembly (alternative 2).

EXHIBIT 4.5

A comparison of alternatives 1 and 2 with the sale of material XY

Alternative 1: Conversion versus immediate sale	**(£)**	**(£)**	**(£)**
1. Sales revenue (900 units at £400 per unit)			360 000
Less Relevant costs:			
2. Material XY opportunity cost		21 000	
3. Material A (600 units at £90)		54 000	
4. Material B (1000 units at £45)		45 000	
5. Direct labour:			
Unskilled (5000 hrs at £6)	30 000		
Semi-skilled	nil		
Highly skilled (5000 hrs at £17)	85 000	115 000	
6. Variable overheads (15 000 hrs at £1)		15 000	
7. Selling and delivery expenses		27 000	
Advertising		18 000	
8. Fixed overheads		—	295 000
Excess of relevant revenues			65 000
Alternative 2: Adaptation versus immediate sale			
9. Saving on purchase of sub-assembly:			
Normal spending (1200 units at £900)		1 080 000	
Revised spending (900 units at £950)		855 000	225 000
Less relevant costs:			
2. Material XY opportunity cost		21 000	
10. Material C (1000 units £55)		55 000	
5. Direct labour:			
Unskilled (4000 hrs at £6)	24 000		
Semi-skilled	nil		
Skilled (4000 hrs at £16)	64 000	88 000	
6. Variable overheads (9000 hrs at £1)		9 000	
8. Fixed overheads		nil	173 000
Net relevant savings			52 000

(Exhibit 4.6 continued)

Notes

1. There will be additional sales revenue of £360 000 if alternative 1 is chosen.
2. Acceptance of either alternative 1 or 2 will mean a loss of revenue of £21 000 from the sale of the obsolete material XY. This is an opportunity cost, which must be covered whichever alternative is chosen. The original purchase cost of £75 000 for material XY is a sunk cost and is irrelevant.
3. Acceptance of alternative 1 will mean that material A must be replaced at an additional cost of £54 000.
4. Acceptance of alternative 1 will mean that material B will be diverted from the production of product Z. The excess of relevant revenues over relevant cost for product Z is £180 and each unit of product Z uses four units of material. The lost contribution (excluding the cost of material B which is incurred for both alternatives) will therefore be £45 for each unit of material B that is used in converting the raw materials into a specialized product.
5. Unskilled labour can be matched exactly to the company's production requirements. The acceptance of either alternative 1 or 2 will cause the company to incur additional unskilled labour costs of £6 for each hour of unskilled labour that is used. It is assumed that the semi-skilled labour would be retained and that there would be sufficient excess supply for either alternative at no extra cost to the company. In these circumstances semi-skilled labour will not have a relevant cost. Skilled labour is in short supply and can only be obtained by reducing production of product L, resulting in a lost contribution of £24 or £6 per hour of skilled labour. We have already established that the relevant cost for labour that is in short supply is the hourly labour cost plus the lost contribution per hour, so the relevant labour cost here will be £16 per hour.
6. It is assumed that for each direct labour hour of input variable overheads will increase by £1. As each alternative uses additional direct labour hours, variable overheads will increase, giving a relevant cost of £1 per direct labour hour.
7. As advertising selling and distribution expenses will be different if alternative 1 is chosen, these costs are clearly relevant to the decision.
8. The company's fixed overheads will remain the same whichever alternative is chosen, and so fixed overheads are not a relevant cost for either alternative.
9. The cost of purchasing the sub-assembly will be reduced by £225 000 if the second alternative is chosen, and so these savings are relevant to the decision.
10. The company will incur additional variable costs of £55 for each unit of material C that is manufactured, so the fixed overheads for material C are not a relevant cost.

When considering a problem such as Example 4.6, there are many different ways in which the information may be presented. The way in which we have dealt with the problem here is to compare each of the two stated alternatives with the other possibility of selling off material XY for its scrap value of £21 000. Exhibit 4.5 sets out the relevant information, and shows that of the three possibilities alternative 1 is to be preferred.

An alternative presentation of this information, which you may prefer, is as follows:

	Sale of obsolete materials for scrap	**Alternative 1**	**Alternative 2**
Relevant revenues less relevant costs	£21 000	£86 000	£73 000
		Difference = £65 000	
			Difference = £13 000 (£86 000 − £73 000)

We show here *the sale of the obsolete materials as a separate alternative*, and so the opportunity cost of material XY, amounting to £21 000 (Exhibit 4.5, item 2) is not included in either alternative 1 or 2, since it is brought into the analysis under the heading 'Sale of obsolete materials for scrap' in the above alternative presentation. Consequently, in both alternatives 1 and 2 the relevant revenues less relevant costs figures shown in Exhibit 4.5 (£65 000 and £52 000) are increased by £21 000. The differences between alternative 1 and 2 and the sale of the obsolete materials are still, however, £65 000 and £52 000 respectively, which gives an identical result to that obtained in Exhibit 4.5.

Summary

In this chapter we have focused on special studies and described the principles involved in determining the relevant cost of alternative courses of action. We have found that a particular cost can be relevant in one situation but irrelevant in another. The important point to note is that relevant costs represent those future costs that will be changed by a particular decision, while irrelevant costs are those that will not be affected by that decision. In the short term total profits will be increased (or total losses decreased) if a course of action is chosen where relevant revenues are in excess of relevant costs. We noted that not all of the important inputs relevant to a decision can always be easily quantified, but that it is essential that any qualitative factors relevant to the decision should be taken into account in the decision-making process.

We have considered a variety of decision-making problems in the form of Examples 4.1–4.6, the last of which consolidated the various aspects of relevant costs. The important point that you should remember from these examples is that the decision-relevant approach adopts whatever time horizon the decision-maker considers relevant for a given situation. In the short term some costs cannot be avoided, and are therefore irrelevant for decision-making purposes. In the longer term, however, many costs are avoidable, and it is therefore important that decision-makers do not focus excessively on the short term. In the long term revenues must be sufficient to cover all costs.

Key Terms and Concepts

decision-relevant approach (p. 81)
differential cash flow (p. 82)
incremental cash flow (p. 82)
limiting factor (p. 88)
opportunity cost (p. 87)
outsourcing (p. 92)
qualitative factors (p. 82)
relevant cost (p. 82)
replacement cost (p. 97)
special studies (p. 81)
written-down value (p. 91).

Review Problems

1. A market gardener is planning his production for next season, and he has asked you as a cost accountant, to recommend the optimal mix of vegetable production for the coming year. He has given you the following data relating to the current year.

	Potatoes	Turnips	Parsnips	Carrots
Area occupied (acres)	25	20	30	25
Yield per acre (tonnes)	10	8	9	12
Selling price per tonne (£)	100	125	150	135
Variable cost per acre (£):				
Fertilizers	30	25	45	40
Seeds	15	20	30	25
Pesticides	25	15	20	25
Direct wages	400	450	500	570

Fixed overhead per annum £54 000

The land that is being used for the production of carrots and parsnips can be used for either crop, but not for potatoes or turnips. The land being used for potatoes and turnips can be used for either crop, but not for carrots or parsnips. In order to provide an adequate market service, the gardener must produce each year at least 40 tonnes each of potatoes and turnips and 36 tonnes each of parsnips and carrots.

(a) You are required to present a statement to show:
  (i) the profit for the current year;
  (ii) the profit for the production mix that you would recommend.

(b) Assuming that the land could be cultivated in such a way that any of the above crops could be produced and there was no market commitment, you are required to:
  (i) advise the market gardener on which crop he should concentrate his production;
  (ii) calculate the profit if he were to do so;
  (iii) calculate in sterling the break-even point of sales.

(25 marks)
CIMA

2. Itervero Ltd, a small engineering company, operates a job order costing system. It has been invited to tender for a comparatively large job which is outside the range of its normal activities and, since there is surplus capacity, the management are keen to quote as low a price as possible. It is decided that the opportunity should be treated in isolation without any regard to the possibility of its leading to further work of a similar nature (although such a possibility does exist). A low price will not have any repercussions on Itervero's regular work.

   The estimating department has spent 100 hours on work in connection with the quotation and they have incurred travelling expense of £550 in connection with a visit to the prospective customer's factory overseas. The following cost estimate has been prepared on the basis of their study.

Inquiry 205H/81
Cost estimate

	(£)
Direct material and components:	
2000 units of A at £25 per unit	50 000
200 units of B at £10 per unit	2 000
Other material and components to be bought in (specified)	12 500
	64 500
Direct labour:	
700 hours of skilled labour at £3.50 per hour	2 450
1500 hours of unskilled labour at £2 per hour	3 000
Overhead:	
Department P (200 hours at £25 per hour)	5 000
Department Q (400 hours at £20 per hour)	8 000
Estimating department:	
100 hours at £5 per hour	500
Travelling expenses	550
Planning department	
300 hours at £5 per hour	1 500
	£85 500

The following information has been brought together:

Material A: This is a regular stock item. The stock holding is more than sufficient for this job. The material currently held has an average cost of £25 per unit but the current replacement cost is £20 per unit.

Material B: A stock of 4000 units of B is currently held in the stores. This material is slow-moving and the stock is the residue of a batch bought seven years ago at a cost of £10 per unit. B currently costs £24 per unit but the resale value is only £18 per unit. A foreman has pointed out that B could be used as a substitute for another type of regularly used raw material which costs £20 per unit.

Direct labour: The workforce is paid on a time basis. The company has adopted a 'no redundancy' policy and this means that skilled workers are frequently moved to jobs which do not make proper use of their skills. The wages included in the cost estimate are for the mix of labour which the job ideally requires. It seems likely, if the job is obtained, that most of the 2200 hours of direct labour will be performed by skilled staff receiving £3.50 per hour.

Overhead – Department P: Department P is the one department of Itervero Ltd that is working at full capacity. The department is treated as a profit centre and it uses a transfer price of £25 per hour for charging out its processing time to other departments. This charge is calculated as follows:

	(£)
Estimated variable cost per machine hour	10
Fixed departmental overhead	8
Department profit	7
	25

Department P's facilities are frequently hired out to other firms and a charge of £30 per hour is made. There is a steady demand from outside customers for the use of these facilities.

Overhead – Department Q: Department Q uses a transfer price of £20 for charging out machine processing time to other departments. This charge is calculated as follows:

	(£)
Estimated variable cost per machine hour	8
Fixed departmental overhead	9
Department profit	3
	20

Estimating department: The estimating department charges out its time to specific jobs using a rate of £5 per hour. The average wage rate within the department is £2.50 per hour but the higher rate is justified as being necessary to cover departmental overheads and the work done on unsuccessful quotations.

Planning department: This department also uses a charging out rate which is intended to cover all department costs.

(a) You are required to restate the cost estimate by using an opportunity cost approach. Make any assumptions that you deem to be necessary and briefly justify each of the figures that you give.

(10 marks)

(b) Discuss the relevance of the opportunity cost approach to the situation described in the question and consider the problems which are likely to be encountered if it is used in practice.

(6 marks)

(c) Briefly discuss the general applicability of opportunity cost in business decision making where a choice exists among alternative courses of action.

(6 marks)
(Total 22 marks)
ACCA

Solutions to Review Problems

SOLUTION 1

(a) *Preliminary calculations*
Variable costs are quoted per acre, but selling prices are quoted per tonne. Therefore, it is necessary to calculate the planned sales revenue per acre. The calculation of the selling price and contribution per acre is as follows:

	Potatoes	Turnips	Parsnips	Carrots
(a) Yield per acre in tonnes	10	8	9	12
(b) Selling price per tonne	£100	£125	£150	£135
(c) Sales revenue per acre, (a) × (b)	£1000	£1000	£1350	£1620
(d) Variable cost per acre	£470	£510	£595	£660
(e) Contribution per acre	£530	£490	£755	£960

(a) (i)

(i) Profit statement for current year

	Potatoes	Turnips	Parsnips	Carrots	Total
(a) Acres	25	20	30	25	
(b) Contribution per acre	£530	£490	£755	£960	
(c) Total contribution (a × b)	£13 250	£9800	£22 650	£24 000	£69 700
				Less fixed costs	£54 000
				Profit	£15 700

(ii) Profit statement for recommended mix

	Area A (45 acres)		Area B (55 acres)		
	Potatoes	Turnips	Parsnips	Carrots	Total
(a) Contribution per acre	£530	£490	£755	£960	
(b) Ranking	1	2	2	1	
(c) Minimum sales requirements in acres[a]		5	4		
(d) Acres allocated[b]	40			51	
(e) Recommended mix (acres)	40	5	4	51	
(f) Total contribution, (a) × (e)	£21 200	£2450	£3020	£48 960	£75 630
				Less fixed costs	£54 000
				Profit	£21 630

Notes

[a] The minimum sales requirement for turnips is 40 tonnes, and this will require the allocation of 5 acres (40 tonnes/8 tonnes yield per acre). The minimum sales requirement for parsnips is 36 tonnes, requiring the allocation of 4 acres (36 tonnes/9 tonnes yield per acre).

[b] Allocation of available acres to products on basis of a ranking that assumes that acres are the key factor.

(b) (i) Production should be concentrated on carrots, which have the highest contribution per acre (£960).

(ii)

	(£)
Contribution from 100 acres of carrots (100 × £960)	96 000
Fixed overhead	54 000
Profit from carrots	42 000

(iii) Break-even point in acres for carrots $= \dfrac{\text{fixed costs (£54 000)}}{\text{contribution per acre (£960)}}$

$= 56.25$ acres

Contribution in sales value for carrots

= £91 125 (56.25 acres at £1620 sales revenue per acre).

SOLUTION 2

(a)

Cost estimate

	(£)
Direct materials and components:	
2000 units of A at £20 per unit[a]	40 000
200 units of B at £20 per unit[b]	4 000
Other material components	12 500
	56 500
Direct labour[c]	
Overhead:	
Department P (200 hours at £30)[d]	6 000
Department Q (400 hours at £8)[e]	3 200
Estimating Department[f]	—
Planning Department[f]	—
	65 700

Notes

[a] It is assumed that using material A on the contract will result in the materials being replaced. Therefore additional (opportunity) costs to the company will be the replacement costs of the materials.

[b] The alternative uses of the materials are to sell them or to use them as substitute materials. The savings are greater when the materials are used as a substitute. Therefore the company will be worse off by £20 per unit of materials used on the contract. Hence the opportunity cost of material B is £20 per unit.

[c] The company appears to have a temporary excess supply of labour. The total labour cost will be the same whether or not the contract is undertaken. Therefore the opportunity cost is zero.

[d] Acceptance of the contract will result in the department losing the opportunity of charging out 200 hours at £30 per hour.

[e] The company will incur £3200 additional costs if the contract is undertaken.

[f] It is assumed that the company will not incur additional costs in the estimating and planning departments if the contract is undertaken. The costs already incurred by the estimating department on the contract are sunk costs. Therefore the opportunity cost is zero for both departments.

(b) The opportunity cost approach is a suitable approach for short-term decision-making. This approach ensures that alternative actions are only charged with the additional costs resulting from the action. Whenever the additional revenues are in excess of the relevant or opportunity costs for a particular course of action, a company will increase its total profits or reduce its total loss. However, in the long term a company must cover all its costs, not just the opportunity costs, if it is to be profitable. In the situation described in the question the opportunity cost approach is appropriate because the company has spare capacity. The opportunity cost of the contract is £65 700, whereas the cost as per the conventional pricing procedure used in the question is £85 500. If the latter cost is used as a basis of a price quotation then there is a danger that the company will lose the contract. As long as the contract price is in excess of the opportunity cost of £65 700, the company will increase its total profits.

The following problems are likely to be encountered:

(i) Fixed costs may be ignored and insufficient contribution may be generated to cover fixed costs (see the beginning of Chapter 6 for an explanation of this).

(ii) Lack of understanding of opportunity costs and the difficulty in determining opportunity costs. This requires knowledge of alternative uses of resources, and this information might be difficult to obtain in practice.

(c) When a course of action requires the use of scarce resources, it is necessary to incorporate the lost profits which will be forgone from using scarce resources. Only by adopting such an approach can we ensure an optimal allocation of scarce resources. For a more detailed discussion and an illustration of this point see sections on 'Product-mix decisions when capacity constraints exist' and 'Outsourcing and make or buy decisions' in Chapter 4.

Questions

4.1

Z Limited manufactures three products, the selling price and cost details of which are given below:

	Product X (£)	Product Y (£)	Product Z (£)
Selling price per unit	75	95	95
Costs per unit:			
Direct materials (£5/kg)	10	5	15
Direct labour (£4/hour)	16	24	20
Variable overhead	8	12	10
Fixed overhead	24	36	30

In a period when direct materials are restricted in supply, the most and the least profitable uses of direct materials are

	Most profitable	Least profitable
A	X	Z
B	Y	Z
C	X	Y
D	Z	Y
E	Y	X

CIMA

4.2

Your company regularly uses material X and currently has in stock 600 kg, for which it paid £1500 two weeks ago. It this were to be sold as raw material it could be sold today for £2.00 per kg. You are aware that the material can be bought on the open market for £3.25 per kg, but it must be purchased in quantities of 1000 kg.

You have been asked to determine the relevant cost of 600 kg of material X to be used in a job for a customer. The relevant cost of the 600 kg is:

(a) £1200
(b) £1325
(c) £1825
(d) £1950
(e) £3250

CIMA

4.3

Q plc makes two products – Quone and Qutwo – from the same raw material. The selling price and cost details of these products are as shown below:

	Quone (£)	Qutwo (£)
Selling price	20.00	18.00
Direct material (£2.00/kg)	6.00	5.00
Direct labour	4.00	3.00
Variable overhead unit	2.00	1.50
	12.00	9.50
Contribution per unit	8.00	8.50

The maximum demand for these products is:

Quone	500 units per week
Qutwo	unlimited number of units per week

If materials were limited to 2000 kg per week, the shadow price (opportunity cost) of these materials would be:

(a) nil;
(b) £2.00 per kg;
(c) £2.66 per kg;
(d) £3.40 per kg;
(e) none of these.

CIMA

4.4

BB Limited makes three components: S, T and U. The following costs have been recorded:

	Component S Unit cost (£)	Component T Unit cost (£)	Component U Unit cost (£)
Variable cost	2.50	8.00	5.00
Fixed cost	2.00	8.30	3.75
Total cost	4.50	16.30	8.75

Another company has offered to supply the components to BB Limited at the following prices:

	Component S	Component T	Component U
Price each	£4	£7	£5.50

Which component(s), if any, should BB Limited consider buying in?

(a) Buy in all three components.
(b) Do not buy any.
(c) Buy in S and U.
(d) Buy in T only.

CIMA

4.5

M plc makes two products – M1 and M2 – budgeted details of which are as follows:

	M1 (£)	M2 (£)
Selling price	10.00	8.00
Costs per unit:		
Direct materials	2.50	3.00
Direct labour	1.50	1.00
Variable overhead	0.60	0.40
Fixed overhead	1.20	1.00
Profit per unit	4.20	2.60

Budgeted production and sales for the year ended 31 December are:

Product M1	10 000 units
Product M2	12 500 units

The fixed overhead shown above comprises both general and specific fixed overhead costs. The general fixed overhead cost has been attributed to units of M1 and M2 on the basis of direct labour cost.

The specific fixed cost totals £2500 per annum and relates to product M2 only.

(a) Both products are available from an external supplier. If M plc could purchase only one of them, the maximum price which should be paid per unit of M1 or M2 instead of internal manufacture would be:

	M1 (£)	M2 (£)
A	4.60	4.40
B	4.60	4.60
C	5.80	4.40
D	5.80	4.60
E	5.80	5.60

(b) If only product M1 were to be made, the number of units to be sold to achieve a profit of £50 000 per annum (to the nearest unit) would be
A 4074;
B 4537;
C 13 333;
D 13 796;
E none of the above.

CIMA

4.6

A company is considering accepting a one-year contract which will require four skilled employees. The four skilled employees could be recruited on a one-year contract at a cost of £40 000, per employee. The employees would be supervised by an existing manager who earns £60 000 per annum. It is expected that supervision of the contract would take 10% of the manager's time.

Instead of recruiting new employees, the company could retrain some existing employees who currently earn £30 000 per year. The training would cost £15 000 in total. If these employees were used they would need to be replaced at a total cost of £100 000.

The relevant labour cost of the contract is:
A £100 000
B £115 000
C £135 000
D £141 000
E £166 000

CIMA

4.7 Make or buy decision

The management of Springer plc is considering next year's production and purchase budgets.

One of the components produced by the company, which is incorporated into another product before being sold, has a budgeted manufacturing cost as follows:

	(£)
Direct material	14
Direct labour (4 hours at £3 per hour)	12
Variable overhead (4 hours at £2 per hour)	8
Fixed overhead (4 hours at £5 per hour)	20
Total cost	54 per unit

Trigger plc has offered to supply the above component at a guaranteed price of £50 per unit.

Required:

(a) Considering cost criteria only, advise management whether the above component should be purchased from Trigger plc. Any calculations should be shown and assumptions made, or aspects which may require further investigation should be clearly stated. (6 marks)

(b) Explain how your above advice would be affected by each of the two *separate* situations shown below.
(i) As a result of recent government legislation if Springer plc continues to manufacture this component the company will incur additional inspection and testing expenses of £56 000 per annum, which are not included in the above budgeted manufacturing costs. (3 marks)
(ii) Additional labour cannot be recruited and if the above component is not manufactured by Springer plc the direct labour released will be employed in increasing the production of an existing product which is sold for £90 and which has a budgeted manufacturing cost as follows:

	(£)
Direct material	10
Direct labour (8 hours at £3 per hour)	24
Variable overhead (8 hours at £2 per hour)	16
Fixed overhead (8 hours at £5 per hour)	40
	90 per unit

All calculations should be shown. (4 marks)

(c) The production director of Springer plc recently said:

'We must continue to manufacture the component as only one year ago we purchased some special grinding equipment to be used exclusively by this component. The equipment cost £100 000, it cannot be resold or used elsewhere and if we cease production of this component we will have to write off the written down book value which is £80 000.'

Draft a brief reply to the production director commenting on his statement. (4 marks)

(Total 17 marks)

ACCA

4.8 Acceptance of a contract

JB Limited is a small specialist manufacturer of electronic components and much of its output is used by the makers of aircraft for both civil and military purposes. One of the few aircraft manufacturers has offered a contract to JB Limited for the supply, over the next twelve months, of 400 identical components.

The data relating to the production of each component is as follows:

(i) Material requirements:
3 kg material M1 – see note 1 below
2 kg material P2 – see note 2 below
1 Part No. 678 – see note 3 below
Note 1. Material M1 is in continuous use by the company. 1000 kg are currently held in stock at a book value of £4.70 per kg but it is known that future purchases will cost £5.50 per kg.
Note 2. 1200 kg of material P2 are held in stock. The original cost of this material was £4.30 per kg but as the material has not been required for the last two years it has been written down to £1.50 per kg scrap value. The only foreseeable alternative use is as a substitute for material P4 (in current use) but this would involve further processing costs of £1.60 per kg. The current cost of material P4 is £3.60 per kg.
Note 3. It is estimated that the Part No. 678 could be bought for £50 each.

(ii) Labour requirements: Each component would require five hours of skilled labour and five hours of semi-skilled. An employee possessing the necessary skills is available and is currently paid £5 per hour. A replacement would, however, have to be obtained at a rate of £4 per hour for the work which would otherwise be done by the skilled employee. The current rate for semi-skilled work is £3 per hour and an additional employee could be appointed for this work.

(iii) Overhead: JB Limited absorbs overhead by a machine hour rate, currently £20 per hour of which £7 is for variable overhead and £13 for fixed overhead. If this contract is undertaken it is estimated that fixed costs will increase for the duration of the contract by £3200. Spare machine capacity is available and each component would require four machine hours.

A price of £145 per component has been suggested by the large company which makes aircraft.

You are required to:

(a) State whether or not the contract should be accepted and support your conclusion with appropriate figures for presentation to management; (16 marks)

(b) comment briefly on *three* factors which management ought to consider and which may influence their decision. (9 marks)

(Total 25 marks)

CIMA

4.9 Decision on which of two mutually exclusive contracts to accept

A company in the civil engineering industry with headquarters located 22 miles from London undertakes contracts anywhere in the United Kingdom.

The company has had its tender for a job in north-east England accepted at £288 000 and work is due to begin in March. However, the company has also been asked to undertake a contract on the south coast of England. The price offered for this contract is £352 000. Both of the contracts cannot be taken simultaneously because of constraints on staff site management personnel and on plant available. An escape clause enables the company to withdraw from the contract in the north-east, provided notice is given before the end of November and an agreed penalty of £28 000 is paid.

The following estimates have been submitted by the company's quantity surveyor:

Cost estimates

	North-east (£)	South coast (£)
Materials:		
In stock at original cost, Material X	21 600	
In stock at original cost, Material Y		24 800
Firm orders placed at original cost, Material X	30 400	
Not yet ordered – current cost, Material X	60 000	
Not yet ordered – current cost, Material Z		71 200
Labour – hired locally	86 000	110 000
Site management	34 000	34 000
Staff accommodation and travel for site management	6 800	5 600
Plant on site – depreciation	9 600	12 800
Interest on capital, 8%	5 120	6 400
Total local contract costs	253 520	264 800
Headquarters costs allocated at rate of 5% on total contract costs	12 676	13 240
	266 196	278 040
Contract price	288 000	352 000
Estimated profit	21 804	73 960

Notes:

1. X, Y and Z are three building materials. Material X is not in common use and would not realize much money if re-sold; however, it could be used on other contracts but only as a substitute for another material currently quoted at 10% less than the original cost of X. The price of Y, a material in common use, has doubled since it was purchased; its net realizable value if re-sold would be its new price less 15% to cover disposal costs. Alternatively it could be kept for use on other contracts in the following financial year.
2. With the construction industry not yet recovered from the recent recession, the company is confident that manual labour, both skilled and unskilled, could be hired locally on a subcontracting basis to meet the needs of each of the contracts.
3. The plant which would be needed for the south coast contract has been owned for some years and £12 800 is the year's depreciation on a straight-line basis. If the north-east contract is undertaken, less plant will be required but the surplus plant will be hired out for the period of the contract at a rental of £6000.
4. It is the company's policy to charge all contracts with notional interest at 8% on estimated working capital involved in contracts. Progress payments would be receivable from the contractee.
5. Salaries and general costs of operating the small headquarters amount to about £108 000 each year. There are usually ten contracts being supervised at the same time.
6. Each of the two contracts is expected to last from March to February which, coincidentally, is the company's financial year.
7. Site management is treated as a fixed cost.

You are required, as the management accountant to the company,

(a) to present comparative statements to show the net benefit to the company of undertaking the more advantageous of the two contracts;

(12 marks)

(b) to explain the reasoning behind the inclusion in (or omission from) your comparative financial statements, of each item given in the cost estimates and the notes relating thereto.

(13 marks)

(Total 25 marks)

CIMA

4.10 Calculation of minimum selling price

You have received a request from EXE plc to provide a quotation for the manufacture of a specialized piece of equipment. This would be a one-off order, in excess of normal budgeted production. The following cost estimate has already been prepared:

		Note	(£)
Direct materials:			
Steel	10 m^2 at £5.00 per sq. metre	1	50
Brass fittings		2	20
Direct labour			
Skilled	25 hours at £8.00 per hour	3	200

Semi-skilled	10 hours at £5.00 per hour	4	50
Overhead	35 hours at £10.00 per hour	5	350
Estimating time		6	100
			770
Administrative overhead at 20% of production cost		7	154
			924
Profit at 25% of total cost		8	231
Selling price			1155

Notes:

1. The steel is regularly used, and has a current stock value of £5.00 per sq. metre. There are currently 100 sq. metres in stock. The steel is readily available at a price of £5.50 per sq. metre.
2. The brass fittings would have to be bought specifically for this job: a supplier has quoted the price of £20 for the fittings required.
3. The skilled labour is currently employed by your company and paid at a rate of £8.00 per hour. If this job were undertaken it would be necessary either to work 25 hours overtime which would be paid at time plus one half *or* to reduce production of another product which earns a contribution of £13.00 per hour.
4. The semi-skilled labour currently has sufficient paid idle time to be able to complete this work.
5. The overhead absorption rate includes power costs which are directly related to machine usage. If this job were undertaken, it is estimated that the machine time required would be ten hours. The machines incur power costs of £0.75 per hour. There are no other overhead costs which can be specifically identified with this job.
6. The cost of the estimating time is that attributed to the four hours taken by the engineers to analyse the drawings and determine the cost estimate given above.
7. It is company policy to add 20% on to the production cost as an allowance against administration costs associated with the jobs accepted.
8. This is the standard profit added by your company as part of its pricing policy.

Required:

(a) Prepare, on a relevant cost basis, the lowest cost estimate that could be used as the basis for a quotation. Explain briefly your reasons for using *each* of the values in your estimate. (12 marks)

(b) There may be a possibility of repeat orders from EXE plc which would occupy part of normal production capacity. What factors need to be considered before quoting for this order? (7 marks)

(c) When an organisation identifies that it has a single production resource which is in short supply, but is used by more than one product, the optimum production plan is determined by ranking the products according to their contribution per unit of the scarce resource.

Using a numerical example of your own, reconcile this approach with the opportunity cost approach used in (a) above. (6 marks)

(Total 25 marks)

CIMA

4.11 Limiting factor analysis

Triproduct Limited makes and sells three types of electronic security systems for which the following information is available.

Standard cost and selling prices per unit

Product	Day scan (£)	Night scan (£)	Omni scan (£)
Materials	70	110	155
Manufacturing labour	40	55	70
Installation labour	24	32	44
Variable overheads	16	20	28
Selling price	250	320	460

Fixed costs for the period are £450 000 and the installation labour, which is highly skilled, is available for 25 000 hours only in a period and is paid £8 per hour.

Both manufacturing and installation labour are variable costs.

The maximum demand for the products is:

Day scan	Night scan	Omni scan
2000 units	3000 units	1800 units

Requirements:

(a) Calculate the shortfall (if any) in hours of installation labour. (2 marks)

(b) Determine the best production plan, assuming that Triproduct Limited wishes to maximise profit. (5 marks)

(c) Calculate the maximum profit that could be achieved from the plan in part (b) above. (3 marks)

(d) Having carried out an investigation of the availability of installation labour, the firm thinks that by offering £12 per hour, additional installation labour would become available and thus overcome the labour shortage.

Requirement:
Based on the results obtained above, advise the firm whether or not to implement this proposal. (5 marks)
(Total 15 marks)
CIMA

4.12 Allocation of scarce capacity and make or buy decision where scarce capacity exists

PQR Limited is an engineering company engaged in the manufacture of components and finished products.

The company is highly mechanised and each of the components and finished products requires the use of one or more types of machine in its machining department. The following costs and revenues (where appropriate) relate to a single component or unit of the finished product:

	Components		Finished products	
	A	B	C	D
	£	£	£	£
Selling price			127	161
Direct materials	8	29	33	38
Direct wages	10	30	20	25
Variable overhead:				
Drilling	6	3	9	12
Grinding	8	16	4	12
Fixed overhead:				
Drilling	12	6	18	24
Grinding	10	20	5	15
Total cost	54	104	89	126

Notes

1. The labour hour rate is £5 per hour.
2. Overhead absorption rates per machine hour are as follows:

	Variable	Fixed
	£	£
Drilling (per hour)	3	6
Grinding (per hour)	4	5

3. Components A and B are NOT used in finished products C and D. They are used in the company's other products, none of which use the drilling or grinding machines. The company does not manufacture any other components.
4. The number of machine drilling hours available is limited to 1650 per week. There are 2500 machine grinding hours available per week. These numbers of hours have been used to calculate the absorption rates stated above.
5. The maximum demand in units per week for each of the finished products has been estimated by the marketing director as:

Product C	250 units
Product D	500 units

6. The internal demand for components A and B each week is as follows:

Component A	50 units
Component B	100 units

7. There is no external market for components A and B.
8. PQR Limited has a contract to supply 50 units of each of its finished products to a major customer each week. These quantities are included in the maximum units of demand given in note 5 above.

Requirement:

(a) Calculate the number of units of *each* finished product that PQR Limited should produce in order to maximise its profits, and the profit per week that this should yield. (12 marks)

(b) The production director has now discovered that he can obtain unlimited quantities of components identical to A and B for £50 and £96 per unit respectively.

State whether this information changes the production plan of the company if it wishes to continue to maximise its profits per week. If appropriate, state the revised production plan and the net benefit per week caused by the change to the production plan. (7 marks)
(Total 19 marks)
CIMA

4.13 Price/output and key factor decisions

You work as a trainee for a small management consultancy which has been asked to advise a

company, Rane Limited, which manufactures and sells a single product. Rane is currently operating at full capacity producing and selling 25 000 units of its product each year. The cost and selling price structure for this level of activity is as follows:

	At 25 000 units output (£ per unit)	(£ per unit)
Production costs		
Direct material	14	
Direct labour	13	
Variable production overhead	4	
Fixed production overhead	8	
Total production cost		39
Selling and distribution overhead:		
Sales commission – 10% of sales value	6	
Fixed	3	
		9
Administration overhead:		
Fixed		2
Total cost		50
Mark up – 20%		10
Selling price		60

A new managing director has recently joined the company and he has engaged your organization to advise on his company's selling price policy. The sales price of £60 has been derived as above from a cost-plus pricing policy. The price was viewed as satisfactory because the resulting demand enabled full capacity operation.

You have been asked to investigate the effect on costs and profit of an increase in the selling price. The marketing department has provided you with the following estimates of sales volumes which could be achieved at the three alternative sales prices under consideration.

Selling price per unit	£70	£80	£90
Annual sales volume (units)	20 000	16 000	11 000

You have spent some time estimating the effect that changes in output volume will have on cost behaviour patterns and you have now collected the following information.

Direct material: The loss of bulk discounts means that the direct material cost per unit will increase by 15% for all units produced in the year if activity reduces below 15 000 units per annum.

Direct labour: Savings in bonus payments will reduce labour costs by 10% for all units produced in the year if activity reduces below 20 000 units per annum.

Sales commission: This would continue to be paid at the rate of 10% of sales price.

Fixed production overhead: If annual output volume was below 20 000 units, then a machine rental cost of £10 000 per annum could be saved. This will be the only change in the total expenditure on fixed production overhead.

Fixed selling overhead: A reduction in the part-time sales force would result in a £5000 per annum saving if annual sales volume falls below 24 000 units. This will be the only change in the total expenditure on fixed selling and distribution overhead.

Variable production overhead: There would be no change in the unit cost for variable production overhead.

Administration overhead: The total expenditure on administration overhead would remain unaltered within this range of activity.

Stocks: Rane's product is highly perishable, therefore no stocks are held.

Task 1

(a) Calculate the annual profit which is earned with the current selling price of £60 per unit.

(b) Prepare a schedule to show the annual profit which would be earned with each of the three alternative selling prices.

Task 2

Prepare a brief memorandum to your boss, Chris Jones. The memorandum should cover the following points:

(a) Your recommendation as to the selling price which should be charged to maximize Rane limited's annual profits.

(b) *Two* non-financial factors which the management of Rane Limited should consider before planning to operate below full capacity.

Another of your consultancy's clients is a manufacturing company, Shortage Limited, which is experiencing problems in obtaining supplies of a major component. The component is used in all of its four products and there is a labour dispute at the

supplier's factory, which is restricting the component's availability.

Supplies will be restricted to 22 400 components for the next period and the company wishes to ensure that the best use is made of the available components. This is the only component used in the four products, and there are no alternatives and no other suppliers.

The components cost £2 each and are used in varying amounts in each of the four products.

Shortage Limited's fixed costs amount to £8000 per period. No stocks are held of finished goods or work in progress.

The following information is available concerning the products.

Maximum demand per period	Product A 4000 units (£ per unit)	Product B 2500 units (£ per unit)	Product C 3600 units (£ per unit)	Product D 2750 units (£ per unit)
Selling price	14	12	16	17
Component costs	4	2	6	8
Other variable costs	7	9	6	4

Task 3

(a) Prepare a recommended production schedule for next period which will maximize Shortage Limited's profit.

(b) Calculate the profit that will be earned in the next period if your recommended production schedule is followed.

AAT

4.14 Relevant costs for a pricing decision

Johnson trades as a chandler at the Savoy Marina. His profit in this business during the year to 30 June was £12 000. Johnson also undertakes occasional contracts to build pleasure cruisers, and is considering the price at which to bid for the contract to build the *Blue Blood* for Mr B.W. Dunn, delivery to be in one year's time. He has no other contract in hand, or under consideration, for at least the next few months.

Johnson expects that if he undertakes the contract he would devote one-quarter of his time to it. To facilitate this he would employ G. Harrison, an unqualified practitioner, to undertake his book-keeping and other paperwork, at a cost of £2000.

He would also have to employ on the contract one supervisor at a cost of £11 000 and two craftsmen at a cost of £8800 each; these costs include Johnson's normal apportionment of the fixed overheads of his business at the rate of 10% of labour cost.

During spells of bad weather one of the craftsmen could be employed for the equivalent of up to three months full-time during the winter in maintenance and painting work in the chandler's business. He would use materials costing £1000. Johnson already has two inclusive quotations from jobbing builders for this maintenance and painting work, one for £2500 and the other for £3500, the work to start immediately.

The equipment which would be used on the *Blue Blood* contract was bought nine years ago for £21 000. Depreciation has been written off on a straight-line basis, assuming a ten-year life and a scrap value of £1000. The current replacement cost of similar new equipment is £60 000, and is expected to be £66 000 in one year's time. Johnson has recently been offered £6000 for the equipment, and considers that in a year's time he would have little difficulty in obtaining £3000 for it. The plant is useful to Johnson only for contract work.

In order to build the *Blue Blood* Johnson will need six types of material, as follows:

	No. of units		Price per unit (£)		
Material code	In stock	Needed for contract	Purchase price of stock items	Current purchase price	Current resale price
A	100	1000	1.10	3.00	2.00
B	1 100	1000	2.00	0.90	1.00
C	—	100	—	6.00	—
D	100	200	4.00	3.00	2.00
E	50 000	5000	0.18	0.20	0.25
F	1 000	3000	0.90	2.00	1.00

Materials B and E are sold regularly in the chandler's business. Material A could be sold to a local sculptor, if not used for the contract. Materials A and E can be used for other purposes, such as property maintenance. Johnson has no other use for materials D and F, the stocks of which are obsolete.

The *Blue Blood* would be built in a yard held on a lease with four years remaining at a fixed annual rental of £5000. It would occupy half of this yard, which is useful to Johnson only for contract work.

Johnson anticipates that the direct expenses of the contract, other than those noted above, would be £6500.

Johnson has recently been offered a one-year appointment at a fee of £15 000 to manage a boat-building firm on the Isle of Wight. If he accepted

the offer he would be unable to take on the contract to build *Blue Blood*, or any other contract. He would have to employ a manager to run the chandler's business at an annual cost (including fidelity insurance) of £10 000, and would incur additional personal living costs of £2000.

You are required:

(a) to calculate the price at which Johnson should be willing to take on the contract in order to break even, based exclusively on the information given above; (15 marks)

(b) to set out any further considerations which you think that Johnson should take into account in setting the price at which he would tender for the contract. (10 marks)

Ignore taxation.

ICAEW

4.15 Deleting a segment

The original budget for the K department of Hilton Ltd for the forthcoming year was as follows:

Budgeted sales and production – 30 000 units

	Per unit of output (£)	Total for 30 000 units (£000)
Sales revenue	10.0	300
Manufacturing cost		
Material A (1 litre per unit)	2.0	60
Material B (1 kg per unit)	1.5	45
Production labour	2.0	60
Variable overhead	1.0	30
Fixed manufacturing overhead	2.0	60
	8.5	255
Non-manufacturing costs	1.0	30
Total costs	9.5	285
Budgeted net profit for year	0.5	15

As part of Hilton's long-term strategic plan the K department was due to be closed at the end of the forthcoming year. However, rumours of the closure have resulted in the majority of K's labour force leaving the firm and this has forced the abandonment of the original budget for the department.

The managing director has suggested that the department could be closed down immediately or, by employing contract labour, could be operated to produce 10 000 or 20 000 units in the year. With the exception of the foreman (see Note (v)), the few remaining members of K's production labour force would then be redeployed within the firm.

The following further information is available:

(i) Each hour of contract labour will cost £3.00 and will produce one unit of the product. Contract labour would have to be trained at a fixed cost of £20 000.

(ii) There are 30 000 litres of material A in stock. This material has no other use and any of it not used in department K will have to be disposed of. Costs of disposal will be £2000 plus £0.50 per litre disposed of.

(iii) There are 15 000 kg of material B in stock. If the material is not used in department K then up to 10 000 kg could be used in another department to substitute for an equivalent weight of a material which currently costs £1.8 per kg. Material B originally cost £1.5 per kg and its current market price (buying or selling) is £2.0 per kg. Costs to Hilton of selling any surplus material B will amount to £1.00 per kg sold.

(iv) Variable overheads will be 30% higher, per unit produced, than originally budgeted.

(v) Included in 'Fixed manufacturing overheads' are

(a) £6000 salary of the departmental foreman,

(b) £7000 depreciation of the machine used in the department.

If the department is closed immediately the foreman, who will otherwise retire at the end of the year, will be asked to retire early and paid £2000 compensation for agreeing to this.

The only machine used in the department originally cost £70 000 and could currently be sold for £43 000. This sales value will reduce to £40 000 at the end of the year and, if used for any production during the year, will decrease by a further £500 per 1000 units produced.

(vi) All other costs included in 'Fixed manufacturing overhead' and all 'Non-manufacturing costs' are apportionments of general overheads, none of which will be altered by any decision concerning the K department.

(vii) The sales manager suggests that a sales volume of 10 000 units could be achieved if the unit sales price were £9.00. A sales volume of 20 000 units would be achieved if the sales price per unit were reduced to £8

and an advertising campaign costing £15 000 were undertaken.

Required:

(a) Advise Hilton Ltd of its best course of action regarding department K, presenting any data in tabular form.

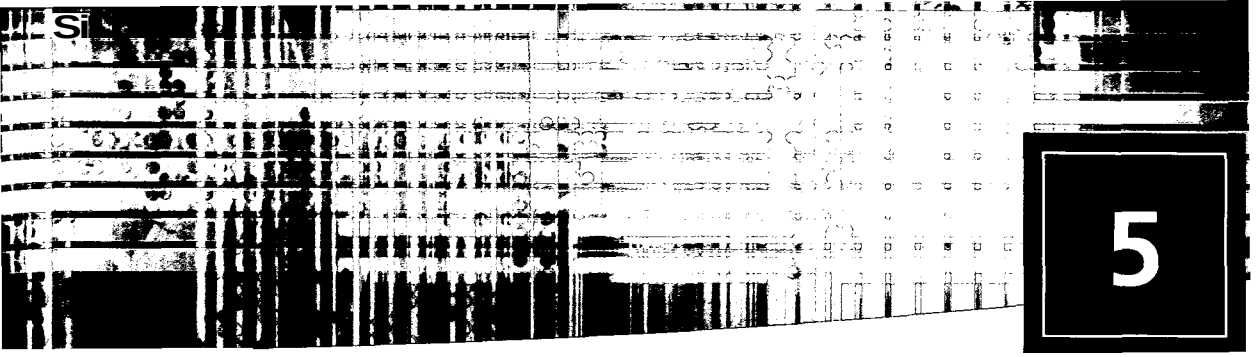
(13 marks)

(b) Show how the advice given in (a) above is altered if the closure of department K would enable its factory space to be rented out for one year at a rental of £8000.

(2 marks)

Ignore taxation and the time value of money.

ACCA



5

Cost assignment

In Chapters 1 and 2 it was pointed out that companies need cost and management accounting systems to perform a number of different functions. In this chapter we are going to concentrate on two of these functions – they are (i) allocating costs between cost of goods sold and inventories for internal and external profit reporting and (ii) providing relevant decision-making information for distinguishing between profitable and unprofitable activities.

In order to perform the above functions a cost accumulation system is required that assigns costs to cost objects. The aim of this chapter is to provide you with an understanding of how costs are accumulated and assigned to cost objects. You should have remembered from Chapter 2 that a cost object is anything for which a separate measurement of cost is desired. Typical cost objects include products, services, customers and locations. In this chapter we shall either use the term cost object as a generic term or assume that products are the cost object. However, the same cost assignment principles can be applied to all cost objects.

In the previous chapter we concentrated on identifying the relevant costs that should be extracted from the costing system for making non-routine decisions. This chapter focuses on the costing system and explains the process of how costs are accumulated and assigned to cost objects. You should note at this stage the monetary amounts accumulated within the costing system may consist of past actual costs or estimated future costs. If the former approach is adopted past costs that are extracted for decision-making should be adjusted to represent estimated future costs.

Besides providing a database from which relevant costs can be extracted for non-routine decisions, information is extracted from the costing system for routine periodic profitability analysis relating to various segments of the business (e.g. products, services, customers, distribution channels). Profits should be analysed periodically to ensure that only profitable activities are undertaken. In some situations cost information is also routinely extracted from the costing system for determining selling prices,

Learning objectives

After studying this chapter, you should be able to:

- distinguish between cause-and-effect and arbitrary cost allocations;
- explain why different cost information is required for different purposes;
- describe how cost systems differ in terms of their level of sophistication;
- understand the factors influencing the choice of optimal cost system;
- explain why departmental overhead rates should be used in preference to a single blanket overhead rate;
- construct an overhead analysis sheet and calculate cost centre allocation rates;
- justify why budgeted overhead rates should be used in preference to actual overhead rates;
- calculate and explain the accounting treatment of the under/over recovery of overheads.

particularly in markets where customized products and services are provided that do not have readily available selling prices.

We begin by explaining how the cost assignment process differs for direct and indirect costs.

Assignment of direct and indirect costs

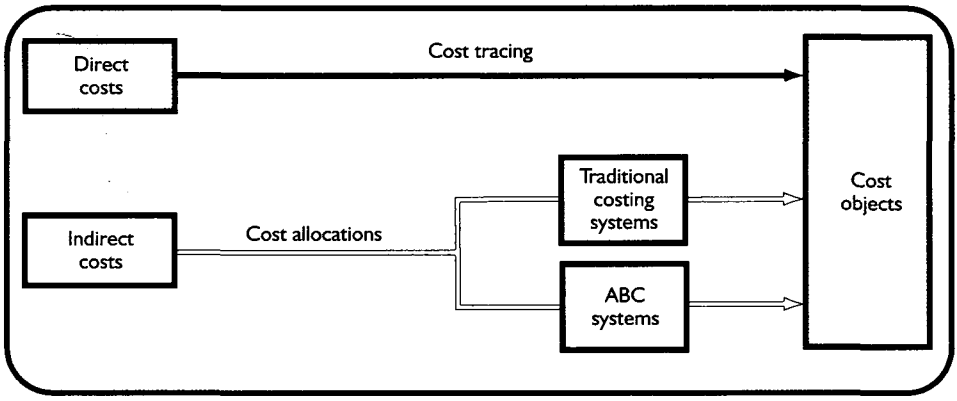
Costs that are assigned to cost objects can be divided into two categories – direct costs and indirect costs. Sometimes the term **overheads** is used instead of indirect costs. Direct costs can be accurately traced to cost objects because they can be specifically and exclusively traced to a particular cost object whereas indirect costs cannot. Where a cost can be directly assigned to a cost object the term **cost tracing** is used. In contrast, indirect costs cannot be traced directly to a cost object because they are usually common to several cost objects. Indirect costs are therefore assigned to cost objects using cost allocations.

A **cost allocation** is the process of assigning costs when a direct measure does not exist for the quantity of resources consumed by a particular cost object. Cost allocations involve the use of surrogate rather than direct measures. For example, consider an activity such as receiving incoming materials. Assuming that the cost of receiving materials is strongly influenced by the number of receipts then costs can be allocated to products (i.e. the cost object) based on the number of material receipts. The basis that is used to allocate costs to cost objects (i.e. the number of material receipts in our example) is called an **allocation base** or **cost driver**. If 20% of the total number of receipts for a period were required for a particular product then 20% of the total costs of receiving incoming materials would be allocated to that product. Assuming that the product was discontinued, and not replaced, we would expect action to be taken to reduce the resources required for receiving materials by 20%.

In the above illustration the allocation base is assumed to be a significant determinant of the cost of receiving incoming materials. Where allocation bases are significant determinants of the costs we shall describe them as **cause-and-effect allocations**. Where a cost allocation base is used that is not a significant determinant of its cost the term **arbitrary allocation** will be used. An example of an arbitrary allocation would be if direct labour hours were used as the allocation base to allocate the costs of materials receiving. If a labour intensive product required a large proportion of direct labour hours (say 30%) but few material receipts it would be allocated with a large proportion of the costs of material receiving. The allocation would be an inaccurate assignment of the resources consumed by the product. Furthermore, if the product were discontinued, and not replaced, the cost of the material receiving activity would not decline by 30% because the allocation base is not a significant determinant of the costs of the materials receiving activity. Arbitrary allocations are therefore likely to result in inaccurate allocations of indirect costs to cost objects.

Figure 5.1 provides a summary of the assignment process. You can see that direct costs are assigned to cost objects using cost tracing whereas indirect cost are assigned using cost allocations. For accurate assignment of indirect costs to cost objects cause-and-effect allocations should be used. Two types of systems can be used to assign indirect costs to cost objects. They are **traditional costing systems** and **activity-based-costing (ABC) systems**. Traditional costing systems were developed in the early 1900s and are still widely used today. They rely extensively on arbitrary cost allocations. ABC systems only emerged in the late 1980s. One of the major aims of ABC systems is to use only cause-and-effect

FIGURE 5.1 *Cost allocations and cost tracing.*



cost allocations. In this chapter we shall concentrate on traditional costing systems and ABC systems will be examined in the next chapter.

Different costs for different purposes

Manufacturing organizations assign costs to products for two purposes: first, for internal profit measurement and external financial accounting requirements in order to allocate the manufacturing costs incurred during a period between cost of goods sold and inventories; secondly, to provide useful information for managerial decision-making requirements. In order to meet financial accounting requirements, it may not be necessary to accurately trace costs to *individual* products. Consider a situation where a firm produces 1000 different products and the costs incurred during a period are £10 million. A well-designed product costing system should accurately analyse the £10 million costs incurred between cost of sales and inventories. Let us assume the true figures are £7 million and £3 million. Approximate but inaccurate *individual* product costs may provide a reasonable approximation of how much of the £10 million should be attributed to cost of sales and inventories. Some product costs may be overstated and others may be understated, but this would not matter for financial accounting purposes as long as the *total* of the individual product costs assigned to cost of sales and inventories was approximately £7 million and £3 million.

For decision-making purposes, however, more accurate product costs are required so that we can distinguish between profitable and unprofitable products. By more accurately measuring the resources consumed by products, or other cost objects, a firm can identify its sources of profits and losses. If the cost system does not capture sufficiently accurately the consumption of resources by products, the reported product costs will be distorted, and there is a danger that managers may drop profitable products or continue production of unprofitable products.

Besides different levels of accuracy, different cost information is required for different purposes. For meeting external financial accounting requirements, financial accounting regulations and legal requirements in most countries require that inventories should be valued at manufacturing cost. Therefore only manufacturing costs are assigned to products for meeting external financial accounting requirements. For decision-making non-manufacturing costs must be taken into account and assigned to products. Not all costs, however may be relevant for decision-making. For example, depreciation of plant and

machinery will not be affected by a decision to discontinue a product. Such costs were described in the previous chapter as irrelevant and sunk for decision-making. Thus depreciation of plant must be assigned to products for inventory valuation but it should not be assigned for discontinuation decisions.

MAINTAINING A SINGLE OR SEPARATE DATABASES

Because different costs and different levels of accuracy are required for different purposes some organizations maintain two separate costing systems, one for decision-making and the other for inventory valuation and profit measurement. In a survey of 187 UK companies Drury and Tayles (2000) reported that 9% of the companies maintained two cost accumulation systems, one for decision-making and the other for inventory valuation. The remaining 91% of organizations maintained a costing system on a single database from which appropriate cost information was extracted to provide the required information for both decision-making and inventory valuation. When a single database is maintained only costs that must be assigned for inventory valuation are extracted for meeting financial accounting requirements, whereas for decision-making only costs which are relevant for the decision are extracted. Inventory valuation is not an issue for many service organizations. They do not carry inventories and therefore a costing system is not required for meeting inventory valuation requirements.

Where a single database is maintained cost assignments cannot be at different levels of accuracy for different purposes. In the late 1980s, according to Johnson and Kaplan (1987), most organizations were relying on costing systems that had been designed primarily for meeting external financial accounting requirements. These systems were designed decades ago when information processing costs were high and precluded the use of more sophisticated methods of assigning indirect costs to products. Such systems are still widely used today. They rely extensively on arbitrary cost allocations which may be sufficiently accurate for meeting external financial accounting requirements but not for meeting decision-making requirements. Johnson and Kaplan concluded that management accounting practices have followed and become subservient to meeting financial accounting requirements.

Cost–benefit issues and cost systems design

These criticisms resulted in the emergence of ABC in the late 1980s. Surveys in many countries suggest that between 20 and 30% of the surveyed organizations have implemented ABC systems. The majority of organizations therefore continue to operate traditional systems. Both traditional and ABC systems vary in their level of sophistication but, as a general rule, traditional systems tend to be simplistic whereas ABC systems tend to be sophisticated. What determines the chosen level of sophistication of a costing system? The answer is that the choice should be made on costs versus benefits criteria. Simplistic systems are inexpensive to operate, but they are likely to result in inaccurate cost assignments and the reporting of inaccurate costs. Managers using cost information extracted from simplistic systems are more likely to make important mistakes arising from using inaccurate cost information. The end result may be a high cost of errors. Conversely, sophisticated systems are more expensive to operate but they minimize the cost of errors. However, the aim should not be to have the most accurate cost system. Improvements should be made in the level of sophistication of the costing system up to the point where the marginal cost of improvement equals the marginal benefit from the improvement.

FIGURE 5.2 *Cost systems – varying levels of sophistication for cost assignment.*

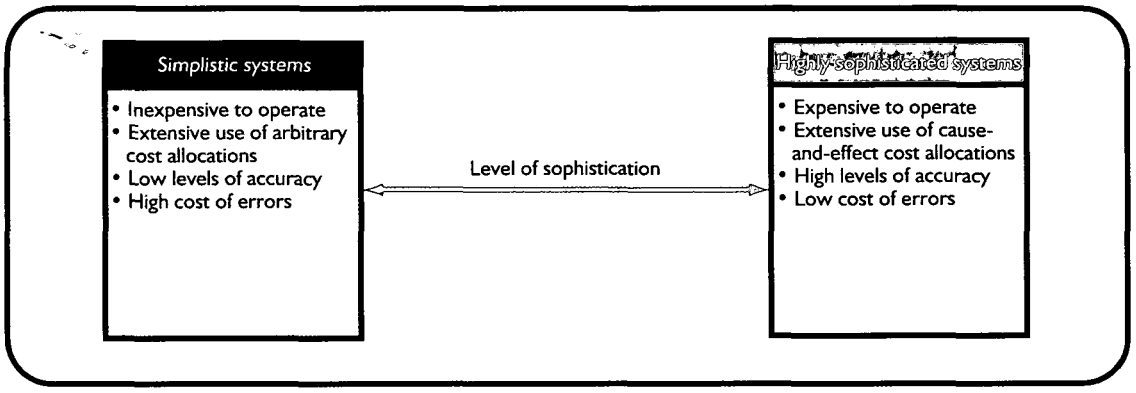


Figure 5.2 illustrates the above points with costing systems ranging from simplistic to sophisticated. Highly simplistic features are located on the extreme left. Common features of such systems are that they are inexpensive to operate, make extensive use of arbitrary allocations of indirect costs and normally result in low levels of accuracy and a high cost of errors. On the extreme right are highly sophisticated systems. These systems use only cause-and-effect allocations, are expensive to operate, have high levels of accuracy and minimize the cost of errors. Cost systems in most organizations are not located at either of these extreme points. Instead, they are located at different points within the range shown in Figure 5.2.

The optimal cost system is different for different organizations. For example, the optimal costing system will be located towards the extreme left for an organization whose indirect costs are a low percentage of total costs and which also has a fairly standardized product range, all consuming organizational resources in similar proportions. In these circumstances simplistic systems may not result in the reporting of inaccurate costs. In contrast, the optimal costing system for organizations with a high proportion of indirect costs, whose products consume organizational resources in different proportions, will be located towards the extreme right. More sophisticated costing systems are required to capture the diversity of consumption of organizational resources and accurately assign the high level of indirect costs to different cost objects.

Assigning direct costs to objects

Both simplistic and sophisticated systems accurately assign direct costs to cost objects. Cost assignment merely involves the implementation of suitable clerical procedures to identify and record the resources consumed by cost objects. Consider direct labour. The time spent on providing a service to a specific customer, or manufacturing a specific product, is recorded on source documents, such as **time sheets** or **job cards**. Details of the customer's account number, job number or the product's code are also entered on these documents. The employee's hourly rate of pay is then entered so that the direct labour cost for the employee can be assigned to the appropriate cost object.

For direct materials the source document is a **materials requisition**. Details of the materials issued for manufacturing a product, or providing a specific service, are recorded on the materials requisition. The customer's account number, job number or product code is also entered and the items listed on the requisition are priced at their cost of acquisition.

The details on the material requisition thus represent the source information for assigning the cost of the materials to the appropriate cost object.

In many organizations the recording procedure for direct costs is computerized using bar coding and other forms of on-line information recording. The source documents only exist in the form of computer records. Because direct costs can be accurately assigned to cost objects whereas many indirect costs cannot the remainder of the chapter will focus on indirect cost assignment.

Plant-wide (blanket) overhead rates

The most simplistic traditional costing system assigns indirect costs to cost objects using a single overhead rate for the organization as a whole. You will recall at the start of this chapter that it was pointed out that indirect costs are also called overheads. The terms **blanket overhead rate** or **plant-wide rate** are used to describe a single overhead rate that is established for the organization as a whole. Let us assume that the total manufacturing overheads for the manufacturing plant of Arcadia are £900 000 and that the company has selected direct labour hours as the allocation base for assigning overheads to products. Assuming that the total number of direct labour hours are 60 000 for the period the plant-wide overhead rate for Arcadia is £15 per direct labour hour (£900 000/60 000 direct labour hours). This calculation consists of two stages. First, overheads are accumulated in one single plant-wide pool for a period. Second, a plant-wide rate is computed by dividing the total amount of overheads accumulated (£900 000) by the selected allocation base (60 000 direct labour hours). Finally, overhead costs are assigned to products, multiplying the plant-wide rate by the units of the selected allocation base (direct labour hours) used by each product.

Assume now that Arcadia is considering establishing separate overheads for each of its three production departments. Further investigations reveal that the products made by the company require different operations and some products do not pass through all three departments. These investigations also indicate that the £900 000 total manufacturing overheads and 60 000 direct labour hours can be analysed as follows:

	Department A	Department B	Department C	Total
Overheads	£200 000	£600 000	£100 000	£900 000
Direct labour hours	20 000	20 000	20 000	60 000
Overhead rate per direct labour hour	£10	£30	£5	£15

Consider now a situation where product Z requires 20 direct labour hours in department C but does not pass through departments A and B. If a plant-wide overhead rate is used then overheads of £300 (20 hours at £15 per hour) will be allocated to product Z. On the other hand, if a departmental overhead rate is used, only £100 (20 hours at £5 per hour) would be allocated to product Z. Which method should be used? The logical answer must be to establish separate departmental overhead rates, since product Z only consumes overheads in department C. If the plant-wide overhead rate were applied, all the factory overhead rates would be averaged out and product Z would be indirectly allocated with some of the overheads of department B. This would not be satisfactory, since product Z does not consume any of the resources and this department incurs a large amount of the overhead expenditure.

Where some departments are more 'overhead-intensive' than others, products spending more time in the overhead-intensive departments should be assigned more overhead costs

than those spending less time. Departmental rates capture these possible effects but plant-wide rates do not, because of the averaging process. We can conclude that a plant-wide rate will generally result in the reporting of inaccurate product costs. A plant-wide rate can only be justified when all products consume departmental overheads in approximately the same proportions. In the above illustration each department accounts for one-third of the total direct labour hours. If all products spend approximately one-third of their time in each department, a plant-wide overhead rate can be used. Consider a situation where product X spends one hour in each department and product Y spends five hours in each department. Overheads of £45 and £225 respectively would be allocated to products X and Y using either a plant-wide rate (3 hours at £15 and 15 hours at £15) or separate departmental overhead rates. If a diverse product range is produced with products spending different proportions of time in each department, separate departmental overhead rates should be established.

However, significant usage of plant-wide overhead rates have been reported in surveys undertaken in many different countries. For example, the percentage usages vary from 20–30% in UK (Drury and Tayles, 1994), USA (Emore and Ness, 1991), Australian (Joye and Blayney, 1990; 1991) and Indian (Joshi, 1998) surveys. In contrast, in Scandinavia only 5% of the Finnish companies (Lukka and Granlund, 1996), one Norwegian company (Bjornenak, 1997b) and none of the Swedish companies sampled (Ask *et al.*, 1996) used a single plant-wide rate. Zero usage of plant-wide rates was also reported from a survey of Greek companies (Ballas and Venieris, 1996). In a more recent study of UK organizations Drury and Tayles (2000) reported that a plant-wide rate was used by 3% of surveyed organizations possibly suggesting a move towards more sophisticated costing systems.

The two-stage allocation process

A framework, known as the two-stage allocation process, can be used as a to summarize the different approaches we have looked at for Arcadia to assign overhead costs to products. The process applies to assigning costs to other cost objects, besides products, and is applicable to all organizations that assign indirect costs to cost objects. The framework applies to both traditional and ABC systems.

The framework is illustrated in Figure 5.3. You can see that in the first stage overheads are assigned to cost centres (also called cost pools). The terms **cost centres** or **cost pools** are used to describe a location to which overhead costs are initially assigned. Normally cost centres consist of departments, but in some cases they consist of smaller segments such as groups of machines. In the second stage the costs accumulated in the cost centres are allocated to cost objects using selected allocation bases (you should remember from our discussion earlier that allocation bases are also called cost drivers). Traditional costing systems tend to use a small number of second stage allocation bases, typically direct labour hours or machine hours. In other words, traditional systems assume that direct labour or machine hours have a significant influence in the long term on the level of overhead expenditure. Other allocation bases used to a lesser extent by traditional systems are direct labour cost, direct materials cost and units of output. Exhibit 5.1 (Section C) shows details of the extent to which different second stage allocation bases are used in different countries. You will see that direct labour and machine hours are the dominant methods.

Let us now apply the framework to our discussion in the previous stage relating to Arcadia. The plant-wide rate overheads (£900 000) are collected in a single cost pool for the plant, or the whole organization if non-manufacturing overheads are to be incorporated in the overhead rate. In the second stage a single plant-wide overhead rate (£15 per hour) is allocated to products based on the number of direct labour hours used by each product.

FIGURE 5.3 *The two-stage allocation process for a traditional costing system.*

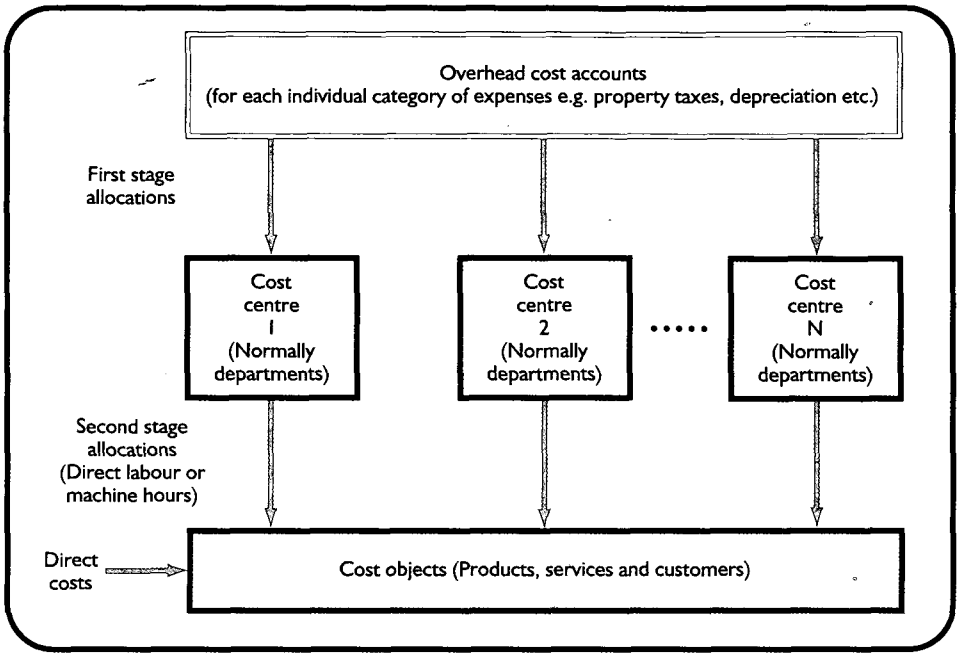


EXHIBIT 5.1

Surveys of practice

(a) Cost centres used in the first stage of the two-stage allocation process

- A survey of Australian organizations by Joye and Blayney (1990):
  36% of the responding organizations used a single plant-wide rate
  24% used overhead rates for groups of work centres
  31% used overhead rates for each work centre
  9% used overhead rates for each machine
- A survey of Swedish organizations by Ask and Ax (1992)[a]:
  70% indicated that cost centres consisted of departments
  32% consisted of work cells
  22% consisted of groups of machines
  15% consisted of single machines
- A Norwegian study by Bjornenak (1997b) reported an average of 38.3 cost centres used by the respondents
- A survey of UK organizations by Drury and Tayles (2000):
  14% used less than 6 cost centres
  21% used 6–10 cost centres
  29% used 11–20 cost centres
  36% used more than 20 cost centres

(b) Number of different second stage allocation bases/cost drivers used

- A survey of UK organizations by Drury and Tayles (2000):
  34% used 1 cost driver
  25% used 2 drivers
  10% used 3 drivers
  21% used 3–10 drivers
  10% used more than 10 drivers
- A Norwegian study by Bjornenak (1997a) reported an average usage of 1.79 cost drivers

(c) Second stage cost allocation bases/cost drivers used[a]

	Norway[b]	Holland[c]	Ireland[d]	Australia[e]	Japan[e]	UK[f]	UK[f]
Direct labour hours/cost	65%	20%	52%	57%	57%	68%	73%
Machine hours	29	9	19	19	12	49	26
Direct materials costs	26	6	10	12	11	30	19
Units of output	40	30	28	20	16	42	31
Prime cost				1	21		
Other	23	35	9				
ABC cost drivers						9	7

A survey of Finnish companies by Lukka and Granlund (1996) reported that direct labour costs, direct labour hours, machine hours, materials use and production quantity were the most widely used allocation bases. Usage rates were not reported.

Notes

[a] The reported percentages exceed 100% because many companies used more than one type of cost centre or allocation base.
[b] Bjornenak (1997b).
[c] Boons *et al.* (1994).
[d] Clarke (1995).
[e] Blayney and Yokoyama (1991).
[f] Drury *et al.* (1993) – The first column relates to the responses for automated and the second to non-automated production centres.

We concluded that, because some departments were more 'overhead intensive' than others, it is preferable to establish separate cost centre overhead rates based on departments. With this approach the total overheads of £900 000 were assigned to the three production departments in the first stage. Separate departmental overhead rates were computed for each department in the second stage (i.e. £10 per direct labour hour department A, £30 for B and £5 for C). Finally, departmental overheads were assigned to products by multiplying the hours spent by a product in each department by the hourly overhead rate. The total overhead assigned to a product is simply the sum of the amounts applied in each department.

How many cost centres should a firm establish? If only a small number of cost centres are established it is likely that activities within a cost centre will not be homogeneous and, if the consumption of the activities by products/services within the cost centres varies, activity resource consumption will not be accurately measured. Therefore, in most situations, increasing the number of cost centres increases the accuracy of measuring

the indirect costs consumed by cost objects. The choice of the number of cost centres should be based on cost–benefit criteria using the principles described on pages 124–5. Exhibit 5.1 (Section A) shows the number of cost centres and second stage cost allocation bases reported by Drury *et al.* in a survey of 187 UK organizations. It can be seen that 35% of the organizations used less than 11 cost centres whereas 23% used more than 30 cost centres. In terms of the number of different second stage cost drivers/allocation bases 69% of the responding organizations used less than four.

An illustration of the two-stage process for a traditional costing system

We shall now use Example 5.1 to provide a more detailed illustration of the two-stage allocation process for a traditional costing system. To keep the illustration manageable it is assumed that the company has only five cost centres – machine departments X and Y, an assembly department and materials handling and general factory support cost centres. The illustration focuses on manufacturing costs but we shall look at non-manufacturing costs later in the chapter. Applying the two-stage allocation process requires the following four steps:

1. assigning all manufacturing overheads to production and service cost centres;
2. reallocating the costs assigned to service cost centres to production cost centres;
3. computing separate overhead rates for each production cost centre;
4. assigning cost centre overheads to products or other chosen cost objects.

Steps 1 and 2 comprise stage one and steps 3 and 4 relate to the second stage of the two-stage allocation process. Let us now consider each of these steps in detail.

STEP 1 – ASSIGNING ALL MANUFACTURING OVERHEADS TO PRODUCTION AND SERVICE COST CENTRES

Using the information given in Example 5.1 our initial objective is to assign all manufacturing overheads to production and service cost centres. To do this requires the preparation of an **overhead analysis sheet**. This document is shown in Exhibit 5.2. In many organizations it will consist only in computer form.

If you look at Example 5.1 you will see that the indirect labour and indirect material costs have been directly traced to cost centres. Although these items cannot be directly assigned to products they can be directly assigned to the cost centres. In other words, they are indirect costs when products are the cost objects and direct costs when cost centres are the cost object. Therefore they are traced directly to the cost centres shown in the overhead analysis sheet in Exhibit 5.2. The remaining costs shown in Example 5.1 cannot be traced directly to the cost centres and must be allocated to the cost centre using appropriate allocation bases. The term **first stage allocation bases** is used to describe allocations at this point. The following list summarizes commonly used first stage allocation bases:

Cost	Basis of allocation
Property taxes, lighting and heating	Area
Employee-related expenditure:	
works management, works canteen, payroll office	Number of employees
Depreciation and insurance of plant and machinery	Value of items of plant and machinery

EXAMPLE 5.1

The annual overhead costs for the Enterprise Company which has three production centres (two machine centres and one assembly centre) and two service centres (materials procurement and general factory support) are as follows:

	(£)	(£)
Indirect wages and supervision		
Machine centres: X	1 000 000	
Y	1 000 000	
Assembly	1 500 000	
Materials procurement	1 100 000	
General factory support	1 480 000	6 080 000
Indirect materials		
Machine centres: X	500 000	
Y	805 000	
Assembly	105 000	
Materials procurement	0	
General factory support	10 000	1 420 000
Lighting and heating	500 000	
Property taxes	1 000 000	
Insurance of machinery	150 000	
Depreciation of machinery	1 500 000	
Insurance of buildings	250 000	
Salaries of works management	800 000	4 200 000
		11 700 000

The following information is also available:

	Book value of machinery (£)	Area occupied (sq. metres)	Number of employees	Direct labour hours	Machine hours
Machine shop: X	8 000 000	10 000	300	1 000 000	2 000 000
Y	5 000 000	5 000	200	1 000 000	1 000 000
Assembly	1 000 000	15 000	300	2 000 000	
Stores	500 000	15 000	100		
Maintenance	500 000	5 000	100		
	15 000 000	50 000	1000		

Details of total materials issues (i.e. direct and indirect materials) to the production centres are as follows:

	£
Machine shop X	4 000 000
Machine shop Y	3 000 000
Assembly	1 000 000
	8 000 000

To allocate the overheads listed above to the production and service centres we must prepare an overhead analysis sheet, as shown in Exhibit 5.2.

EXHIBIT 5.2

Overhead analysis sheet

Item of expenditure	Basis of allocation	Total (£)	Production centres: Machine centre X (£)	Production centres: Machine centre Y (£)	Production centres: Assembly (£)	Service centres: Materials procurement (£)	Service centres: General factory support (£)
Indirect wage and supervision	Direct	6 080 000	1 000 000	1 000 000	1 500 000	1 100 000	1 480 000
Indirect materials	Direct	1 420 000	500 000	805 000	105 000		10 000
Lighting and heating	Area	500 000	100 000	50 000	150 000	150 000	50 000
Property taxes	Area	1 000 000	200 000	100 000	300 000	300 000	100 000
Insurance of machinery	Book value of machinery	150 000	80 000	50 000	10 000	5 000	5 000
Depreciation of machinery	Book value of machinery	1 500 000	800 000	500 000	100 000	50 000	50 000
Insurance of buildings	Area	250 000	50 000	25 000	75 000	75 000	25 000
Salaries of works management	Number of employees	800 000	240 000	160 000	240 000	80 000	80 000
	(1)	11 700 000	2 970 000	2 690 000	2 480 000	1 760 000	1 800 000
Reallocation of service centre costs							
Materials procurement	Value of materials issued	—	880 000	660 000	220 000	1 760 000	
General factory support	Direct labour hours	—	450 000	450 000	900 000		1 800 000
	(2)	11 700 000	4 300 000	3 800 000	3 600 000	—	—
Machine hours and direct labour hours			2 000 000	1 000 000	2 000 000		
Machine hour overhead rate			£2.15	£3.80			
Direct labour hour overhead rate					£1.80		

Applying the allocation bases to the data given in respect of the Enterprise Company in Example 5.1 it is assumed that property taxes, lighting and heating, and insurance of buildings are related to the total floor area of the buildings, and the benefit obtained by each cost centre can therefore be ascertained according to the proportion of floor area which it occupies. The total floor area of the factory shown in Example 5.1 is 50 000 square metres; machine centre X occupies 20% of this and machine centre Y a further 10%. Therefore, if you refer to the overhead analysis sheet in Exhibit 5.2 you will see that 20% of property taxes, lighting and heating and insurance of buildings are allocated to machine centre X, and 10% are allocated to machine centre Y.

The insurance premium paid and depreciation of machinery are generally regarded as being related to the book value of the machinery. Because the book value of machinery for machine centre X is 8/15 of the total book value and machine centre Y is 5/15 of the total book value then 8/15 and 5/15 of the insurance and depreciation of machinery is allocated to machine centres X and Y.

It is assumed that the amount of time that works management devotes to each cost centre is related to the number of employees in each centre; since 30% of the total employees are employed in machine centre X, 30% of the salaries of works management will be allocated to this centre.

If you now look at the overhead analysis sheet shown in Exhibit 5.2, you will see in the row labelled '(1)' that all manufacturing overheads for the Enterprise Company have been assigned to the three production and two service cost centres.

STEP 2 – REALLOCATING THE COSTS ASSIGNED TO SERVICE COST CENTRES TO PRODUCTION COST CENTRES

The next step is to reallocate the costs that have been assigned to service cost centres to production cost centres. Service departments (i.e. service cost centres) are those departments that exist to provide services of various kinds to other units within the organization. They are sometimes called support departments. The Enterprise Company has two service centres. They are materials procurement and general factory support which includes activities such as production scheduling and machine maintenance. These service centres render essential services that support the production process, but they do not deal directly with the products. Therefore it is not possible to allocate service centre costs to products passing through these centres. To assign costs to products traditional costing systems reallocate service centre costs to production centres that actually work on the product. The method that is chosen to allocate service centre costs to production centre should be related to the benefits that the production centres derive from the service rendered.

We shall assume that the value of materials issued (shown in Example 5.1) provides a suitable approximation of the benefit that each of the production centres receives from materials procurement. Therefore 50% of the value of materials is issued to machine centre X, resulting in 50% of the total costs of materials procurement being allocated to this centre. If you refer to Exhibit 5.3 you will see that £880 000 (50% of material procurement costs of £1 760 000) has been reallocated to machine centre X. It is also assumed that direct labour hours provides an approximation of the benefits received by the production centres from general factory support resulting in the total costs for this centre being reallocated to the production centres proportionate to direct labour hours. Therefore since machine centre X consumes 25% of the direct labour hours £450 000 (25% of the total costs of £1 800 000 assigned to general factory support) has been reallocated to machine centre X. You will see in the row labelled '(2)' in Exhibit 5.2 that all manufacturing costs have now been assigned to the three production centres. This completes the first stage of the two-stage allocation process.

STEP 3 – COMPUTING SEPARATE OVERHEAD RATES FOR EACH PRODUCTION COST CENTRE

The second stage of the two-stage process is to allocate overheads of each production centre to overheads passing through that centre. The most frequently used allocation bases used by traditional costing systems are based on the amount of time products spend in each production centre – normally direct labour hours and machine hours. In respect of non-machine centres, direct labour hours is the most frequently used allocation base. This implies that the overheads incurred by a production centre are closely related to direct labour hours worked. In the case of machine centres a machine hour overhead rate is

preferable since most of the overheads (e.g. depreciation) are likely to be more closely related to machine hours. We shall assume that the Enterprise Company uses a **machine hour rate** for the machine production centres and a **direct labour hour rate** for the assembly centre. The overhead rates are calculated by applying the following formula:

$$\frac{\text{cost centre overheads}}{\text{cost centre direct labour hours or machine hours}}$$

The calculations using the information given in Example 5.1 are as follows:

$$\text{Machine centre X} = \frac{£4\,300\,000}{2\,000\,000 \text{ machine hours}} = £2.15 \text{ per machine hour}$$

$$\text{Machine centre Y} = \frac{£3\,800\,000}{1\,000\,000 \text{ machine hours}} = £3.80 \text{ per machine hour}$$

$$\text{Assembly department} = \frac{£3\,600\,000}{2\,000\,000 \text{ direct labour hours}} = £1.80 \text{ per direct labour hour}$$

STEP 4 – ASSIGNING COST CENTRE OVERHEADS TO PRODUCTS OR OTHER CHOSEN COST OBJECTS

The final step is to allocate the overheads to products passing through the production centres. Therefore if a product spends 10 hours in machine cost centre A overheads of £21.50 (10 × £2.15) will be allocated to the product. We shall compute the manufacturing costs of two products. Product A is a low sales volume product with direct costs of £100. It is manufactured in batches of 100 units and each unit requires 5 hours in machine centre A, 10 hours in machine centre B and 10 hours in the assembly centre. Product B is a high sales volume product thus enabling it to be manufactured in larger batches. It is manufactured in batches of 200 units and each unit requires 10 hours in machine centre A, 20 hours in machine centre B and 20 hours in the assembly centre. Direct costs of £200 have been assigned to product B. The calculations of the manufacturing costs assigned to the products are as follows:

Product A	**£**
Direct costs (100 units × £100)	10 000
Overhead allocations	
Machine centre A (100 units × 5 machine hours × £2.15)	1 075
Machine centre B (100 units × 10 machine hours × £3.80)	3 800
Assembly (100 units × 10 direct labour hours × £1.80)	1 800
Total cost	16 675
Cost per unit (£16 675/100 units) = £166.75	

Product B	**£**
Direct costs (200 units × £200)	40 000
Overhead allocations	
Machine centre A (200 units × 10 machine hours × £2.15)	4 300
Machine centre B (200 units × 20 machine hours × £3.80)	15 200
Assembly (200 units × 20 direct labour hours × £1.80)	7 200
Total cost	66 700
Cost per unit (£66 700/200 units) = £333.50	

The overhead allocation procedure is more complicated where service cost centres serve each other. In Example 5.1 it was assumed that materials procurement does not provide any services for general factory support and that general factory support does not provide any services for materials procurement. An understanding of situations where service cost centres do serve each other is not, however, necessary for a general understanding of the overhead procedure, and the problem of service centre reciprocal cost allocations is therefore not dealt with in this book. For an explanation of how to deal with the problem of service centre reciprocal cost allocations you should refer to Drury (2000, ch. 3).

Extracting relevant costs for decision-making

The cost computations relating to the Enterprise Company for products A and B represent the costs that should be generated for meeting stock valuation and profit measurement requirements. For decision-making non-manufacturing costs should also be taken into account. In addition, some of the costs that have been assigned to the products may not be relevant for certain decisions. For example, if you look at the overhead analysis sheet in Exhibit 5.2 you will see that property taxes, depreciation of machinery and insurance of buildings and machinery have been assigned to cost centres, and thus included in the costs assigned to products. If these cost are unaffected by a decision to discontinue a product they should not be assigned to products when undertaking product discontinuation reviews. However, if cost information is used to determine selling prices such costs may need to be assigned to products to ensure that the selling price of a customer's order covers a fair share of all organizational costs. It is therefore necessary to ensure that the costs incorporated in the overhead analysis are suitably coded so that different overhead rates can be extracted for different combinations of costs. This will enable relevant cost information to be extracted from the database for meeting different requirements. For an illustration of this approach you should refer to the second self-assessment question and answer at the end of this chapter.

Our objective in this chapter has not been to focus on the cost information that should be extracted from the costing system for meeting decision-making requirements. Instead, it is to provide you with an understanding of how cost systems assign costs to cost objects. In the previous chapter, and also in Chapter 7, the rationale for determining the cost information that should be extracted for decision-making is explained.

Budgeted overhead rates

Our discussion in this chapter has assumed that the *actual* overheads for an accounting period have been allocated to the products. However, the calculation of overhead rates based on the *actual* overheads incurred during an accounting period causes a number of problems. First, the product cost calculations have to be delayed until the end of the accounting period, since the overhead rate calculations cannot be obtained before this date, but information on product costs is required quickly if it is to be used for monthly profit calculations and inventory valuations or as a basis for setting selling prices. Secondly, one may argue that the timing problem can be resolved by calculating actual overhead rates at more frequent intervals, say on a monthly basis, but the objection to this proposal is that a large amount of overhead expenditure is fixed in the short term whereas activity will vary from month to month, giving large fluctuations in the overhead rates. Consider Example 5.2.

Such fluctuating overhead rates are not representative of typical, normal production conditions. Management has committed itself to a specific level of fixed costs in the light

EXAMPLE 5.2

The fixed overheads for Euro are £24 000 000 per annum, and monthly production varies from 400 000 to 1 000 000 hours. The monthly overhead rate for fixed overhead will therefore fluctuate as follows:

Monthly overhead	£2 000 000	£2 000 000
Monthly production	400 000 hours	1 000 000 hours
Monthly overhead rate	£5 per hour	£2 per hour

Overhead expenditure that is fixed in the short term remains constant each month, but monthly production fluctuates because of holiday periods and seasonal variations in demand. Consequently the overhead rate varies from £2 to £5 per hour. It would be unreasonable for a product worked on in one month to be allocated overheads at a rate of £5 per hour and an identical product worked on in another month allocated at a rate of only £2 per hour.

of foreseeable needs for beyond one month. Thus, where production fluctuates, monthly overhead rates may be volatile. Furthermore, some costs such as repairs, maintenance and heating are not incurred evenly throughout the year. Therefore, if monthly overhead rates are used, these costs will not be allocated fairly to units of output. For example, heating costs would be charged only to winter production so that products produced in winter would be more expensive than those produced in summer.

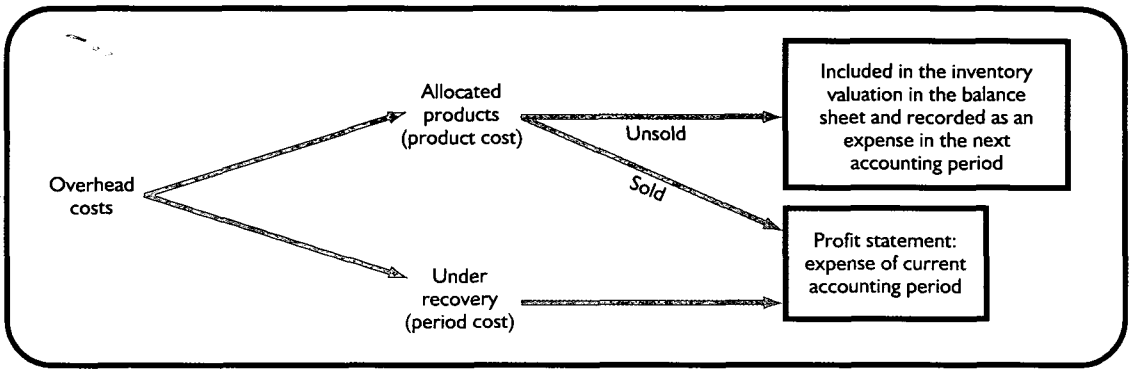
An average, annualized rate based on the relationship of total annual overhead to total annual activity is more representative of typical relationships between total costs and volume than a monthly rate. What is required is a normal product cost based on average long-term production rather than an actual product cost, which is affected by month-to-month fluctuations in production volume. Taking these factors into consideration, it is preferable to establish a **budgeted overhead rate** based on annual *estimated* overhead expenditure and activity. Consequently the procedure outlined in the previous sections for calculating cost centre overhead rates for traditional and ABC systems should be based on *standard* activity levels and not *actual* activity levels. Surveys of product costing practices indicate that most organizations use annual budgeted activity as a measure of standard activity.

Under- and over-recovery of overheads

The effect of calculating overhead rates based on budgeted annual overhead expenditure and activity is that it will be most unlikely that the overhead allocated to products manufactured during the period will be the same as the actual overhead incurred. Consider a situation where the estimated annual fixed overheads are £2 000 000 and the estimated annual activity is 1 000 000 direct labour hours. The estimated fixed overhead rate will be £2 per hour. Assume that actual overheads are £2 000 000 and are therefore identical with the estimate, but that actual activity is 900 000 direct labour hours instead of the estimated 1 000 000 hours. In this situation only £1 800 000 will be charged to production. This calculation is based on 900 000 direct labour hours at £2 per hour, giving an under-recovery of overheads of £200 000.

Consider an alternative situation where the actual overheads are £1 950 000 instead of the estimated £2 000 000, and actual activity is 1 000 000 direct labour hours, which is identical to the original estimate. In this situation 1 000 000 direct labour hours at £2 per

FIGURE 5.4 *Illustration of under-recovery of factory overheads.*



hour will be charged to production giving an over-recovery of £50 000. This example illustrates that there will be an under- or over-recovery of overheads whenever actual activity or overhead expenditure is different from the budgeted overheads and activity used to estimate the budgeted overhead rate. This under- or over-recovery of fixed overheads is also called a volume variance.

Accounting regulations in most countries recommend that the under- or over-recovery of overheads should be regarded as a period cost adjustment. For example, the UK Statement of Standard Accounting Practice on Stocks and Work in Progress (SSAP 9) recommends the allocation of overheads in the valuation of inventories and work in progress needs to be based on the company's normal level of activity and that any under- or over-recovery should be written off in the current year. This procedure is illustrated in Figure 5.4. Note that any under- or over-recovery of overhead is not allocated to products. Also note that the under-recovery is recorded as an expense in the current accounting period whereas an over-recovery is recorded as a reduction in the expenses for the period. Finally you should note that our discussion here is concerned with how to treat any under- or over-recovery for the purpose of financial accounting and its impact on inventory valuation and profit measurement.

Maintaining the database at standard costs

Most organizations whose activities consist of a series of common or repetitive operations maintain their database at standard, rather than actual cost, for both traditional and ABC systems. Standard costs are pre-determined target costs that should be incurred under efficient operating conditions. For example, assume that the standard direct labour cost for performing a particular operation is £40 (consisting of 5 hours at £8 per hour) and the standard cost of a purchased component (say component Z) is £50. The direct costs for a product requiring only this operation and the purchased component Z would be recorded in the database at a standard cost of £90. Assuming that the product only passed through a single cost centre with a budgeted overhead rate of £20 per direct labour hour the overhead cost for the product would be recorded in the database at £100 standard cost (5 standard direct labour hours at £20 per hour). Instead of a product being recorded in the database at its standard *unit* cost the database may consist of the standard costs of a batch of output, such as normal batch sizes of say 100 or 200 units output of the product.

When a standard costing system is used the database is maintained at standard cost and actual output is costed at the standard cost. Actual costs are recorded, but not at the individual product level, and an adjustment is made at the end of the accounting period by

recording as a period cost the difference between standard cost and actual cost for the actual output. This adjustment ensures that the standard costs are converted to actual costs in the profit statement for meeting external financial accounting reporting requirements.

It is not important at this point that you have a detailed understanding of a standard costing system. However, it is important that you are aware that a database may consist of standard (estimated) costs rather than actual costs. We shall look at standard costing in detail in Chapter 12.

Non-manufacturing overheads

In respect of financial accounting, only manufacturing costs are allocated to products. Non-manufacturing overheads are regarded as period costs and are disposed of in exactly the same way as the under- or over-recovery of manufacturing overheads outlined in Figure 5.4. For external reporting it is therefore unnecessary to allocate non-manufacturing overheads to products. However, for decision-making non-manufacturing costs should be assigned to products. For example, in many organizations it is not uncommon for selling prices to be based on estimates of total cost or even actual cost. Housing contractors and garages often charge for their services by adding a percentage profit margin to actual cost.

Some non-manufacturing costs may be a direct cost of the product. Delivery costs, salesmen's salaries and travelling expenses may be directly identifiable with the product, but it is likely that many non-manufacturing overheads cannot be allocated directly to specific products. On what basis should we allocate non-manufacturing overheads? The answer is that we should select an allocation base/cost driver that corresponds most closely to non-manufacturing overheads. The problem is that allocation bases that are widely used by traditional costing systems, such as direct labour hours, machine hours and direct labour cost are not necessarily those that are closely related to non-manufacturing overheads. Therefore traditional systems tend to use arbitrary, rather than cause-and-effect allocation bases, to allocate non-manufacturing overheads to products. The most widely used approach (see Exhibit 5.3) is to allocate non-manufacturing overheads on the ability of the products to bear such costs. This approach can be implemented by allocating non-manufacturing costs to products on the basis of their manufacturing costs. This procedure is illustrated in Example 5.3.

Because of the arbitrary nature of the cost allocations, some organizations that use traditional costing systems as a basis for setting selling prices do not to allocate non-manufacturing overheads to products. Instead, they add a percentage

EXHIBIT 5.3

Methods used by UK organizations to allocate non-manufacturing overheads to products

	(%)
Allocation as a percentage of total manufacturing cost	32
Direct labour hours/cost methods	25
Percentage of total selling price	12
Non-manufacturing overheads not traced to products	23
Other methods	8
	100

SOURCE: Drury *et al.* (1993).

EXAMPLE 5.3

The estimated non-manufacturing and manufacturing costs of a company for the year ending 31 December are £500 000 and £1 million respectively. The non-manufacturing overhead absorption rate is calculated as follows:

$$\frac{\text{estimated non-manufacturing overhead}}{\text{estimated manufacturing cost}}$$

In percentage terms each product will be allocated with non-manufacturing overheads at a rate of 50% of its total manufacturing cost.

profit margin to each product so that it provides a profit contribution and a contribution to non-manufacturing overheads. We shall consider in more detail how cost information can be used in determining selling prices in Chapter 7. Recent developments in ABC have provided a mechanism for more accurately assigning non-manufacturing overheads to products. These developments will be explained in the next chapter.

Summary

The aim of this chapter has been to provide you with an understanding of how costs are assigned to cost objects. Direct costs can be accurately traced to cost objects whereas indirect costs cannot. Therefore indirect costs must be assigned using cost allocation bases. Allocation bases which are significant determinants of costs that are being allocated are described as cause-and-effect allocations whereas arbitrary allocations refer to allocation bases that are not the significant determinant of the costs. To accurately measure the cost of resources used by cost objects cause-and-effect allocations should be used.

Most organizations accumulate costs within a single database and different categories of costs are extracted for meeting different purposes. The sophistication and accuracy of costing systems vary and cost–benefit criteria should determine the optimal costing system for an organization. The range of the sophistication of costing systems varies from simplistic traditional to sophisticated ABC systems. Simplistic traditional systems make significant use of arbitrary cost allocations whereas ABC systems aim to use only cause-and-effect cost allocations.

Both systems use the two-stage allocation process. In the first stage overheads are assigned to cost centres, while the second stage allocates cost centre overheads to products. Some companies use only a single plant-wide overhead rate, but it has been shown that this approach can only be justified where products spend approximately equal proportions of time in each production cost centre. The two-stage procedure involves the following steps:

1. the allocation of overheads to production and service centres or departments;
2. the apportionment of service department overhead to production departments;
3. the calculation of appropriate departmental overhead rates;
4. the allocation of overheads to products passing through each department.

These steps were illustrated with Example 5.1 for a traditional costing system. The allocation bases that are most frequently used in the second stage by traditional costing systems are the direct labour hour method for non-machine departments and the machine hour rate for machine departments.

As the use of actual overhead rates causes a delay in the calculation of product costs, and the use of monthly overhead rates causes fluctuations in monthly overhead rates, it has been suggested that budgeted annual overhead rates should be used. However, the use of annual budgeted overhead rates gives an under or over-recovery of overhead whenever actual overhead expenditure or activity is different from budget. Any under- or over-recovery of overhead is generally regarded as a period cost adjustment and written off to the profit and loss account.

For meeting financial accounting requirements non-manufacturing overheads are not assigned to products. Instead, they are treated as period costs.

For decision-making non-manufacturing costs must be considered but traditional costing systems allocate them using arbitrary allocations that result in the reporting of distorted product costs. Recent developments in ABC have provided a mechanism for more accurately assigning non-manufacturing overheads to products.

Key Terms and Concepts

activity-based-costing (ABC) (p. 122)
allocation base (p. 122)
arbitrary allocation (p. 122)
blanket overhead rate (p. 126)
budgeted overhead rates (p. 136)
cause-and-effect allocations (p. 122)
cost allocation (p. 122)
cost centre (p. 127)

cost driver (p. 122)
cost pool (p. 127)
cost tracing (p. 122)
direct labour hour rate (p. 134)
first stage allocation bases (p. 130)
job cards (p. 125)
machine hour rate (p. 134)
materials requisition (p. 125)
overhead analysis sheet (p. 130)
overheads (p. 122)
plant-wide rate (p. 126)
service departments (p. 133)
standard costs (p. 137)
support departments (p. 133)
time sheets (p. 125)
traditional costing systems (p. 122)
under- or over-recovery of overheads (p. 137)
volume variance (p. 137)

Review Problems

1. Bookdon Public Limited Company manufactures three products in two production departments, a machine shop and a fitting section; it also has two service departments, a canteen and a machine maintenance section. Shown below are next year's budgeted production data and manufacturing costs for the company.

	Product X	Product Y	Product Z
Production	4200 units	6900 units	1700 units
Prime cost:			
Direct materials	£11 per unit	£14 per unit	£17 per unit
Direct labour:			
Machine shop	£6 per unit	£4 per unit	£2 per unit
Fitting section	£12 per unit	£3 per unit	£21 per unit
Machine hours per unit	6 hours per unit	3 hours per unit	4 hours per unit

	Machine shop	Fitting section	Canteen	Machine maintenance section	Total
Budgeted overheads (£):					
Allocated overheads	27 660	19 470	16 600	26 650	90 380
Rent, rates, heat and light					17 000
Depreciation and insurance of equipment					25 000
Additional data:					
Gross book value of equipment (£)	150 000	75 000	30 000	45 000	
Number of employees	18	14	4	4	
Floor space occupied (square metres)	3 600	1 400	1 000	800	

It has been estimated that approximately 70% of the machine maintenance section's costs are incurred servicing the machine shop and the remainder incurred servicing the fitting section.

Required:

(a) (i) Calculate the following budgeted overhead absorption rates:
A machine hour rate for the machine shop.
A rate expressed as a percentage of direct wages for the fitting section.
All workings and assumptions should be clearly shown. (12 marks)

(ii) Calculate the budgeted manufacturing overhead cost per unit of product X. (2 marks)

(b) The production director of Bookdon PLC has suggested that 'as the actual overheads incurred and units produced are usually different from the budgeted and as a consequence profits of each month end are distorted by over/under absorbed overheads, it would be more accurate to calculate the actual overhead cost per unit each month end by dividing the total number of all units actually produced during the month into the actual overheads incurred.'
Critically examine the production director's suggestion. (8 marks)

(Total 22 marks)
ACCA

2. Shown below is next year's budget for the forming and finishing departments of Tooton Ltd. The departments manufacture three different types of component, which are incorporated into the output of the firm's finished products.

	Component A	**Component B**	**Component C**
Production	14 000 units	10 000 units	6000 units
Prime cost (£ per unit):			
Direct materials			
Forming dept	8	7	9
Direct labour			
Forming dept	6	9	12
Finish dept	10	15	8
	24	31	29
Manufacturing times (hours per unit):			
Machining			
Forming dept	4	3	2
Direct labour			
Forming dept	2	3	4
Finishing dept	3	10	2

	Forming department (£)	**Finishing department (£)**
Variable overheads	200 900	115 500
Fixed overheads	401 800	231 000
	£602 700	£346 500
Machine time required and available	98 000 hours	—
Labour hours required and available	82 000 hours	154 000 hours

The forming department is mechanized and employs only one grade of labour, the finishing department employs several grades of labour with differing hourly rates of pay.

Required:

(a) Calculate suitable overhead absorption rates for the forming and finishing departments for next year and include a brief explanation for your choice of rates. (6 marks)

(b) Another firm has offered to supply next year's budgeted quantities of the above components at the following prices:

Component A £30 Component B £65 Component C £60

Advise management whether it would be more economical to purchase any of the above components from the outside supplier. You must show your workings and, considering cost criteria only, clearly state any assumptions made or any aspects that may require further investigation. (8 marks)

(c) Critically consider the purpose of calculating production overheads absorption rates. (8 marks)

(Total 22 marks)

ACCA

Solutions to Review Problems

SOLUTION 1

(a) (i) Calculation of budgeted overhead absorption rates:

	Apportionment of overheads to production departments				
	Machine shop (£)	**Fitting section (£)**	**Canteen (£)**	**Machine maintenance section (£)**	**Total (£)**
Allocated overheads	27 660	19 470	16 600	26 650	90 380
Rent, rates, heat and light[a]	9 000	3 500	2 500	2 000	17 000
Depreciation and insurance of equipment[a]	12 500	6 250	2 500	3 750	25 000
	49 160	29 220	21 600	32 400	132 380
Service department apportionment					
Canteen[b]	10 800	8 400	(21 600)	2 400	—
Machine maintenance section	24 360	10 440	—	(34 800)	—
	84 320	48 060	—	—	132 380

Calculation of absorption bases

Product	Budgeted production	Machine shop: Machine hours per product	Machine shop: Total machine hours	Fitting section: Direct labour cost per product (£)	Fitting section: Total direct wages (£)
X	4200 units	6	25 200	12	50 400
Y	6900 units	3	20 700	3	20 700
Z	1700 units	4	6 800	21	35 700
			52 700		106 800

Budgeted overhead absorption rates

Machine shop	Fitting section
$\frac{\text{budgeted overheads}}{\text{budgeted machine hours}} = \frac{£84\,320}{£52\,700}$	$\frac{\text{budgeted overheads}}{\text{budgeted direct wages}} = \frac{48\,060}{106\,800}$
= £1.60 per machine hour	= 45% of direct wages

Notes

[a] Rents, rates, heat and light are apportioned on the basis of floor area. Depreciation and insurance of equipment are apportioned on the basis of book value.

[b] Canteen costs are reapportioned according to the number of employees. Machine maintenance section costs are reapportioned according to the percentages given in the question.

(ii) The budgeted manufacturing overhead cost for producing one unit of product X is as follows:

	(£)
Machine shop: 6 hours at £1.60 per hour	9.60
Fittings section: 45% of £12	5.40
	15.00

(b) The answer should discuss the limitations of blanket overhead rates and actual overhead rates. See 'Blanket overhead rates' and 'Predetermined overhead rates' in Chapter 5 for the answer to this question.

SOLUTION 2

(a) The calculation of the overhead absorption rates are as follows:

Forming department machine hour rate
= £6.15 per machine hour (£602 700/98 000 hours)

Finishing department labour hour rate
= £2.25 per labour hour (£346 500/154 000 hours)

The forming department is mechanized, and it is likely that a significant proportion of overheads will be incurred as a consequence of employing and running the machines. Therefore a machine hour rate has been used. In the finishing department several grades of labour are used. Consequently the direct wages percentage method is inappropriate, and the direct labour hour method should be used.

(b) The decision should be based on a comparison of the incremental costs with the purchase price of an outside supplier if spare capacity exists. If no spare capacity

exists then the lost contribution on displaced work must be considered. The calculation of incremental costs requires that the variable element of the total overhead absorption rate must be calculated. The calculation is:

Forming department variable machine hour rate
= £2.05 (£200 900/98 000 hours)
Finishing department variable direct labour hour rate
= £0.75 (£115 500/154 000 hours)

The calculation of the variable costs per unit of each component is:

		A (£)	B (£)	C (£)
Prime cost		24.00	31.00	29.00
Variable overheads:	Forming	8.20	6.15	4.10
	Finishing	2.25	7.50	1.50
Variable unit manufacturing cost		34.45	44.65	34.60
Purchase price		£30	£65	£60

On the basis of the above information, component A should be purchased and components B and C manufactured. This decision is based on the following assumptions:

(i) Variable overheads vary in proportion to machine hours (forming department) and direct labour hours (finishing department).
(ii) Fixed overheads remain unaffected by any changes in activity.
(iii) Spare capacity exists.

For a discussion of make-or-buy decisions see Chapter 4.

(c) Production overhead absorption rates are calculated in order to ascertain costs per unit of output for stock valuation and profit measurement purposes. Such costs are inappropriate for decision-making and cost control. For an explanation of this see 'Extracting relevant costs for decision making' in Chapter 5.

Questions

5.1

A company uses a predetermined overhead recovery rate based on machine hours. Budgeted factory overhead for a year amounted to £720 000, but actual factory overhead incurred was £738 000. During the year, the company absorbed £714 000 of factory overhead on 119 000 actual machine hours.

What was the company's budgeted level of machine hours for the year?

A 116 098
B 119 000
C 120 000
D 123 000

ACCA

5.2

A company absorbs overheads on machine hours which were budgeted at 11 250 with overheads of £258 750. Actual results were 10 980 hours with overheads of £254 692.

Overheads were:

A under-absorbed by £2152
B over-absorbed by £4058
C under-absorbed by £4058
D over-absorbed by £2152

CIMA

5.3

The following data are to be used for sub-questions (i) and (ii) below:

Budgeted labour hours	8 500
Budgeted overheads	£148 750
Actual labour hours	7 928
Actual overheads	£146 200

(i) Based on the data given above, what is the labour hour overhead absorption rate?
A £17.50 per hour
B £17.20 per hour
C £18.44 per hour
D £18.76 per hour

(ii) Based on the data given above, what is the amount of overhead under/over-absorbed?
A £2550 under-absorbed
B £2529 over-absorbed
C £2550 over-absorbed
D £7460 under-absorbed

CIMA

5.4

A firm makes special assemblies to customers' orders and uses job costing. The data for a period are:

	Job no. AA10 (£)	Job no. BB15 (£)	Job no. CC20 (£)
Opening WIP	26 800	42 790	—
Material added in period	17 275	—	18 500
Labour for period	14 500	3 500	24 600

The budgeted overheads for the period were £126 000.

(i) What overhead should be added to job number CC20 for the period?
A £24 600
B £65 157
C £72 761
D £126 000

(ii) Job no. BB15 was completed and delivered during the period and the firm wishes to earn $33\frac{1}{3}\%$ profit on sales.
What is the selling price of job number BB15?
A £69 435
B £75 521
C £84 963
D £138 870

(iii) What was the approximate value of closing work in progress at the end of the period?
A £58 575
B £101 675
C £147 965
D £217 323

CIMA

5.5

A company absorbs overheads on machine hours. In a period, actual machine hours were 17 285, actual overheads were £496 500 and there was under-absorption of £12 520.
What was the budgeted level of overheads?
A £483 980
B £496 500
C £509 020
D It cannot be calculated from the information provided.

CIMA

5.6 Overhead analysis, calculation of overhead rates and a product cost

Knowing that you are studying for the CIMA qualification, a friend who manages a small business has sought your advice about how to produce quotations in response to the enquiries which her business receives. Her business is sheet metal fabrication – supplying ducting for dust extraction and airconditioning installations. She believes that she has lost orders recently through the use of a job cost estimating system which was introduced, on the advice of her auditors, seven years ago. You are invited to review this system.

Upon investigation, you find that a plant-wide percentage of 125% is added to prime costs in order to arrive at a selling price. The percentage added is intended to cover all overheads for the three production departments (Departments P, Q and R), all the selling, distribution and administration costs, and the profit.

You also discover that the selling, distribution and administration costs equate to roughly 20% of total production costs, and that to achieve the desired return on capital employed, a margin of 20% of sales value is necessary.

You recommend an analysis of overhead cost items be undertaken with the objective of determining a direct labour hour rate of overhead absorption for each of the three departments work passes through. (You think about activity-based costing but feel this would be too sophisticated and difficult to introduce at the present time.)

There are 50 direct workers in the business plus 5 indirect production people.

From the books, records and some measuring, you ascertain the following information which will enable you to compile an overhead analysis spreadsheet, and to determine overhead absorption rates

per direct labour hour for departmental overhead purposes:

Cost/expense	Annual amount	Basis for apportionment where allocation not given
	£	
Repairs and maintenance	62 000	Technical assessment: P £42 000, Q £10 000, R £10 000
Depreciation	40 000	Cost of plant and equipment
Consumable supplies	9 000	Direct labour hours
Wage-related costs	87 000	12½% of direct wages costs
Indirect labour	90 000	Direct labour hours
Canteen/rest/smoke room	30 000	Number of direct workers
Business rates and insurance	26 000	Floor area

Other estimates/information

	Department P	Department Q	Department R
Estimated direct labour hours	50 000	30 000	20 000
Direct wages costs	£386 000	£210 000	£100 000
Number of direct workers	25	15	10
Floor area in square metres	5 000	4 000	1 000
Plant and equipment, at cost	£170 000	£140 000	£90 000

Required:

(a) Calculate the overhead absorption rates for each department, based on direct labour hours. (9 marks)

(b) Prepare a sample quotation for Job 976, utilizing information given in the question, your answer to (a) above, and the following additional information:

Estimated direct material cost:	£800
Estimated direct labour hours:	30 in Department P 10 in Department Q 5 in Department R

(3 marks)

(c) Calculate what would have been quoted for Job 976 under the 'auditors' system' and comment on whether your friend's suspicions about lost business could be correct.

(3 marks)

(Total 15 marks)

CIMA

5.7 Overhead analysis and calculation of product costs

A furniture-making business manufactures quality furniture to customers' orders. It has three production departments and two service departments. Budgeted overhead costs for the coming year are as follows:

	Total (£)
Rent and Rates	12 800
Machine insurance	6 000
Telephone charges	3 200
Depreciation	18 000
Production Supervisor's salaries	24 000
Heating & Lighting	6 400
	70 400

The three production departments – A, B and C, and the two service departments – X and Y, are housed in the new premises, the details of which, together with other statistics and information, are given below.

	Departments A	B	C	X	Y
Floor area occupied (sq.metres)	3000	1800	600	600	400
Machine value (£000)	24	10	8	4	2
Direct labour hrs budgeted	3200	1800	1000		
Labour rates per hour	£3.80	£3.50	£3.40	£3.00	£3.00
Allocated Overheads:					
Specific to each department (£000)	2.8	1.7	1.2	0.8	0.6
Service Department X's costs apportioned	50%	25%	25%		
Service Department Y's costs apportioned	20%	30%	50%		

Required:

(a) Prepare a statement showing the overhead cost budgeted for each department, showing the basis of apportionment used. Also calculate suitable overhead absorption rates. (9 marks)

(b) Two pieces of furniture are to be manufactured for customers. Direct costs are as follows:

	Job 123	Job 124
Direct Material	£154	£108
Direct Labour	20 hours Dept A	16 hours Dept A
	12 hours Dept B	10 hours Dept B
	10 hours Dept C	14 hours Dept C

Calculate the total costs of each job.

(5 marks)

(c) If the firm quotes prices to customers that reflect a required profit of 25% on selling price, calculate the quoted selling price for each job. (2 marks)

(Total 16 marks)

AAT

5.8 Overhead analysis sheet and calculation of overhead rates

Dunstan Ltd manufactures tents and sleeping bags in three separate production departments. The principal manufacturing processes consist of cutting material in the pattern cutting room, and sewing the material in either the tent or the sleeping bag departments. For the year to 31 July cost centre expenses and other relevant information are budgeted as follows:

	Total (£)	Cutting room (£)	Tents (£)	Sleeping bags (£)	Raw material stores (£)	Canteen (£)	Maintenance (£)
Indirect wages	147 200	6 400	19 500	20 100	41 200	15 000	45 000
Consumable materials	54 600	5 300	4 100	2 300	–	18 700	24 200
Plant depreciation	84 200	31 200	17 500	24 600	2 500	3 400	5 000
Power	31 700						
Heat and light	13 800						
Rent and rates	14 400						
Building insurance	13 500						
Floor area (sq. ft)	30 000	8 000	10 000	7 000	1 500	2 500	1 000
Estimated power usage (%)	100	17	38	32	3	8	2
Direct labour (hours)	112 000	7 000	48 000	57 000	—	—	—
Machine usage (hours)	87 000	2 000	40 000	45 000	—	—	—
Value of raw material issues (%)	100	62.5	12.5	12.5	—	—	12.5

Requirements:

(a) Prepare in columnar form a statement calculating the overhead absorption rates for each machine hour and each direct labour hour for each of the three production units. You should use bases of apportionment and absorption which you consider most appropriate, and the bases used should be clearly indicated in your statement. (16 marks)

(b) 'The use of pre-determined overhead absorption rates based on budgets is preferable to the use of absorption rates calculated from historical data available after the end of a financial period.'

Discuss this statement insofar as it relates to the financial management of a business. (5 marks)

(Total 21 marks)

ICAEW

5.9 Calculation of overhead absorption rates and under/over-recovery of overheads

BEC Limited operates an absorption costing system. Its budget for the year ended 31 December shows that it expects its production overhead expenditure to be as follows:

	Fixed £	Variable £
Machining department	600 000	480 000
Hand finishing department	360 000	400 000

During the year it expects to make 200 000 units of its product. This is expected to take 80 000 machine hours in the machining department and 120 000 labour hours in the hand finishing department.

The costs and activity are expected to arise evenly throughout the year, and the budget has been used as the basis of calculating the company's absorption rates.

During March the monthly profit statement reported

(i) that the actual hours worked in each department were

Machining	6000 hours
Hand finishing	9600 hours

(ii) that the actual overhead costs incurred were

	Fixed £	Variable £
Machining	48 500	36 000
Hand finishing	33 600	33 500

(iii) that the actual production was 15 000 units.

Required:

(a) Calculate appropriate predetermined absorption rates for the year ended 31 December (4 marks)

(b) (i) Calculate the under/over absorption of overhead for each department of the company for March; (4 marks)

(ii) Comment on the problems of using predetermined absorption rates based on the arbitrary apportionment of overhead costs, with regard to comparisons of actual/target performance; (4 marks)

(c) State the reasons why absorption costing is used by companies. (3 marks)

(Total 15 marks)

CIMA

5.10 Calculation of under/over recovery of overheads

A company produces several products which pass through the two production departments in its factory. These two departments are concerned with filling and sealing operations. There are two service departments, maintenance and canteen, in the factory.

Predetermined overhead absorption rates, based on direct labour hours, are established for the two production departments. The budgeted expenditure for these departments for the period just ended, including the apportionment of service department overheads, was £110 040 for filling, and £53 300 for sealing. Budgeted direct labour hours were 13 100 for filling and 10 250 for sealing.

Service department overheads are apportioned as follows:

Maintenance	– Filling	70%
Maintenance	– Sealing	27%
Maintenance	– Canteen	3%
Canteen	– Filling	60%
	– Sealing	32%
	– Maintenance	8%

During the period just ended, actual overhead costs and activity were as follows:

	(£)	Direct labour hours
Filling	74 260	12 820
Sealing	38 115	10 075
Maintenance	25 050	
Canteen	24 375	

Required:

(a) Calculate the overheads absorbed in the period and the extent of the under/over absorption in each of the two production departments. (14 marks)

(b) State, and critically assess, the objectives of overhead apportionment and absorption. (11 marks)

(Total 25 marks)

ACCA

5.11 Product cost calculation and costs for decision-making

Shown below is next year's budget for an engineering company manufacturing two different products in two production departments, namely a machine shop and an assembly department. A stores department is responsible for storing and issuing materials.

Product	**X**	**Y**
Sales and production volume	4 000 units	5 000 units
Material costs, per unit	£16	£10
Direct labour:	Hours per unit	Hours per unit
Machine shop (£5 per hour)	10	12
Assembly department (£4 per hour)	8	10
Machining:		
Machine shop	8	14
Assembly department	1	—

	Machine shop	**Assembly department**	**Stores**
	£	**£**	**£**
Production overhead:			
Variable	561 000	254 200	—
Fixed	588 000	392 000	42 000
	1 149 000	646 200	42 000
Number of employees	40	60	4
Floor area (M^2)	6 000	6 000	2 000
Material usage	£80 000	£60 000	—

Maximum practical capacity is 140 000 machine hours for the machine shop and additional capacity for the assembly department is easily obtainable. Machine hour capacity cannot be increased over the next year. Fixed overheads are common and unavoidable to all alternatives and will remain

unchanged irrespective of the level of production capacity.

Overheads are charged to production on the basis of budgeted activity, and selling prices are determined on a cost-plus basis by adding 20 per cent to total cost.

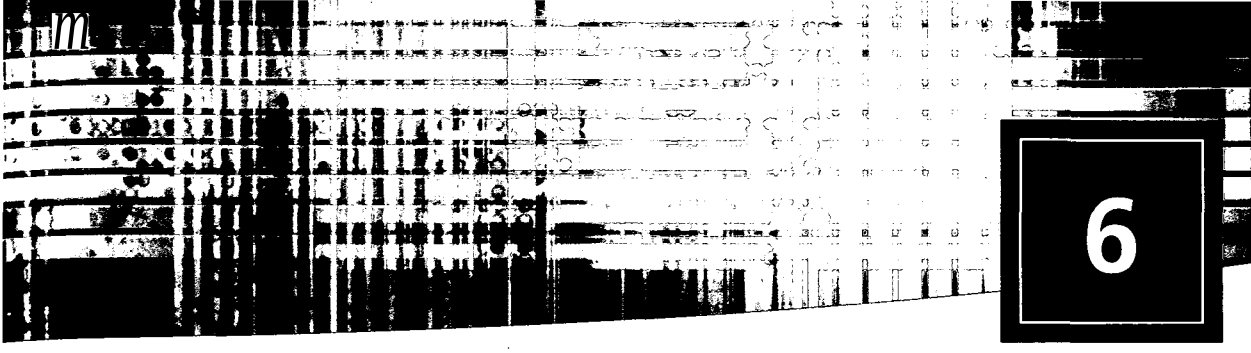
(a) You are required to establish an appropriate overhead absorption rate for each production department and calculate the selling price for each unit using the company's cost-plus pricing method. You must clearly state and briefly justify the methods of overhead absorption used. (9 marks)

(b) In addition to the above data, two special orders have been received, outside the normal run of business, and not provided for in the budget. They are as follows:

(i) an order for 1000 units of product X from Regan plc offering to pay £200 per unit for them;

(ii) a contract to supply 500 units per month of product X from Thatcher plc for 12 months at a price per unit of £220.

You are required to set out the considerations which the management of the engineering company should take into account when deciding whether to accept each of these orders, and advise the company as far as you are able on the basis of the information given. (10 marks)



6

Activity-based costing

In the previous chapter the cost assignment process for a traditional costing system was described. During the 1980s the limitations of traditional product costing systems began to be widely publicized. These systems were designed decades ago when most companies marketed a narrow range of products. Indirect costs were relatively small, and the distortions arising from inappropriate overhead allocations were not significant. Information processing costs were high and it was therefore difficult to justify more sophisticated methods of assigning indirect costs to cost objects.

By the 1980s companies were marketing a wide range of products, indirect costs were no longer relatively unimportant and information costs had ceased to be a barrier to introducing more sophisticated systems. Furthermore, the intense global competition of the 1980s resulted in decision errors from poor cost information becoming more probable and more costly. It is against this background that a new, and more sophisticated costing system, called activity-based costing (ABC) emerged in the late 1980s.

In this chapter we shall focus on ABC systems. In particular, the measurement of indirect costs for decision-making using ABC techniques will be examined. The major aims of the chapter are to explain how an ABC system operates and provide you with a conceptual understanding of ABC. You should also note that ABC can also be used for managing and controlling costs. These aspects are considered in Chapter 15.

Some of the issues explored in the chapter are complex and may not be appropriate for readers pursuing an introductory management accounting course. The sections that relate to the more advanced material are marked with the symbol AR and a vertical red line is used to highlight the section. If you are pursuing an introductory course you may prefer to omit the advanced reading sections, or skim them, on your first reading. You should read them only when you fully understand the remaining content of the chapter.

Unless otherwise stated we shall assume that products are the cost objects but the techniques used and the principles established

Learning objectives

After studying this chapter you should be able to:

- explain the role of a cost accumulation system for generating relevant cost information for decision-making;
- describe the differences between activity-based and traditional costing systems;
- illustrate how traditional costing systems can provide misleading information for decision-making;
- compute product costs using an activity-based costing system;
- explain each of the four stages involved in designing ABC systems;
- describe the ABC cost hierarchy;
- describe the ABC profitability analysis hierarchy;
- describe the ABC resource consumption model.

can be applied to other cost objects such as customers, services and locations. We begin with an examination of the role that a cost accumulation system plays in generating relevant cost information for decision-making.

The role of a cost accumulation system in generating relevant cost information for decision-making

There are three main reasons why a cost accumulation system is required to routinely generate relevant cost information for decision-making. They are:

1. many indirect costs are relevant for decision-making;
2. an attention-directing information system is required to identify those potentially unprofitable products that require more detailed special studies;
3. product decisions are not independent.

There is a danger that only those incremental costs that are uniquely attributable to individual products will be classified as relevant for decision-making. Direct costs are transparent and how they will be affected by decisions is clearly observable. In contrast, how indirect costs will be affected by decisions is not clearly observable. There has been a tendency in the past to assume that these costs are fixed and irrelevant for decision-making. In many organizations, however, these are costs that have escalated over the years. The message is clear – they cannot be assumed to be fixed and irrelevant for decision-making.

The costs of many joint resources fluctuate in the long term according to the demand for them. The cost of support functions fall within this category. They include activities such as materials procurement, materials handling, production scheduling, warehousing, expediting and customer order processing. The costs of these activities are either not directly traceable to products, or would involve such detailed tracing, the costs of doing so would far exceed their benefits. Product introduction, discontinuation, redesign and mix decisions determine the demand for support function resources. For example, if a decision results in a 10% reduction in the demand for the resources of a support activity then we would expect, in the long term, for some of the costs of that support activity to decline by 10%. Therefore, to estimate the impact that decisions will have on the support activities (and their future costs) a cost accumulation system is required that assigns indirect costs, using cause-and-effect allocations, to products.

For decision-making it could be argued that relevant costs need only be ascertained when the need arises. For example, why not undertake special studies at periodic intervals to make sure that each product is still profitable? Estimates could be made only when undertaking a special study of those relevant costs that would be avoided if a product was discontinued. This approach is fine for highly simplified situations where an organization only produces a few products and where all relevant costs are uniquely attributable to individual products. However, most organizations produce hundreds of products and the

range of potential decisions to explore undertaking special studies is enormous and unmanageable. For example, Kaplan (1990) considers a situation where a company has 100 products and outlines the difficulties of determining which product, or product combinations, should be selected for undertaking special studies. Kaplan states:

> First how do you think about which product you should even think about making a decision on? There are 100 different products to consider. But think about all the combinations of these products: which two products, three products or groupings of 10 or 20 products should be analyzed? It's a simple exercise to calculate that there are 2^{100} different combinations of the 100 products ... so there is no way to do an incremental revenue/incremental analysis on all relevant combinations (p. 13).

To cope with the vast number of potential product combinations organizations need attention-directing information to highlight those specific products, or combination of products, that appear to be questionable and which require further detailed special studies to ascertain their viability. Periodic product profitability analysis meets this requirement. A cost accumulation system is therefore required to assign costs to products for periodic profitability analysis.

The third reason for using a cost accumulation system is that many product related decisions are not independent. Consider again those joint resources shared by most products and that fluctuate in the longer term according to the demand for them. If we focus only on individual products and assume that they are independent, decisions will be taken in isolation of decisions made on other products. For joint resources the incremental/avoidable costs relating to a decision to add or drop a single product may be zero. Assuming that 20 products are viewed in this manner then the sum of the incremental costs will be zero. However, if the 20 products are viewed as a whole there may be a significant change in resource usage and incremental costs for those joint resources that fluctuate according to the demand for them.

Cooper (1990b) also argues that decisions should not be viewed independently. He states:

> The decision to drop one product will typically not change 'fixed' overhead spending. In contrast, dropping 50 products might allow considerable changes to be made. Stated somewhat tritely, the sum of the parts (the decision to drop individual products) is not equal to the sum of the whole (the realisable savings from having dropped 50 products). To help them make effective decisions, managers require cost systems that provide insights into the whole, not just isolated individual parts (p. 58).

Thus, where product decisions are not independent the multiplication of product costs, that include the cost of joint resources, by the units lost from ceasing production (or additional units from introducing a new product) may provide an approximation of the change in the long term of total company costs arising from the decisions. The rationale for this is that the change in resource consumption will ultimately be followed by a change in the cash flow pattern of the organization because organizations make product introduction or abandonment decisions for many products rather than just a single product. These issues are complex and will be explained in more detail later in the chapter.

Types of cost systems

Costing systems can vary in terms of which costs are assigned to cost objects and their level of sophistication. Typically cost systems are classified as follows:

1. direct costing systems;
2. traditional absorption costing systems;
3. activity-based costing systems.

Direct costing systems only assign direct costs to cost objects. Hence they report contributions to indirect costs. They are appropriate for decision-making where the cost of those joint resources that fluctuate according to the demand for them are insignificant. Negative or low contribution items should then be highlighted for special studies. An estimate of those indirect costs that are relevant to the decision should be incorporated within the analysis at the special study stage. The disadvantage of direct costing systems is that systems are not in place to measure and assign indirect costs to cost objects. Thus any attempt to incorporate indirect costs into the analysis at the special studies stage must be based on guesswork and arbitrary estimates. Direct costing systems can therefore only be recommended where indirect costs are a low proportion of an organization's total costs.

Both traditional and ABC systems assign indirect costs to cost objects. The major features of traditional systems were described in the previous chapter. In this chapter we shall concentrate on ABC.

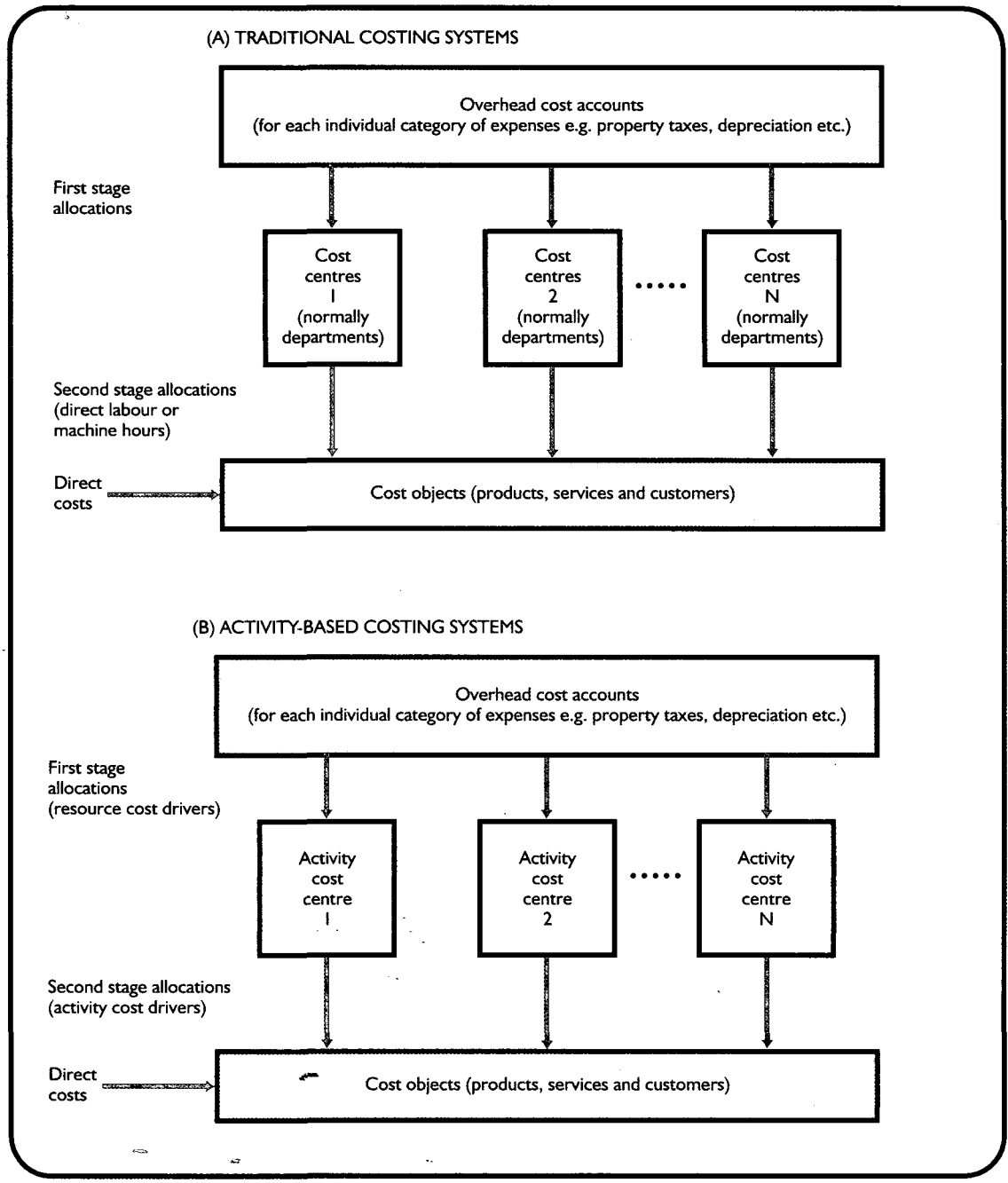
A comparison of traditional and ABC systems

Figure 6.1 illustrates the major differences between traditional costing and ABC systems. The upper panel of this diagram is identical to Figure 5.3 that was used in the previous chapter to describe a traditional costing system. It is apparent from Figure 6.1 that both systems involve the two-stage allocation process. In the first stage a traditional system allocates overheads to production and service departments and then reallocates service department costs to the production departments. An ABC system assigns overheads to each major activity (rather than departments). With ABC systems, many activity-based cost centres (alternatively known as activity cost pools) are established, whereas with traditional systems overheads tend to be pooled by departments, although they are normally described as cost centres.

Activities consist of the aggregation of many different tasks and are described by verbs associated with objects. Typical support activities include: schedule production, set-up machines, move materials, purchase materials, inspect items, process supplier records, expedite and process customer orders. Production process activities include machine products and assemble products. Within the production process, activity cost centres are often identical to the cost centres used by traditional cost systems. Support activities are also sometimes identical to cost centres used by traditional systems, such as when the purchasing department and activity are both treated as cost centres. Overall, however, ABC systems will normally have a greater number of cost centres.

The second stage of the two-stage allocation process allocates costs from cost centres (pools) to products or other chosen cost objects. Traditional costing systems trace overheads to products using a small number of second stage allocation bases, which vary directly with the volume produced. Instead of using the terms 'allocation bases' or 'overhead allocation rates' ABC systems use the term 'cost driver'. Direct labour hours and machine hours are the allocation bases that are normally used by traditional costing systems. In contrast, ABC systems use many different second-stage cost drivers, including non-volume-based drivers, such as the number of production runs for production scheduling and the number of purchase orders for the purchasing activity. A further

FIGURE 6.1 *An illustration of the two-stage allocation process for traditional and activity-based costing systems.*



distinguishing feature is that traditional systems normally allocate service/support costs to production centres. Their costs are merged with the production cost centre costs and thus included within the production centre overhead rates. In contrast, ABC systems tend to establish separate cost driver rates for support centres, and assign the cost of support activities directly to cost objects without any reallocation to production centres.

Therefore the major distinguishing features of ABC systems are that within the two-stage allocation process they rely:

(i) On a greater number of cost centres

(ii) On a greater number and variety of second stage cost drivers

By using a greater number of cost centres and cost drivers that cause activity resource consumption, and assigning activity costs to cost objects on the basis of cost driver usage, ABC systems can more accurately measure the resources consumed by cost objects. Traditional cost systems report less accurate costs because they use cost drivers where no cause-and-effect relationships exist to assign support costs to cost objects.

The emergence of ABC systems

During the 1980s the limitations of traditional product costing systems began to be widely publicized. These systems were designed decades ago when most companies manufactured a narrow range of products, and direct labour and materials were the dominant factory costs. Overhead costs were relatively small, and the distortions arising from inappropriate overhead allocations were not significant. Information processing costs were high, and it was therefore difficult to justify more sophisticated overhead allocation methods.

Today companies produce a wide range of products; direct labour represents only a small fraction of total costs, and overhead costs are of considerable importance. Simplistic overhead allocations using a declining direct labour base cannot be justified, particularly when information processing costs are no longer a barrier to introducing more sophisticated cost systems. Furthermore, the intense global competition of the 1980s has made decision errors due to poor cost information more probable and more costly. Over the years the increased opportunity cost of having poor cost information, and the decreased cost of operating more sophisticated cost systems, increased the demand for more accurate product costs (Holzer and Norreklit, 1991). It is against this background that ABC has emerged.

Decreasing information processing costs resulted in a few firms in the USA and Europe implementing ABC type systems during the 1980s. In a series of articles based on observations of innovative ABC type systems Cooper and Kaplan conceptualized the ideas underpinning these systems and coined the term ABC. These articles were first published in 1988. They generated a considerable amount of publicity and consultants began to market and implement ABC systems before the end of the decade. In a survey of UK companies Innes and Mitchell (1991) reported that approximately 10% of the surveyed companies had implemented, or were in the process of implementing ABC. Based on their experience of working with early US adopters, Cooper and Kaplan articulated their ideas and reported further theoretical advances in articles published between 1990 and 1992. These ideas and the theoretical advances are described in the remainder of this chapter. ABC ideas have now become firmly embedded in the management accounting literature

and educational courses and many practitioners have attended courses and conferences on the topic.

Volume-based and non-volume-based cost drivers

Our comparison of ABC systems with traditional costing systems indicated that ABC systems rely on a greater number and variety of second stage cost drivers. The term 'variety of cost drivers' refers to the fact that ABC systems use both volume-based and non-volume-based cost drivers. In contrast, traditional systems use only volume-based cost drivers. **Volume-based cost drivers** assume that a product's consumption of overhead resources is directly related to units produced. In other words, they assume that the overhead consumed by products is highly correlated with the number of units produced. Typical volume-based cost drivers used by traditional systems are units of output, direct labour hours and machine hours. These cost drivers are appropriate for measuring the consumption of expenses such as machine energy costs, depreciation related to machine usage, indirect labour employed in production centres and inspection costs where each item produced is subject to final inspection. For example, machine hours are an appropriate cost driver for energy costs since if volume is increased by 10%, machine hours are likely to increase by 10%, thus causing 10% more energy costs to be consumed. Similarly, an increase in volume of 10% is likely to increase the consumption of direct labour hours by 10% and, assuming that indirect labour hours are correlated with direct labour hours, 10% more indirect labour costs will be consumed.

Volume-based drivers are appropriate in the above circumstances because activities are performed each time a unit of the product or service is produced. In contrast, non-volume related activities are not performed each time a unit of the product or service is produced. Consider, for example, two activities – setting up a machine and re-engineering products. Set-up resources are consumed each time a machine is changed from one product to another. It costs the same to set up a machine for 10 or 5000 items. As more set-ups are done more set-up resources are consumed. The number of set-ups, rather than the number of units produced, is a more appropriate measure of the consumption of the set-up activity. Similarly, product re-engineering costs may depend upon the number of different engineering works orders and not the number of units produced. For both of these activities, **non-volume-based cost drivers** such as number of set-ups and engineering orders are needed for the accurate assignment of the costs of these activities.

Using only volume-based cost drivers to assign non-volume related overhead costs can result in the reporting of distorted product costs. The extent of distortion depends on what proportion of total overhead costs the non-volume based overheads represent and the level of product diversity. If a large proportion of an organization's costs are unrelated to volume there is a danger that inaccurate product costs will be reported. Conversely, if non-volume-related overhead costs are only a small proportion of total overhead costs, the distortion of product costs will not be significant. In these circumstances traditional product costing systems are likely to be acceptable.

Product diversity applies when products consume different overhead activities in dissimilar proportions. Differences in product size, product complexity, sizes of batches and set-up times cause product diversity. If all products consume overhead resources in similar proportions product diversity will be low and products will consume non-volume-related activities in the same proportion as volume-related activities. Hence, product cost distortion will not occur with traditional product costing systems. Two conditions are therefore necessary for product cost distortion – non-volume-related overhead costs are a large proportion of total overhead costs and product diversity applies. Where these two conditions exist traditional product costing systems can result in the overcosting of high

EXAMPLE 6.1

Assume that the Balearic company has only one overhead cost centre or cost pool. It currently operates a traditional costing system using direct labour hours to allocate overheads to products. The company produces several products, two of which are products HV and LV. Product HV is made in high volumes whereas product LV is made in low volumes. Product HV consumes 30% of the direct labour hours and product LV consumes only 5%. Because of the high volume production product HV can be made in large production batches but the irregular and low level of demand for product LV requires it to be made in small batches. A detailed investigation indicates that the number of batches processed causes the demand for overhead resources. The traditional system is therefore replaced with an ABC system using the number of batches processed as the cost driver. You ascertain that each product accounts for 15% of the batches processed during the period and the overheads assigned to the cost centre that fluctuate in the long term according to the demand for them amount to £1 million. The direct costs and sales revenues assigned to the products are as follows:

	Product HV (£)	**Product LV (£)**
Direct costs	310 000	40 000
Sales revenues	600 000	150 000

Show the product profitability analysis for products HV and LV using the traditional and ABC systems.

volume products and undercosting of low volume products. Consider the information presented in Example 6.1.

The reported product costs and profits for the two products are as follows:

	Traditional system		**ABC system**	
	Product HV (£)	**Product LV (£)**	**Product HV (£)**	**Product LV (£)**
Direct costs	310 000	40 000	310 000	40 000
Overheads allocated[a]	300 000 (30%)	50 000 (5%)	150 000 (15%)	150 000 (15%)
Reported profits/(losses)	(10 000)	60 000	140 000	(40 000)
Sales revenues	600 000	150 000	600 000	150 000

Note

[a]Allocation of £1 million overheads using direct labour hours and a number of batches processed as the cost driver

Because product HV is a high volume product that consumes 30% of the direct labour hours whereas product LV, the low volume product consumes only 5%, the traditional system that uses direct labour hours as the allocation base allocates six times more overheads to product HV. However, ABC systems recognize that overheads are caused by other factors, besides volume. In our example, all of the overheads are assumed to be volume unrelated. They are caused by the number of batches processed and the ABC system establishes a cause-and-effect allocation relationship by using the number of batches processed as the cost driver. Both products require 15% of the total number of batches so they are allocated with an equal amount of overheads.

It is apparent from the consumption ratios of the two products that the traditional system based on direct labour hours will overcost high volume products. Consumption ratios represent the proportion of each activity consumed by a product. The consumption ratios if direct labour hours are used as the cost driver are 0.30 for product HV and 0.05 for product LV so that six times more overheads will be assigned to product HV. When the number of batches processed are used as the cost driver the consumption ratios are 0.15 for each product and an equal amount of overhead will be assigned to each product. Distorted product costs are reported with the traditional costing system that uses the volume-based cost driver because the two conditions specified above apply. First, non-volume-related overheads are a large proportion of total overheads, being 100% in our example. Second, product diversity exists because the product consumption ratios for the two identified cost drivers are significantly different. Our illustration shows that if the consumption ratios for batches processed had been the same as the ratios for direct labour the traditional and ABC systems would report identical product costs.

With the traditional costing system misleading information is reported. A small loss is reported for product HV and if it were discontinued the costing system mistakenly gives the impression that overheads will decline in the longer term by £300 000. Furthermore, the message from the costing system is to concentrate on the more profitable speciality products like product LV. In reality this strategy would be disastrous because low volume products like product LV are made in small batches and require more people for scheduling production, performing set-ups, inspection of the batches and handling a large number of customer requests for small orders. The long-term effect would be escalating overhead costs.

In contrast, the ABC system allocates overheads on a cause-and-effect basis and more accurately measures the relatively high level of overhead resources consumed by product LV. The message from the profitability analysis is the opposite from the traditional system; that is, product HV is profitable and product LV is unprofitable. If product LV is discontinued, and assuming that the cost driver is the cause of all the overheads then a decision to discontinue product LV should result in the reduction in resource spending on overheads by £150 000.

Example 6.1 is very simplistic. It is assumed that the organization has established only a single cost centre or cost pool, when in reality many will be established with a traditional system, and even more with an ABC system. Furthermore, the data have been deliberately biased to show the superiority of ABC. The aim of the illustration has been to highlight the potential cost of errors that can occur when information extracted from simplistic and inaccurate cost systems is used for decision-making.

An illustration of the two-stage process for an ABC system

We shall now use the data presented in Example 5.1 (the Enterprise Company) from the previous chapter to illustrate ABC in more detail. This example was used to provide the relevant information to compute the product costs shown in Exhibit 5.2 for a traditional costing system. To refresh your memory you should now refer back to Example 5.1 and Exhibit 5.2 in the previous chapter and also read pages 134–5 relating to step 4 of the two-stage process.

With the ABC system it is assumed that the activity cost centres for machining and assembling products are identical to the production cost centres used by the traditional costing system. We shall also assume that three activity cost centres have been established for each of the support functions. They are purchasing components, receiving components

and disbursing materials for the materials procurement function and production scheduling, setting-up machines and quality inspection of the completed products for the general factory support function. Exhibit 6.1 provides the additional information required for an ABC system and also shows the activity-based product cost calculations.

If you refer to column 2 in the upper section of Exhibit 6.1 you will see that the costs assigned to the production activities have been extracted from row 1 in the overhead analysis sheet shown in Exhibit 5.2, that was used for the traditional costing system. In the overhead analysis sheet we only assigned support costs with the traditional costing system to the materials procurement and the general factory support functions, and not to the activities within these support functions. However, the costs for the activities within these functions would be derived adopting the same approach as that used in Exhibit 5.2, but to simplify the presentation the cost assignments to the individual activity cost centres within the material procurement and general factory support functions are not shown.

Note that from the second column in the upper section of Exhibit 6.1 that the costs assigned to the purchasing, receiving and disbursement of materials activities total £1 760 000, the same as the total allocated to the materials procurement function by the traditional system. Similarly, the total costs assigned to the production scheduling, set-up and quality inspection activities total £1 800 000, the same as the total costs allocated to the general factory support function.

Now look at columns 1 and 3 in the upper section of Exhibit 6.1. You will see that with the ABC system the Enterprise Company has established nine activity cost centres and seven different second-stage cost drivers. Note also that the cost drivers for the production activities are volume-based and are the same as those used for the traditional costing system. Based on their observations of ABC systems Kaplan and Cooper (1998) suggest that relatively simple ABC systems having 30–50 activity cost centres and many cost drivers ought to report reasonably accurate costs.

Cost drivers should be significant determinants of the cost of activities. For example, if the cost of processing purchase orders is determined by the number of purchase orders that each product generates, then the number of purchase orders would represent the cost driver for the cost of processing purchase orders. Other cost drivers used by the Enterprise Company are shown in column 3 of the upper section of Exhibit 6.1. They are the number of receipts for receiving components, number of production runs for disbursing materials and scheduling production, number of set-up hours for setting up the machines and the number of first item inspections for quality inspection of a batch of completed products. You will see from column 5 in the first section of Exhibit 6.1 that cost driver rates are computed by dividing the activity centre cost by the quantity of the cost driver used.

Activity centre costs are assigned to products by multiplying the cost driver rate by the quantity of the cost driver used by products. These calculations are shown in the second section of Exhibit 6.1. You will see from the first section in Exhibit 6.1 that the costs assigned to the purchasing activity are £960 000 for processing 10 000 purchasing orders resulting in a cost driver rate of £96 per purchasing order. The second section shows that a batch of 100 units of product A, and 200 units of product B, each require one component and thus one purchase order. Therefore purchase order costs of £96 are allocated to each batch. The same approach is used to allocate the costs of the remaining activities shown in Exhibit 6.1. You should now work through Exhibit 6.1 and study the product cost calculations.

The costs assigned to products using each costing system are as follows:

	Traditional costing system £	**ABC system** £
Product A	166.75	205.88
Product B	333.50	301.03

EXHIBIT 6.1

An illustration of cost assignment with an ABC system

Compared with the ABC system the traditional system undercosts product A and overcosts product B. By reallocating the service centre costs to the production centres and allocating the costs to products on the basis of either machine hours or direct labour hours the traditional system incorrectly assumes that these volume-based allocation bases are the cause of the costs of the support activities. Compared with product A,

(1) Activity	(2) Activity cost cost £	(3) Activity cost driver	(4) Quantity of activity cost driver	(5) Activity cost driver rate (Col.2 / Col.4)
Production activities:				
Machining: activity centre A	2 970 000	Number of machine hours	2 000 000 machine hours	£1.485 per hour
Machining: activity centre B	2 690 000	Number of machine hours	1 000 000 machine hours	£2.69 per hour
Assembly	2 480 000	Number of direct labour hours	2 000 000 direct lab. hours	£1.24 per hour
	8 140 000			
Materials procurement activities:				
Purchasing components	960 000	Number of purchase orders	10 000 purchase orders	£96 per order
Receiving components	600 000	Number of material receipts	5 000 receipts	£120 per receipt
Disburse materials	200 000	Number of production runs	2 000 production runs	£100 per production run
	1 760 000			
General factory support activities:				
Production scheduling	1 000 000	Number of production runs	2 000 production runs	£500 per production run
Set-up machines	600 000	Number of set-up hours	12 000 set-up hours	£50 per set-up hour
Quality inspection	200 000	Number of first item inspections	1 000 inspections	£200 per inspection
	1 800 000			
Total cost of all manufacturing activities	11 700 000			

Computation of product costs

(1) Activity	(2) Activity cost driver rate	(3) Quantity of cost driver used by 100 units of product A	(4) Quantity of cost driver used by 200 units of product B	(5) Activity cost assigned to product A (Col. 2 × Col.3)	(6) Activity cost assigned to product B (Col. 2 × Col.4)
Machining: activity centre A	£1.485 per hour	500 hours	2 000 hours	742.50	2 970.00
Machining: activity centre B	£2.69 per hour	1 000 hours	4 000 hours	2 690.00	10 760.00
Assembly	£1.24 per hour	1 000 hours	4 000 hours	1 240.00	4 960.00
Purchasing components	£96 per order	1 component	1 component	96.00	96.00
Receiving components	£120 per receipt	1 component	1 component	120.00	120.00
Disburse materials	£100 per production run	5 production runs[a]	1 production run	500.00	100.00
Production scheduling	£500 per production run	5 production runs[a]	1 production run	2 500.00	500.00
Set-up machines	£50 per set-up hour	50 set-up hours	10 set-up hours	2 500.00	500.00
Quality inspection	£200 per inspection	1 inspection	1 inspection	200.00	200.00
Total overhead cost				10 588.50	20 206.00
Units produced				100 units	200 units
Overhead cost *per unit*				£105.88	£101.03
Direct costs *per unit*				100.00	200.00
Total cost *per unit* of output				205.88	301.03

Note

[a]Five production runs are required to machine several unique components before they can be assembled into a final product.

product B consumes twice as many machine and direct labour hours. Therefore, relative to Product A, the traditional costing system allocates twice the amount of support costs to product B.

In contrast, ABC systems create separate cost centres for each major support activity and allocate costs to products using cost drivers that are the significant determinants of the

cost of the activities. The ABC system recognizes that a batch of both products consume the same quantity of purchasing, receiving and inspection activities and, for these activities, allocates the same costs to both products. Because product B is manufactured in batches of 200 units, and product A in batches of 100 units, the cost per unit of output for product B is half the amount of Product A for these activities. Product A also has five unique components, whereas product B has only one, resulting in a batch of Product A requiring five production runs whereas a batch of Product B only requires one. Therefore, relative to product B, the ABC system assigns five times more costs to product A for the production scheduling and disbursement of materials activities (see columns 5 and 6 in the lower part of Exhibit 6.1). Because product A is a more complex product it requires relatively more support activity resources and the cost of this complexity is captured by the ABC system.

Designing ABC systems

The discussion so far has provided a broad overview of ABC. We shall now examine ABC in more detail by looking at the design of ABC systems. Four steps are involved. They are:

1. identifying the major activities that take place in an organization;
2. assigning costs to cost pools/cost centres for each activity;
3. determining the cost driver for each major activity;
4. assigning the cost of activities to products according to the product's demand for activities.

The first two steps relate to the first stage, and the final two steps to the second stage, of the two-stage allocation process shown in Figure 6.1. Let us now consider each of these stages in more detail.

STEP 1: IDENTIFYING ACTIVITIES

Activities are composed of the aggregation of units of work or tasks and are described by verbs associated with tasks. For example, purchasing of materials might be identified as a separate activity. This activity consists of the aggregation of many different tasks, such as receiving a purchase request, identifying suppliers, preparing purchase orders, mailing purchase orders and performing follow-ups.

Activities are identified by carrying out an activity analysis. Innes and Mitchell (1995b) suggest that a useful starting point is to examine a physical plan of the workplace (to identify how all work space is being used) and the payroll listings (to ensure all relevant personnel have been taken into account). This examination normally has to be supplemented by a series of interviews with the staff involved, or having staff complete a time sheet for a specific time period explaining how their time is spent. Interviewers will ask managers and employees questions such as what staff work at the location and what tasks are performed by the persons employed at the location.

Many detailed tasks are likely to be identified in the first instance, but after further interviews, the main activities will emerge. The activities chosen should be at a reasonable level of aggregation based on costs versus benefits criteria. For example, rather than classifying purchasing of materials as an activity, each of its constituent tasks could be classified as separate activities. However, this level of decomposition would involve the collection of a vast amount of data and is likely to be too costly for product costing

purposes. Alternatively, the purchasing activity might be merged with the materials receiving, storage and issuing activities to form a single materials procurement and handling activity. This is likely to represent too high a level of aggregation because a single cost driver is unlikely to provide a satisfactory determinant of the cost of the activity. For example, selecting the number of purchase orders as a cost driver may provide a good explanation of purchasing costs but may be entirely inappropriate for explaining costs relating to receiving and issuing. Therefore, instead of establishing materials procurement and handling as a single activity it may be preferable to decompose it into three separate activities; namely purchasing, receiving and issuing activities, and establish separate cost drivers for each activity.

In some of the early ABC systems hundreds of separate activity cost centres were established but recent studies suggest that between twenty and thirty activity centres tend to be the norm. The final choice of activities must be a matter of judgement but it is likely to be influenced by factors such as the total cost of the activity centre (it must be of significance to justify separate treatment) and the ability of a single driver to provide a satisfactory determinant of the cost of the activity. Activities with the same product consumption ratios can use the same driver to assign costs to products. Thus, all activities that have the same cost driver can be merged to form a single activity cost centre. However, if there are significant differences in activity product consumption ratios products will consume activities in dissimilar proportions and the activities should not be aggregated.

STEP 2: ASSIGNING COSTS TO ACTIVITY COST CENTRES

After the activities have been identified the cost of resources consumed over a specified period must be assigned to each activity. The aim is to determine how much the organization is spending on each of its activities. Many of the resources will be directly attributable to specific activity centres but others (such as labour and lighting and heating costs) may be indirect and jointly shared by several activities. These costs should be assigned to activities on the basis of cause-and-effect cost drivers, or interviews with staff who can provide reasonable estimates of the resources consumed by different activities. Arbitrary allocations should not be used. The greater the amount of costs traced to activity centres by cost apportionments at this stage the more arbitrary and less reliable will be the product cost information generated by ABC systems. Cause-and-effect cost drivers used at this stage to allocate shared resources to individual activities are called **resource cost drivers**.

STEP 3: SELECTING APPROPRIATE COST DRIVERS FOR ASSIGNING THE COST OF ACTIVITIES TO COST OBJECTS

In order to assign the costs attached to each activity cost centre to products a cost driver must be selected for each activity centre. Cost drivers used at this stage are called **activity cost drivers**. Several factors must be borne in mind when selecting a suitable cost driver. First, it should provide a good explanation of costs in each activity cost pool. Second, a cost driver should be easily measurable, the data should be relatively easy to obtain and be identifiable with products. The costs of measurement should therefore be taken into account.

Activity cost drivers consist of transaction and duration drivers. **Transaction drivers**, such as the number of purchase orders processed, number of customer orders processed, number of inspections performed and the number of set-ups undertaken, all count the number of times an activity is performed. Transaction drivers are the least expensive type

of cost driver but they are also likely to be the least accurate because they assume that the same quantity of resources is required every time an activity is performed. However, if the variation in the amount of resources required by individual cost objects is not great transaction drivers will provide a reasonably accurate measurement of activity resources consumed. If this condition does not apply then duration cost drivers should be used.

Duration drivers represent the amount of time required to perform an activity. Examples of duration drivers include set-up hours and inspection hours. For example, if one product requires a short set-up time and another requires a long time then using set-up hours as the cost driver will more accurately measure activity resource consumption than the transaction driver (number of set-ups) which assumes that an equal amount of activity resources are consumed by both products. Using the number of set-ups will result in the product that requires a long set-up time being undercosted whereas the product that requires a short set-up will be overcosted. This problem can be overcome by using set-up hours as the cost driver, but this will increase the measurement costs.

In most situations data will not initially be available relating to the past costs of activities or potential cost driver volumes. To ascertain potential cost drivers interviews will be required with the personnel involved with the specific activities. The interviews will seek to ascertain what causes the particular activity to consume resources and incur costs. The final choice of a cost driver is likely to be based on managerial judgement after taking into account the factors outlined above.

STEP 4: ASSIGNING THE COST OF THE ACTIVITIES TO PRODUCTS

The final stage involves applying the cost driver rates to products. Therefore the cost driver must be measurable in a way that enables it to be identified with individual products. Thus, if set-up hours are selected as a cost driver, there must be a mechanism for measuring the set-up hours consumed by each product. Alternatively, if the number of set-ups is selected as the cost driver measurements by products are not required since all products that require a set-up are charged with a constant set-up cost. The ease and cost of obtaining data on cost driver consumption by products is therefore a factor that must be considered during the third stage when an appropriate cost driver is being selected.

Activity hierarchies

Early ABC systems were subject to a number of criticisms, particularly relating to theoretical aspects. As a response to these criticisms a number of theoretical developments emerged during the 1990s.

The first theoretical development was reported by Cooper (1990a) who classified manufacturing activities along a cost hierarchy dimension consisting of:

1. unit-level activities;
2. batch-level activities;
3. product-sustaining activities;
4. facility-sustaining activities.

Cooper uses the term **unit-level activities** to describe volume-related activities. They are performed each time a unit of the product or service is produced. Expenses in this category include direct labour, direct materials, energy costs and expenses that are consumed in proportion to machine processing time (such as maintenance). Unit-level activities consume resources in proportion to the number of units of production and sales volume. For example, if a firm produces 10% more units it will consume 10% more labour cost, 10 % more machine hours and 10% more energy costs. Typical cost drivers for unit level activities are volume-related drivers, such as labour hours, machine hours and the quantity of materials processed. These cost drivers are also used by traditional costing systems. Traditional systems are therefore also appropriate for assigning the costs of unit-level activities to cost objects.

Batch-related activities, such as setting up a machine or processing a purchase order, are performed each time a batch of goods is produced. The cost of batch-related activities varies with the number of batches made, but is common (or fixed) for all units within the batch. For example, set-up resources are consumed when a machine is changed from one product to another. As more batches are produced, more set-up resources are consumed. It costs the same to set-up a machine for 10 or 5000 items. Thus the demands for the set-up resources are independent of the number of units produced after completing the set-up. Similarly, purchasing resources are consumed each time a purchasing order is processed, but the resources consumed are independent of the number of units included in the purchase order. Other examples of batch-related costs include resources devoted to production scheduling, first-item inspection and materials movement. Traditional costing systems treat batch-related expenses as fixed costs. Whereas ABC systems assume that they vary with the number of batches processed.

Product-sustaining activities or **service-sustaining activities** are performed to enable the production and sale of individual products (or services). Examples of product-sustaining activities provided by Kaplan and Cooper (1998) include maintaining and updating product specifications and the technical support provided for individual products and services. Other examples are the resources to prepare and implement engineering change notices (ECNs), to design processes and test routines for individual products, and to perform product enhancements. The costs of product-sustaining activities are incurred irrespective of the number of units of output or the number of batches processed and their expenses will tend to increase as the number of products manufactured is increased. ABC uses product-level bases such as number of active part numbers and number of ECNs to assign these costs to products. Kaplan and Cooper (1998) have extended their ideas to situations where customers are the cost objects with the equivalent term for product-sustaining being **customer-sustaining activities**. Customer market research and support for an individual customer, or groups of customers if they represent the cost object, are examples of customer-sustaining activities.

The final activity category is **facility-sustaining** (or **business-sustaining**) **activities**. They are performed to support the facility's general manufacturing process and include general administrative staff, plant management and property costs. They are incurred to support the organization as a whole and are common and joint to all products manufactured in the plant. There would have to be a dramatic change in activity, resulting in an expansion or contraction in the size of the plant, for facility-sustaining costs to change. Such events are most unlikely in most organizations. Therefore the ABC literature advocates that these costs should not be assigned to products since they are unavoidable and irrelevant for most decisions. Instead, they are regarded as common costs to *all* products made in the plant and deducted as a lump sum from the total of the operating margins from *all* products.

Activity-based costing profitability analysis

The second theoretical development was first highlighted by Kaplan (1990) and Cooper and Kaplan (1991). They apply the ABC hierarchical activity classification to profitability analysis. In addition, they stress that the reported ABC product costs do not provide information that can be used directly for decision-making. Instead, they report attention-directing information by highlighting those potentially unprofitable products or services that require more detailed special studies. Cooper (1997) has stressed that a major role of ABC is to develop profitability maps (i.e. periodic profitability analysis by cost objects) that are used to focus managerial attention. He argues that because the cost of special studies are high the number performed has to be carefully controlled; hence the need for good attention-directing information. He concludes that the primary value of ABC systems lies in the quality of the profitability analysis generated.

Kaplan and Cooper (1998) extended cost hierarchies to develop activity-profitability maps by different cost objects. The general principles of activity profitability maps (or profitability analysis) for different cost objects is illustrated in Figure 6.2. This approach categorizes costs according to the causes of their variability at different hierarchical levels. Hierarchies identify the lowest level to which cost can meaningfully be assigned without relying on arbitrary allocations. In Figure 6.2 the lowest hierarchical levels (shown at the top of the diagram) are product, customer and facility contributions and, ignoring the business unit level the highest levels (shown at the bottom of the diagram) are product lines, distribution channels and country profits.

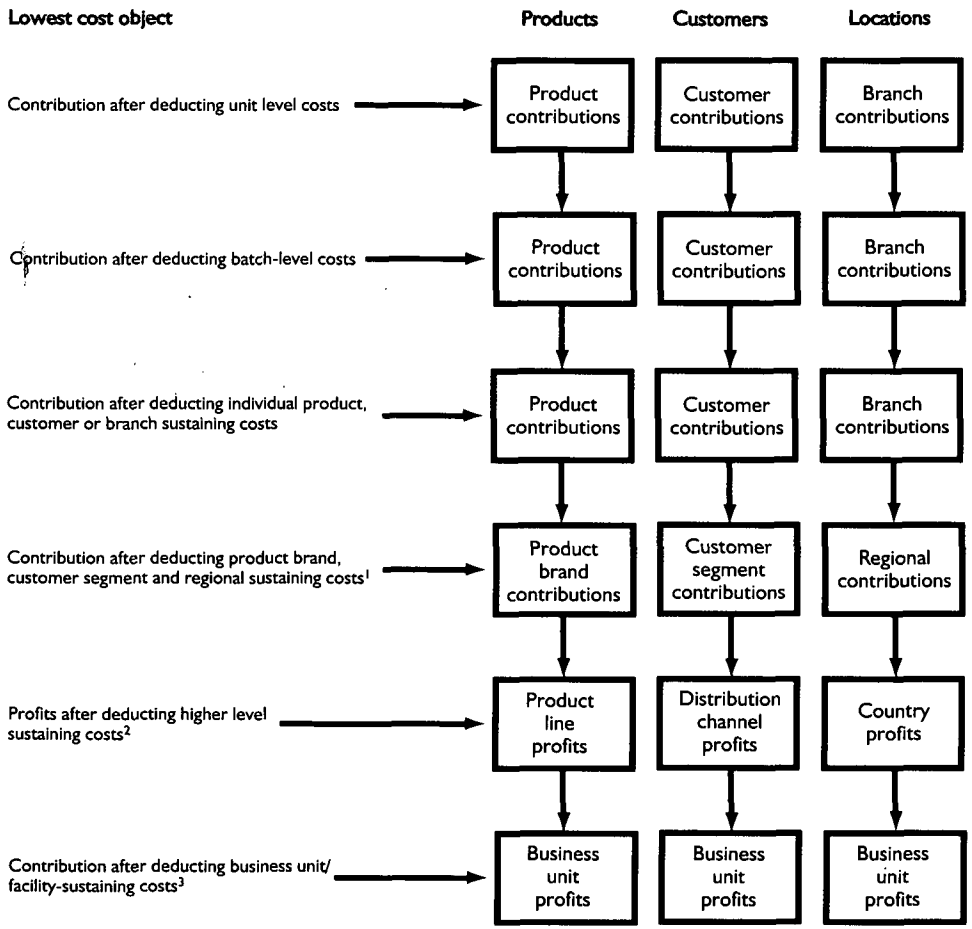
Let us initially focus on *products as the cost object*. Look at the column for products as the cost object in Figure 6.2. You will see that a unit-level contribution margin is calculated for each *individual* product. This is derived by deducting the cost of unit-level activities from sales revenues. From this unit-level contribution expenses relating to batch-related activities are deducted. Next the cost of product-sustaining activities are deducted. Thus, three different contribution levels are reported at the *individual* product level. Differentiating contributions at these levels provides a better understanding of the implications of product-mix and discontinuation decisions in terms of cost and profit behaviour.

In Figure 6.2 there are two further levels within the product hierarchy. They are the product brand level and the product line level. Some organizations do not market their products by brands and therefore have only one further level within the product hierarchy. A product line consists of a group of similar products. For example, banks have product lines such as savings accounts, lending services, currency services, insurance services and brokering services. Each product line contains individual product variants. The savings product line would include low balance/low interest savings accounts, high balance/high interest accounts, postal savings accounts and other product variants. The lending services product line would include personal loans, house mortgage loans, business loans and other product variants within the product line.

Some organizations market groupings of products within their product lines as separate brands. A typical example of the difference between product brands and product lines is Procter and Gamble who market some of their products within their detergent product line under the Tide label and others without this label.

Where products are marketed by brands, all expenditure relating to a brand, such as management and brand marketing is for the benefit of all products within the brand and not for any specific individual product. Therefore, such **brand-sustaining expenses** should be attributed to the brand and not to individual products within the brand.

FIGURE 6.2 *An illustration of hierarchical profitability analysis.*



Notes
[1] Consists of expenses dedicated to sustaining specific product brands or customer segments or regions but which cannot be attributed to individual products, customers or branches.
[2] Consists of expenses dedicated to sustaining the product lines or distribution channels or countries but which cannot be attributed to lower items within the hierarchy.
[3] Consists of expenses dedicated to the business as a whole and not attributable to any lower items within the hierarchy.

The same reasoning can be applied to the next level in the hierarchy. For example, marketing, research and development and distribution expenses might be incurred for the benefit of the whole product line and not for any specific brands or products within the line. Therefore these **product line-sustaining expenses** should be attributed to the product line but no attempt should be made to allocate them to individual products or brands. Finally, the profit for the organizational unit as a whole can be determined by deducting facility-sustaining expenses from the sum of the individual product line contributions.

A similar approach to the one described above for products can also be applied to other cost objects. The two final columns shown in Figure 6.2 illustrate how the approach can be applied to customers and locations. The aim of ABC hierarchical profitability analysis is to assign all organizational expenses to a particular hierarchical or organizational level where cause-and-effect cost assignments can be established so that arbitrary allocations are non-existent. The hierarchical approach helps to identify the impact on resource consumption by adding or dropping items at each level of the hierarchy. For example, if a brand is dropped activities at the brand level and below (i.e. above the brand profits row in Figure 6.2) which are uniquely associated with the brand will be affected, but higher level activities (i.e. at the product line level) will be unaffected. Similarly, if a product within a particular brand is dropped then all unit, batch and product-sustaining activities uniquely associated with that product will be affected but higher level brand and product-level activities will be unaffected. For a further discussion of ABC profitability analysis you should refer to pages 202–4.

Resource consumption models

The third, and possibly the most important theoretical advance in ABC systems was reported by Cooper and Kaplan (1992) in a paper which emphasized that ABC systems are **models of resource consumption**. The paper showed how ABC systems measure the cost of using resources and not the cost of supplying resources and highlighted the critical role played by unused capacity. To have a good conceptual grasp of ABC it is essential that you understand the content of this section.

Kaplan (1994) used the following equation to formalize the relationship between activity resources supplied and activity resources used for each activity:

$$\begin{matrix}\text{Cost of resources} \\ \text{supplied}\end{matrix} = \begin{matrix}\text{Cost of resources} \\ \text{used}\end{matrix} + \begin{matrix}\text{Cost of unused} \\ \text{capacity}\end{matrix} \qquad (6.1)$$

To illustrate the application of the above formula we shall use Example 6.2. The left-hand side of the above equation indicates that the amount of expenditure on an activity depends on the cost of resources supplied rather than the cost of resources used. Example 6.2 contains data relating to the processing of purchase orders activity in which the equivalent of ten full-time staff are committed to the activity. You will see that the estimated annual cost is £300 000. This represents the **cost of resources supplied**. This expenditure provides the capacity to process 15 000 purchase orders (i.e. the quantity of resources supplied of the cost driver) per annum. Therefore the estimated cost of processing each purchase order is £20 (£300 000/15 000 orders that can be processed).

During any particular period the number of orders processed will vary. In Example 6.2 it is assumed that the Etna Company expects to process 13 000 purchase orders (i.e. the quantity of resources used). The ABC system will therefore assign £260 000 (13 000

EXAMPLE 6.2

The following information relates to the purchasing activity in a division of the Etna Company for the next year:

(1) Resources supplied

10 full-time staff at £30 000 per year (including employment costs)	= £300 000 annual activity cost
Cost driver	= Number of purchase orders processed
Quantity of cost driver supplied per year: (Each member of staff can process 1500 orders per year)	= 15 000 purchase orders
Estimated cost driver rate	= £20 per purchase order (£300 000/15 000 orders)

(2) Resources used

Estimated number of purchase orders to be processed during the year	= 13 000
Estimated cost of resources used assigned to parts and materials	= £260 000 (13 000 × £20)

(3) Cost of unused capacity

Resources supplied (15 000) – Resources used (13 000) at £20 per order	= £40 000 (2000 × £20)

orders at £20 per order) to the parts and materials ordered during the year. This represents the **cost of resources used**.

The **cost of unused capacity** represents the difference between the cost of resources supplied and the cost of resources used. Resources have been acquired to enable 15 000 purchase orders to be processed but during the year only 13 000 orders will be processed giving an unused capacity of 2000 purchase orders. Hence the predicted cost of the unused capacity will be £40 000 (2000 orders at £20 per order).

Unused capacity arises because the supply of some resources has to be acquired in discrete amounts in advance of usage such that the supply cannot be continually adjusted in the short run to match exactly the usage of resources. Typical expenses in this category include the acquisition of equipment or the employment of non-piecework employees. The expenses of supplying these resources are incurred independently of usage in the short run and this independence has led to them being categorized as fixed costs. Kaplan and Cooper (1998) describe such resources as **committed resources**. In contrast, there are other types of resources whose supply can be continually adjusted to match exactly the usage of resources. For example, materials, casual labour and the supply of energy for running machinery can be continually adjusted to match the exact demand. Thus the cost of supplying these resources will generally equal the cost of resources used and the resources will have no unused capacity. Kaplan and Cooper classify these resources as '**flexible resources**' although they have traditionally been categorized as variable costs.

The problem of adjusting the supply of resources to match the usage of resources and eliminating unused capacity therefore applies only to committed resources. Where the cost of supplying resources in the short run is fixed, the quantity used will fluctuate each period based on the activities performed for the output produced. Activity-based

off with ABC initially analysed past costs. Besides being historical the disadvantage of this approach is that actual cost driver usage is used as the denominator level to calculate the cost driver rates. Thus cost driver rates and product costs will include the cost of unused capacity. Hence the cost of unused capacity for each activity is not highlighted for management attention. Nevertheless, the information provided for the first time an insight into the resources consumed by products and customers and their profitability based on measuring the resource usage rather than arbitrary allocations.

However, rather than focusing on the past it is preferable to concentrate on the future profitability of products and customers using estimated activity-based costs. It is therefore recommended that an activity-cost database is maintained at estimated standard costs that are updated on an annual or semi-annual basis.

ABC in service organizations

Kaplan and Cooper (1998) suggest that service companies are ideal candidates for ABC, even more than manufacturing companies. Their justification for this statement is that most of the costs in service organizations are indirect. In contrast, manufacturing companies can trace important components (such as direct materials and direct labour) of costs to individual products. Therefore indirect costs are likely to be a much smaller proportion of total costs. Service organizations must also supply most of their resources in advance and fluctuations in the usage of activity resources by individual services and customers does not influence short-term spending to supply the resources. Such costs are treated by traditional costing systems as fixed and irrelevant for most decisions. This resulted in a situation where profitability analysis was not considered helpful for decision-making. Furthermore, until recently many service organizations were either government owned monopolies or operated in a highly regulated, protected and non-competitive environment. These organizations were not subject to any great pressures to improve profitability by identifying and eliminating non-profit making activities. Cost increases could also be absorbed by increasing the prices of services to customers. Little attention was therefore given to developing cost systems that accurately measured the costs and profitability of individual services.

Privatization of government owned monopolies, deregulation, intensive competition and an expanding product range created the need for service organizations to develop management accounting systems that enabled them to understand their cost base and determine the sources of profitability for their products/services, customers and markets. Many service organizations have therefore only recently implemented management accounting systems. They have had the advantage of not having to meet some of the constraints imposed on manufacturing organizations, such as having to meet financial accounting stock valuation requirements or the reluctance to scrap or change existing cost systems that might have become embedded in organizations. Furthermore, service organizations have been implementing new costing systems at the same time as the deficiencies of traditional systems were being widely publicized. Also new insights were beginning to emerge on how cost systems could be viewed as resource consumption models which could be used to make decisions on adjusting the spending on the supply of resources to match resource consumption.

A UK survey by Drury and Tayles (2000) suggests that service organizations are more likely to implement ABC systems. They reported that 51% of the financial and service organizations surveyed, compared with 15% of manufacturing organizations, had implemented ABC. Kaplan and Cooper (1998) illustrate how ABC was applied in The Co-

operative Bank, a medium sized UK bank. ABC was used for product and customer profitability analysis. The following are some of the activities and cost drivers that were identified:

Activity	Cost driver
Provide ATM services	Number of ATM transactions
Clear debit items	Number of debits processed
Clear credit items	Number of credits processed
Issue chequebooks	Number of chequebooks issued
Computer processing	Number of computer transactions
Prepare statements of account transactions	Number of statements issued
Administer mortgages	Number of mortgages maintained

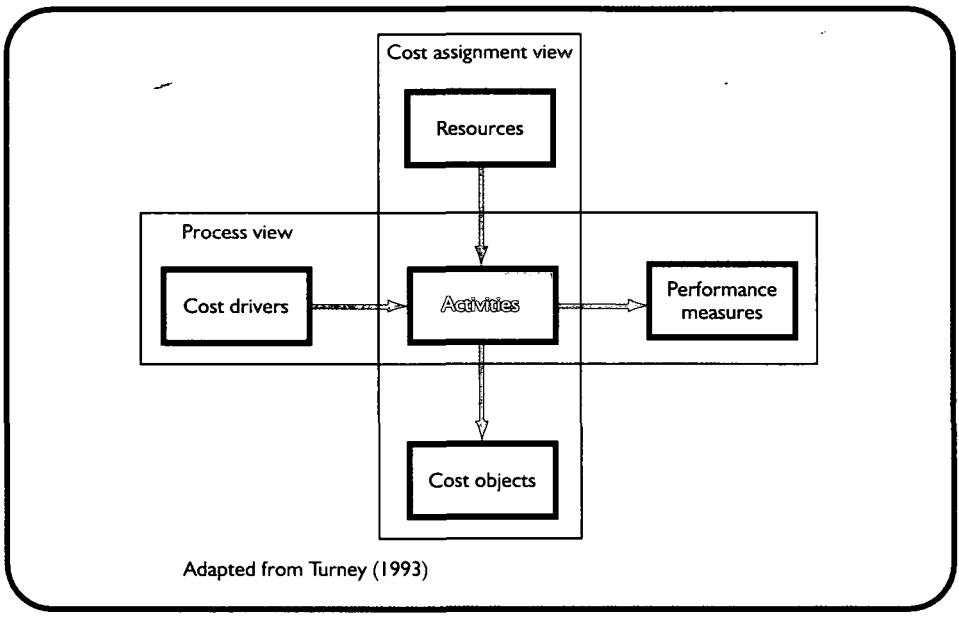
Activity costs were allocated to the different savings and loans products based on their demand for the activities using the cost drivers as a measure of resource consumption. Some expenses, such as finance and human resource management, were not assigned to products because they were considered to be for the benefit of the organization as a whole and not attributable to individual products. These business sustaining costs represented approximately 15% of total operating expenses. Profitability analysis was extended to customer segments within product groups. The study revealed that approximately half of the current accounts, particularly those with low balances and high transactions were unprofitable. By identifying the profitable customer segments the marketing function was able to direct its effort to attracting more new customers, and enhancing relationships with those existing customers, whose behaviour would be profitable to the bank.

ABC cost management applications

Our aim in this chapter has been to look at how ABC can be used to provide information for decision-making by more accurately assigning costs to cost objects, such as products, customers and locations. In addition, ABC can be used for a range of cost management applications. They include cost reduction, activity-based budgeting, performance measurement, benchmarking of activities, process management and business process re-engineering. Figure 6.3 illustrates the product costing and cost management applications of ABC. The vertical box relates to product costing where costs are first assigned to activities and then to cost objects. The horizontal box relates to cost management. Here a process approach is adopted and costs are assigned to activities which then represent the basis for cost management applications. Thus, ABC can be adopted for both product costing and cost management or applied only to product costing or cost management. If ABC is only applied to cost management the second stage of assigning costs from activities to cost objects is omitted.

The decision to implement ABC should not, therefore, be based only on its ability to produce more accurate and relevant decision-making information. Indeed, a survey by Innes and Mitchell (1995a) on ABC applications suggests that the cost management applications tend to outweigh the product costing applications which were central to ABC's initial development. We shall examine ABC applications to cost management in Chapter 15.

FIGURE 6.3 *Product costing and cost management applications of ABC.*



Adapted from Turney (1993)

EXHIBIT 6.2

Surveys of company practice

Significant variations in the usage of ABC both within the same country and across different countries have been reported. These differences may arise from the difficulty in precisely defining the difference between traditional costing systems and ABC systems and the specific time period when the surveys were actually undertaken.

Survey evidence suggests that over the last decade there has been an increasing interest in ABC. In the UK, surveys in the early 1990s reported adoption rates around 10% (Innes and Mitchell, 1991; Nicholls, 1992; Drury *et al.*, 1993). Similar adoption rates of 10% were found in Ireland (Clarke, 1992) and 14% in Canada (Armitage and Nicholson, 1993). In the USA Green and Amenkhienan (1992) claimed that 45% of firms used ABC to some extent. More recent surveys suggest higher ABC adoption rates. In the UK reported usage was 20% (Innes and Mitchell, 1995a), 22% (Banerjee and Kane, 1996), 21% (Evans and Ashworth, 1996) and 23% (Drury and Tayles, 2000). In the USA Shim and Stagliano (1997) reported a usage rate of 27%.

Reported usage rates for mainland Europe are 19% in Belgium (Bruggeman *et al.*, 1996) and 6% in Finland in 1992, 11% in 1993 and 24% in 1995 (Virtanen *et al.*, 1996). Low usage rates have been reported in Denmark (Israelsen *et al.*, 1996), Sweden (Ask *et al.*, 1996) and Germany (Scherrer, 1996). Activity-based techniques

do not appear to have been adopted in Greece (Ballas and Venieris, 1996), Italy (Barbato *et al.*, 1996) or Spain (Saez-Torrecilla *et al.*, 1996).

Other studies have examined the applications of ABC. Innes and Mitchell (1995) found that cost reduction was the most widely used application. Other widely used applications included product/service pricing, cost modelling and performance measurement/improvement. ABC was used for stock valuation by 29% of ABC adopters thus suggesting that the majority of ABC users have separate systems for stock valuation and management accounting applications.

According to Bjornenak (1997a) there has been little research on who adopts ABC and for what reasons. His survey indicated that 40% of the responding Norwegian companies had adopted ABC as an idea (i.e. they had implemented ABC or planned to do so). Different variables relating to cost structure, competition, existing cost systems, size and product diversity were tested as explanatory factors for the adoption of ABC but only cost structure and size were found to be statistically significant. The UK study by Drury and Tayles indicated that company size and business sector had a significant impact on ABC adoption rates. The adoption rates were 45% for the largest organizations and 51% for financial and service organizations. Although the ABC adopters used significantly more cost pools and cost drivers than the non-adopters most adopters used fewer cost pools and drivers compared with what is recommended in the literature. Approximately, 50% of the ABC adopters used less than 50 cost centres and less than 10 separate types of cost driver rates.

Friedman and Lyne's (1995) case study research of 12 UK companies cited top management support as a significant factor influencing the success or failure of ABC systems. Implementation problems identified by the various studies included the amount of work in setting up the system and data collection, difficulties in identifying activities and selecting cost drivers, lack of resources and inadequate computer software. The benefits reported by the studies included more accurate cost information for product pricing, more accurate profitability analysis, improved cost control and a better understanding of cost causation.

Summary

Indirect relevant costs can be difficult to identify and measure. This chapter has shown how ABC systems can identify and measure relevant costs. ABC systems do not report relevant costs for all possible situations but they do provide a superior way of determining relevant costs. The major distinguishing features between ABC and traditional costing systems were compared. ABC systems rely on a greater number of cost centres and second stage cause-and-effect cost drivers. An ABC system involves the following four stages:

1. identify the major activities which take place in an organization;
2. create a cost centre/cost pool for each major activity;
3. determine the cost driver for each major activity;
4. trace the cost of activities to products according to a product's demand (using cost drivers as a measure of demand) for activities.

ABC systems provide more meaningful decision-making information because they recognize that many of the so-called fixed overhead costs vary in proportion to changes other than production volume. By identifying the cost drivers that cause costs to change and assigning costs to products on the basis of cost driver usage, costs can be more accurately traced to products. This cause-and-effect relationship provides a superior way of determining relevant costs.

Early ABC systems were subject to a number of criticisms, particularly relating to theoretical aspects. As a response to these criticisms a number of theoretical developments emerged during the 1990s. The first theoretical development classified manufacturing activities along a cost hierarchy dimension consisting of unit-level, batch-level, product-sustaining and facility-sustaining activities. The second was to apply the cost hierarchy to profitability analysis. The aim is to assign all organizational expenses to a particular hierarchical or organizational level where cause-and-effect cost assignments can be established so that arbitrary allocations are non-existent. It was also emphasized that ABC profitability analysis provides attention-directing information by highlighting those potentially unprofitable products or services that require more detailed studies.

The third, and most important, theoretical development, emphasized that ABC systems are models of resource consumption. They measure the cost of *using* resources and not the cost of *supplying* resources. The difference between the cost of resources supplied and the cost of resources used represents the cost of unused capacity. The cost of unused capacity for each activity is the reporting mechanism for identifying the need to adjust the supply of resources to match the usage of resources. However, to translate the benefits of reduced activity demands into cash flow savings management action is required to remove the unused capacity by reducing the spending on the supply of the resources.

ABC must meet the cost/benefit criterion and improvements should be made in the level of sophistication of the costing system up to the point where the marginal cost of improvement equals the marginal benefit from improvement. Sophisticated ABC systems are likely to be optimal in organizations having the following characteristics – intensive competition, a high proportion of indirect costs and a diverse product range.

Key Terms and Concepts

activities (p. 156)
activity cost drivers (p. 165)
batch-related activities (p. 167)
brand-sustaining expenses (p. 168)
business and sustaining activities (p. 167)
committed resources (p. 171)
consumption ratios (p. 161)
cost drivers (p. 156)

cost of resources supplied (p. 170)
cost of resources used (p. 171)
cost of unused capacity (p. 171)
customer-sustaining activities (p. 167)
duration drivers (p. 166)
facility-sustaining activities (p. 167)
flexible resources (p. 171)
models of resource consumption (p. 170)
non-volume-based cost drivers (p. 159)
product-line sustaining expenses (p. 170)
product-sustaining activities (p. 167)
resource cost drivers (p. 165)
service-sustaining activities (p. 167)
transaction drivers (p. 165)
unit-level activities (p. 167)
volume-based cost drivers (p. 159)

Recommended Reading

Kaplan and Cooper have been the major contributors to the development of activity-based costing. Much of this chapter has therefore drawn off their ideas. For a detailed description of activity-based costing which incorporates all of Kaplan and Cooper's ideas you should consult *Cost and Effect: Using Integrated Systems to Drive Profitability and Performance* (1998). You should refer to the bibliography at the end of this book for the detailed reference.

Review Problems

The following information provides details of the costs, volume and cost drivers for a particular period in respect of ABC plc, a hypothetical company:

	Product X	Product Y	Product Z	Total
1. Production and sales (units)	30 000	20 000	8000	
2. Raw material usage (units)	5	5	11	
3. Direct material cost	£25	£20	£11	£1 238 000
4. Direct labour hours	$1\frac{1}{3}$	2	1	88 000
5. Machine hours	$1\frac{1}{3}$	1	2	76 000
6. Direct labour cost	£8	£12	£6	
7. Number of production runs	3	7	20	30
8. Number of deliveries	9	3	20	32
9. Number of receipts (2×7)[a]	15	35	220	270
10. Number of production orders	15	10	25	50
11. Overhead costs:				
Set-up	30 000			
Machines	760 000			
Receiving	435 000			
Packing	250 000			
Engineering	373 000			
	£1 848 000			

[a]The company operates a just-in-time inventory policy, and receives each component once per production run.

In the past the company has allocated overheads to products on the basis of direct labour hours.

However, the majority of overheads are more closely related to machine hours than direct labour hours.

The company has recently redesigned its cost system by recovering overheads using two volume-related bases: machine hours and a materials handling overhead rate for recovering overheads of the receiving department. Both the current and the previous cost system reported low profit margins for product X, which is the company's highest-selling product. The management accountant has recently attended a conference on activity-based costing, and the overhead costs for the last period have been analysed by the major activities in order to compute activity-based costs.

From the above information you are required to:

(a) Compute the product costs using a traditional volume-related costing system based on the assumptions that:
  (i) all overheads are recovered on the basis of direct labour hours (i.e. the company's past product costing system);
  (ii) the overheads of the receiving department are recovered by a materials handling overhead rate and the remaining overheads are recovered using a machine hour rate (i.e. the company's current costing system).

(b) Compute product costs using an activity-based costing system.

(c) Briefly explain the differences between the product cost computations in (a) and (b).

Solution to Review Problem

(a) (i)

$$\text{Direct labour overhead rate} = \frac{\text{total overheads (£1 848 000)}}{\text{total direct labour hours (88 000)}}$$
$$= £21 \text{ per direct labour hour}$$

Product costs

Product	**X (£)**	**Y (£)**	**Z (£)**
Direct labour	8	12	6
Direct materials	25	20	11
Overhead[a]	28	42	21
Total cost	61	74	38

Note
[a] X = $1\frac{1}{3}$ hours × £21
Y = 2 hours × £21
Z = 1 hour × £21

(ii) Materials handling

$$\text{Overhead rate} = \frac{\text{receiving department overheads (£435 000)}}{\text{direct material cost (£1 238 000)}} \times 100$$
$$= 35.14\% \text{ of direct material cost}$$

$$\text{Machine hour overhead rate} = \frac{\text{other overheads (£1 413 000)}}{\text{76 000 machine hours}}$$
$$= £18.59 \text{ per machine hour}$$

Product costs

Product	X (£)	Y (£)	Z (£)
Direct labour	8.00	12.00	6.00
Direct materials	25.00	20.00	11.00
Materials handling overhead	8.78 (£25 × 35.14%)	7.03 (£20 × 35.14%)	3.87 (£11 × 35.14%)
Other overheads[a] (machine hour basis)	24.79	18.59	37.18
Total cost	66.57	57.62	58.05

Note
[a] X = $1\frac{1}{3}$ × £18.59
Y = 1 × £18.59
Z = 2 × £18.59

(b) The cost per transaction or activity for each of the cost centres is as follows:
Set-up cost

$$\text{Cost per setup} = \frac{\text{setup cost (£30 000)}}{\text{number of production runs (30)}} = £1000$$

Receiving

$$\text{Cost per receiving order} = \frac{\text{receiving cost (£435 000)}}{\text{number of orders (270)}} = £1611$$

Packing

$$\text{Cost per packing order} = \frac{\text{packing cost (£250 000)}}{\text{number of orders (32)}} = £7812$$

Engineering

$$\text{Cost per production order} = \frac{\text{engineering cost (£373 000)}}{\text{number of production orders (50)}} = £7460$$

The total set-up cost for the period was £30 000 and the cost per transaction or activity for the period is £1000 per set-up. Product X required three production runs, and thus £3000 of the set-up cost is traced to the production of product X for the period. Thus the cost per set-up per unit produced for product X is £0.10 (£3000/30 000 units).

Similarly, product Z required 20 set-ups, and so £20 000 is traced to product Z. Hence the cost per set-up for product Z is £2.50 (£20 000/8000 units).

The share of a support department's cost that is traced to each unit of output for each product is therefore calculated as follows:

$$\text{cost per transaction} \times \frac{\text{number of transactions per product}}{\text{number of units produced}}$$

The unit standard costs for products X, Y and Z using an activity-based costing system are

	X	Y	Z
Direct labour	£8.00	£12.00	£6.00
Direct materials	25.00	20.00	11.00
Machine overhead[a]	13.33	10.00	20.00

Set-up costs	0.10	0.35	2.50
Receiving[b]	0.81	2.82	44.30
Packing[c]	2.34	1.17	19.53
Engineering[d]	3.73	3.73	23.31
Total manufacturing cost	53.31	50.07	126.64

Notes
[a] Machine hours × machine overhead rate (£760 000/76 000 hrs)
[b] X = (£1611 × 15)/30 000
Y = (£1611 × 35)/20 000
Z = (£1611 × 220)/8 000
[c] X = (£7812 × 9)/30 000
Y = (£7812 × 3)/20 000
Z = (£7812 × 20)/8 000
[d] X = (£7460 × 15)/30 000
Y = (£7460 × 10)/20 000
Z = (£7460 × 25)/8 000

(c) The traditional product costing system assumes that products consume resources in relation to volume measures such as direct labour, direct materials or machine hours. The activity-based system recognizes that some overheads are unrelated to production volume, and uses cost drivers that are independent of production volume. For example, the activity-based system assigns the following percentage of costs to product Z, the low volume product:

Set-up-related costs	66.67%	(20 out of 30 set-ups)
Delivery-related costs	62.5%	(20 out of 32 deliveries)
Receiving costs	81.5%	(220 out of 270 receiving orders)
Engineering-related costs	50%	(25 out of 50 production orders)

In contrast, the current costing system assigns the cost of the above activities according to production volume, measured in machine hours. The total machine hours are

Product X	40 000 (30 000 × $1\frac{1}{3}$)
Product Y	20 000 (20 000 × 1)
Product Z	16 000 (8 000 × 2)
	76 000

Therefore 21% (16 000/76 000) of the non-volume-related costs are assigned to product Z if machine hours are used as the allocation base. Hence the traditional system undercosts the low-volume product, and, on applying the above approach, it can be shown that the high-volume product (product X) is overcosted. For example, 53% of the costs (40 000/76 000) are traced to product X with the current system, whereas the activity-based system assigns a much lower proportion of non-volume-related costs to this product.

Questions

6.1

The traditional methods of cost allocation, cost apportionment and absorption into products are being challenged by some writers who claim that much information given to management is misleading when these methods of dealing with fixed overheads are used to determine product costs.

You are required to explain what is meant by *cost allocation*, *cost apportionment* and *absorption* and to describe briefly the alternative approach of

activity-based costing in order to ascertain total product costs. (15 marks)
CIMA

6.2
'It is now fairly widely accepted that conventional cost accounting distorts management's view of business through unrepresentative overhead allocation and inappropriate product costing.

This is because the traditional approach usually absorbs overhead costs across products and orders solely on the basis of the direct labour involved in their manufacture. And as direct labour as a proportion of total manufacturing cost continues to fall, this leads to more and more distortion and misrepresentation of the impact of particular products on total overhead costs.'

(From an article in *The Financial Times*)

You are required to discuss the above and to suggest what approaches are being adopted by management accountants to overcome such criticism. (15 marks)
CIMA

6.3
'Attributing direct costs and absorbing overhead costs to the product/service through an activity-based costing approach will result in a better understanding of the true cost of the final output.' (*Source:* a recent CIMA publication on costing in a service environment.)

You are required to explain and comment on the above statement. (15 marks)
CIMA

6.4
Large service organisations, such as banks and hospitals, used to be noted for their lack of standard costing systems, and their relatively unsophisticated budgeting and control systems compared with large manufacturing organisations. But this is changing and many large service organisations are now revising their use of management accounting techniques.

Requirements:
(a) Explain which features of large-scale service organisations encourage the application of activity-based approaches to the analysis of cost information. (6 marks)
(b) Explain which features of service organisations may create problems for the application of activity-based costing. (4 marks)
(c) Explain the uses for activity-based cost information in service industries. (4 marks)
(d) Many large service organisations were at one time state-owned, but have been privatised. Examples in some countries include electricity supply and telecommunications. They are often regulated. Similar systems of regulation of prices by an independent authority exist in many countries, and are designed to act as a surrogate for market competition in industries where it is difficult to ensure a genuinely competitive market.

Explain which aspects of cost information and systems in service organisations would particularly interest a regulator, and why these features would be of interest. (6 marks)
(Total 20 marks)
CIMA

6.5 Calculation of ABC product costs and a discussion of the usefulness of ABC
Trimake Limited makes three main products, using broadly the same production methods and equipment for each. A conventional product costing system is used at present, although an activity-based costing (ABC) system is being considered. Details of the three products for a typical period are:

	Hours per unit		Materials per unit	Volumes
	Labour hours	Machine hours	£	Units
Product X	$\frac{1}{2}$	$1\frac{1}{2}$	20	750
Product Y	$1\frac{1}{2}$	1	12	1250
Product Z	1	3	25	7000

Direct labour costs £6 per hour and production overheads are absorbed on a machine hour basis. The rate for the period is £28 per machine hour.
(a) You are required to calculate the cost per unit for each product using conventional methods. (4 marks)

Further analysis shows that the total of production overheads can be divided as follows:

	(%)
Costs relating to set-ups	35
Costs relating to machinery	20

Costs relating to materials handling	15
Costs relating to inspection	30
Total production overhead	100%

The following activity volumes are associated with the product line for the period as a whole.

Total activities for the period:

	Number of set-ups	Number of movements of materials	Number of inspections
Product X	75	12	150
Product Y	115	21	180
Product Z	480	87	670
	670	120	1000

You are required

(b) to calculate the cost per unit for each product using ABC principles; (15 marks)

(c) to comment on the reasons for any differences in the costs in your answers to (a) and (b). (3 marks)

(Total 22 marks)

CIMA

6.6 Preparation of conventional costing and ABC profit statements

The following budgeted information relates to Brunti plc for the forthcoming period:

	Products		
	XYI (000)	YZT (000)	ABW (000)
Sales and production (units)	50	40	30
	(£)	(£)	(£)
Selling price (per unit)	45	95	73
Prime cost (per unit)	32	84	65
	Hours	Hours	Hours
Machine department (machine hours per unit)	2	5	4
Assembly department (direct labour hours per unit)	7	3	2

Overheads allocated and apportioned to production departments (including service cost centre costs) were to be recovered in product costs as follows:

Machine department at £1.20 per machine hour

Assembly department at £0.825 per direct labour hour

You ascertain that the above overheads could be re-analysed into 'cost pools' as follows:

Cost pool	£000	Cost driver	Quantity for the period
Machining services	357	Machine hours	420 000
Assembly services	318	Direct labour hours	530 000
Set-up costs	26	Set-ups	520
Order processing	156	Customer orders	32 000
Purchasing	84	Suppliers' orders	11 200
	941		

You have also been provided with the following estimates for the period:

	Products		
	XYI	YZT	ABW
Number of set-ups	120	200	200
Customer orders	8000	8000	16 000
Suppliers' orders	3000	4000	4200

Required:

(a) Prepare and present profit statements using:

(i) conventional absorption costing; (5 marks)

(ii) activity-based costing; (10 marks)

(b) Comment on why activity-based costing is considered to present a fairer valuation of the product cost per unit. (5 marks)

(Total 20 marks)

ACCA

6.7 Comparison of ABC with traditional product costing

(a) In the context of activity-based costing (ABC), it was stated in *Management Accounting – Evolution not Revolution* by Bromwich and Bhimani, that 'Cost drivers attempt to link costs to the scope of output rather than the scale of output thereby generating less arbitrary product costs for decision making.' You

are required to explain the terms 'activity-based costing' and 'cost drivers'. (13 marks)

(b) XYZ plc manufactures four products, namely A, B, C and D, using the same plant and processes. The following information relates to a production period:

Product	Volume	Material cost per unit	Direct labour per unit	Machine time per unit	Labour cost per unit
A	500	£5	$\frac{1}{2}$ hour	$\frac{1}{4}$ hour	£3
B	5000	£5	$\frac{1}{2}$ hour	$\frac{1}{4}$ hour	£3
C	600	£16	2 hours	1 hour	£12
D	7000	£17	$1\frac{1}{2}$ hours	$1\frac{1}{2}$ hours	£9

Total production overhead recorded by the cost accounting system is analysed under the following headings:

Factory overhead applicable to machine-oriented activity is £37 424

Set-up costs are £4355

The cost of ordering materials is £1920

Handling materials – £7580

Administration for spare parts – £8600.

These overhead costs are absorbed by products on a machine hour rate of £4.80 per hour, giving an overhead cost per product of:

A = £1.20 B = £1.20 C = £4.80 D = £7.20

However, investigation into the production overhead activities for the period reveals the following totals:

Product	Number of set-ups	Number of material orders	Number of times material was handled	Number of spare parts
A	1	1	2	2
B	6	4	10	5
C	2	1	3	1
D	8	4	12	4

You are required:

(i) to compute an overhead cost per product using activity-based costing, tracing overheads to production units by means of cost drivers. (6 marks)

(ii) to comment briefly on the differences disclosed between overheads traced by the present system and those traced by activity-based costing. (6 marks)

(Total 25 marks)

CIMA

6.8 Comparison of traditional product costing with ABC

Duo plc produces two products A and B. Each has two components specified as sequentially numbered parts i.e. product A (parts 1 and 2) and product B (parts 3 and 4). Two production departments (machinery and fitting) are supported by five service activities (material procurement, material handling, maintenance, quality control and set up). Product A is a uniform product manufactured each year in 12 monthly high volume production runs. Product B is manufactured in low volume customised batches involving 25 separate production runs each month. Additional information is as follows:

	Product A	Product B
Production details:		
Components	Parts 1, 2	Parts 3, 4
Annual volume produced	300 000 units	300 000 units
Annual direct labour hours:		
Machinery department	500 000 DLH	600 000 DLH
Fitting department	150 000 DLH	200 000 DLH

Overhead Cost Analysis[a]

	(£000s)
Material handling	1 500
Material procurement	2 000
Set-up	1 500
Maintenance	2 500
Quality control	3 000
Machinery (machinery power, depreciation etc.)[b]	2 500
Fitting (machine, depreciation, power etc.)[b]	2 000
	15 000

[a] It may be assumed that these represent fairly homogeneous activity-based cost pools.

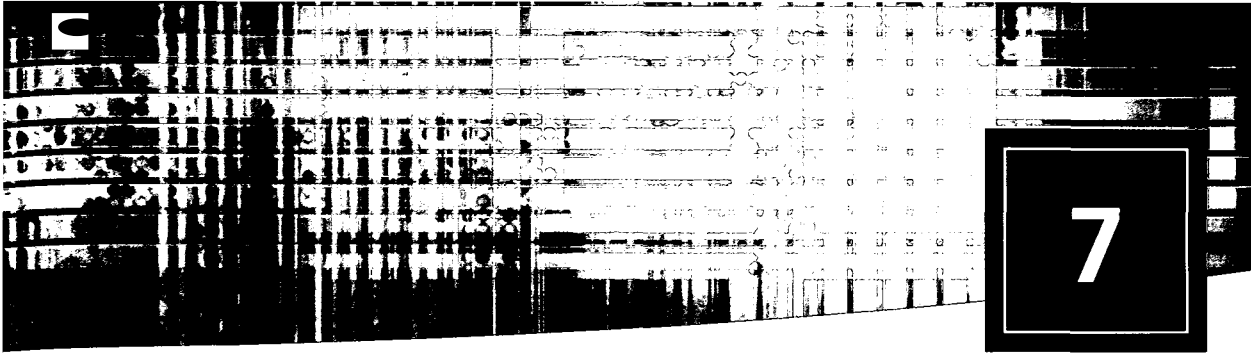
[b] It is assumed these costs (depreciation, power etc.) are primarily production volume driven and that direct labour hours are an appropriate surrogate measure of this.

Cost Driver Analysis

	Annual Cost Driver Volume per Component			
Cost Driver	**Part 1**	**Part 2**	**Part 3**	**Part 4**
Material movements	180	160	1 000	1 200
Number of orders	200	300	2 000	4 000
Number of set-ups	12	12	300	300
Maintenance hours	7 000	5 000	10 000	8 000
Number of inspections	360	360	2 400	1 000
Direct labour hours	150 000	350 000	200 000	400 000
Direct labour hours	50 000	100 000	60 000	140 000

You are required to compute the unit costs for products A and B using (i) a traditional volume-based product costing system and (ii) an activity-based costing system.

(Adapted from Innes, J. and Mitchell, F., Activity Based Costing: A Review with Case Studies, *Chartered Institute of Management Accountants*, 1990)



7

Pricing decisions and profitability analysis

Accounting information is often an important input to pricing decisions. Organizations that sell products or services that are highly customized or differentiated from each other by special features, or who are market leaders, have some discretion in setting selling prices. In these organizations the pricing decision will be influenced by the cost of the product. The cost information that is accumulated and presented is therefore important for pricing decisions. In other organizations prices are set by overall market and supply forces and they have little influence over the selling prices of their products and services. Nevertheless, cost information is still of considerable importance in these organizations for determining the relative profitability of different products and services so that management can determine the target product mix to which its marketing effort should be directed.

In this chapter we shall focus on both of the above situations. We shall consider the role that accounting information plays in determining the selling price by a price setting firm. Where prices are set by the market our emphasis will be on examining the cost information that is required for product-mix decisions. In particular, we shall focus on both product and customer profitability analysis.

The theoretical solution to pricing decisions is derived from economic theory, which explains how the optimal selling price is determined. A knowledge of economic theory provides a suitable framework for considering the cost information that is appropriate for pricing decisions. This chapter therefore begins with a description of economic theory.

Learning objectives

After studying this chapter, you should be able to:

- describe how the optimum output and selling price is determined using economic theory;
- explain the relevant cost information that should be presented in price setting firms for both short-term and long-term decisions;
- describe product and customer profitability analysis and the information that should be included for managing the product and customer mix;
- explain the role that target costing plays in the pricing decision;
- describe the different cost-plus pricing methods for deriving selling prices;
- explain the limitations of cost-plus pricing;
- justify why cost-plus pricing is widely used;
- describe the different pricing policies.

Economic theory

The central feature of the economic model is the assumption that the firm will attempt to set the selling price at a level where profits are maximized. For monopolistic/imperfect competition the model assumes that the lower the price, the larger will be the volume of sales.[1] This relationship is depicted in Figure 7.1, which is known as a demand curve.

Points A and B represent two of many possible price/quantity combinations. You will see that at a price P_a, the quantity demanded will be Q_a, while at the lower price of P_b the quantity demanded will increase to Q_b. The economist describes the sensitivity of demand to changes in price as the price elasticity of demand. Demand is elastic when there are substitutes for a product, or when customers do not value the product very highly; the result is that a small increase/decrease in price causes a large decrease/increase in the quantity demanded. Alternatively, demand is inelastic when customers place a high value on the product, or when no close substitutes exist; the result is that a small increase/decrease in price causes only a small decrease/increase in the quantity demanded (see Figure 7.2).

If you compare the two graphs in Figure 7.2, you will see that in (a) an increase in price from P_A to P_B results in only a small reduction in the quantity demanded, whereas in (b) the same increase in price results in a large reduction in the quantity demanded.

ESTABLISHING THE OPTIMUM SELLING PRICE

The precise quantification of the relationship between the selling price and the quantity demanded is very difficult in practice, but let us assume here that management has produced an estimate of the sales demand at various selling prices, as shown in Exhibit 7.1.

You will note that if the price is reduced from £40 to £38 the total revenue will increase by £18, and that each successive price reduction causes incremental or marginal revenue to increase by successively smaller amounts. This process eventually results in a decline in total revenue when the price per unit is reduced from £30 to £28.

To determine the optimum selling price (i.e. the price at which total profits are maximized), it is also necessary for management to estimate the total costs for each of the sales levels given in Exhibit 7.1; this cost information is set out in Exhibit 7.2.

EXHIBIT 7.1

Estimate of sales demand at different price levels

Price (£)	Unit of sales demand	Total revenue (£)	Marginal revenue (£)
40	10	400	
38	11	418	18
36	12	432	14
34	13	442	10
32	14	448	6
30	15	450	2
28	16	448	− 2

EXHIBIT 7.2

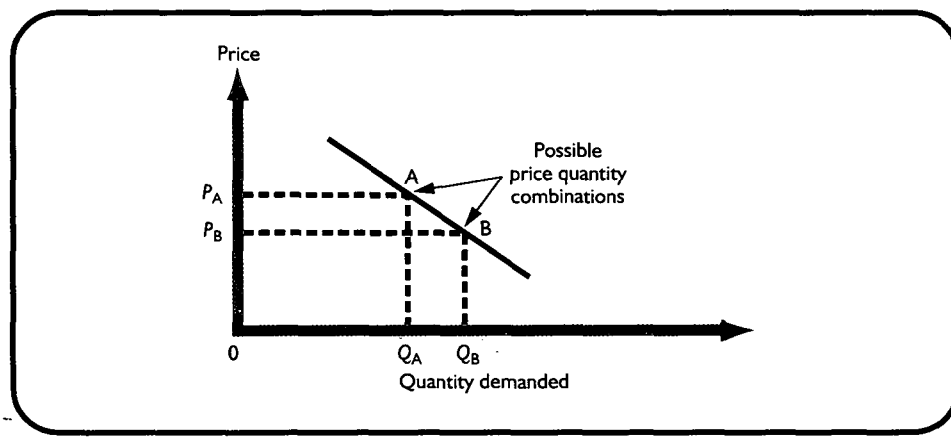
Estimate of total costs at different volume levels

The final stage is to calculate the profit for each sales level and select the most profitable price–volume combination. The profit calculations are obtained by combining the information given in Exhibits 7.1 and 7.2 (see Exhibit 7.3).

You can see from Exhibit 7.3 that profits are maximized at a selling price of £34 when 13 units are sold.

Price (£)	Demand and output	Total costs (£)	Marginal cost (£)
40	10	360	
38	11	364	4
36	12	370	6
34	13	378	8
32	14	388	10
30	15	400	12
28	16	414	14

FIGURE 7.1 *A demand curve.*



GRAPHICAL PRESENTATION

Economic theory would normally present the information contained in Exhibits 7.1 to 7.3 in graphical form as shown in Figure 7.3.

The shape of the graphs for the total revenue and the total cost lines is based on the explanations outlined in Chapter 3. If you refer to the top diagram in Figure 7.3, you will see that it indicates that the difference between total revenue and total cost increases as long as total revenue is climbing more rapidly than total cost. When total cost is climbing more rapidly than total revenue (i.e. unit marginal cost exceeds unit marginal revenue), a decision to increase the number of units sold will actually reduce the total profit. The

FIGURE 7.2 *Price elasticity of demand: (a) inelastic demand; (b) elastic demand.*

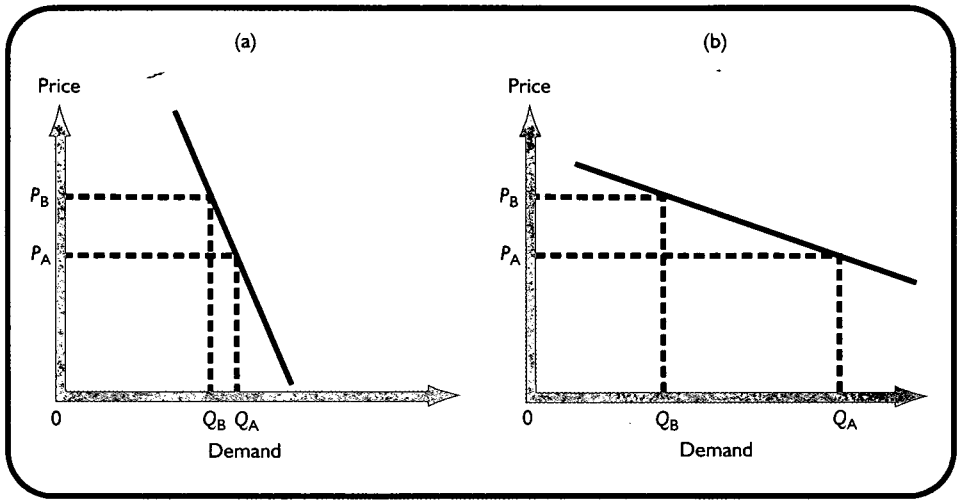


EXHIBIT 7.3

Estimate of profits at different output levels

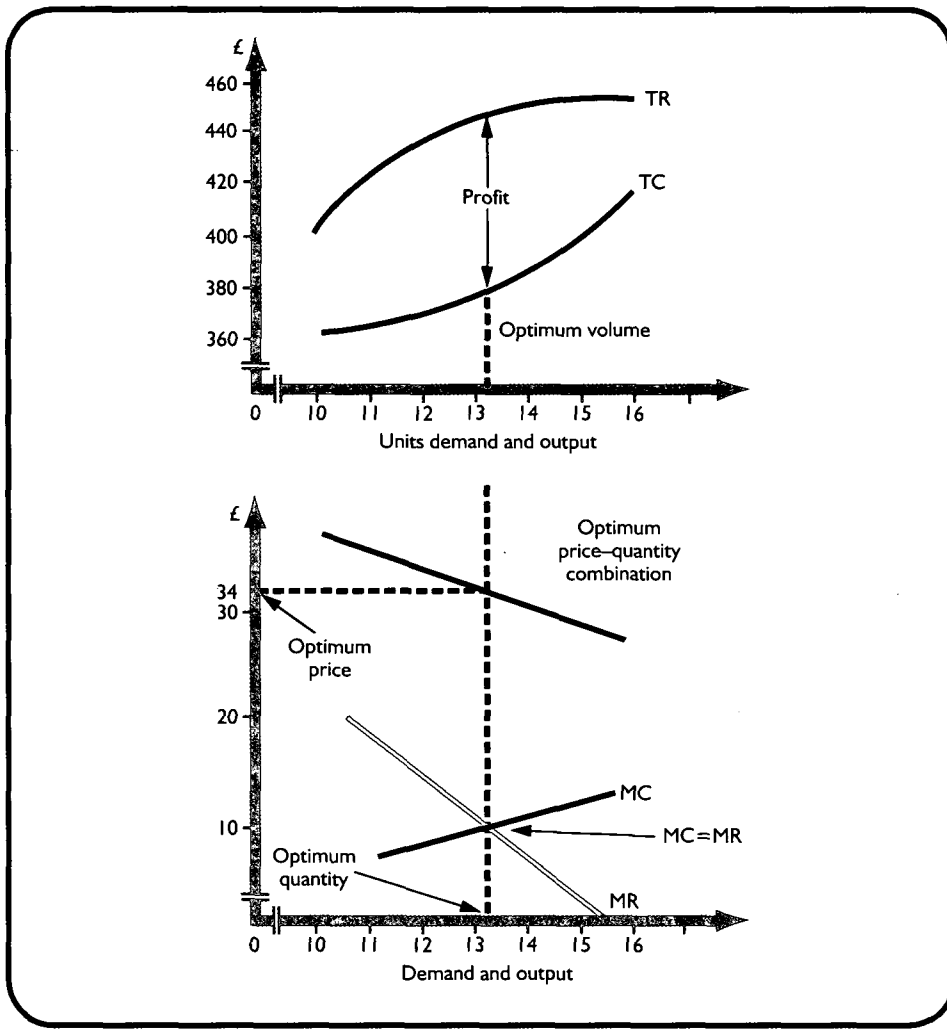
difference between total cost and total revenue is the greatest at a volume level of 13 units; the price required to generate this demand is £34 and this is the optimum selling price.

The lower part of Figure 7.3 shows the cost and revenue information in terms of marginal revenue and marginal cost. Marginal revenue represents the increase in total revenue from the sale of one additional unit, and marginal cost represents the increase in total cost when output is increased by one additional unit. Note that the marginal revenue line slopes downwards to the right as demand increases, reflecting the fact that the slope of the total revenue line decreases as demand increases. Similarly, the marginal cost line slopes upwards because of the assumption that total cost increases as output increases.

Price (£)	Units sold	Total revenue (£)	Total cost (£)	Profit (£)
40	10	400	360	40
38	11	418	364	54
36	12	432	370	62
34	13	442	378	64
32	14	448	388	60
30	15	450	400	50
28	16	448	414	34

Exhibit 7.1 and the demand/price curve in the lower part of Figure 7.3 indicates that to increase sales demand from 10 units to 11 units it is necessary to reduce the selling price from £40 to £38. This increases total revenue from £400 to £418, the difference of £18

FIGURE 7.3 *Economist's model for establishing optimum price. MC, marginal cost; MR, marginal revenue; TC, total cost; TR, total revenue.*



being the marginal revenue of the eleventh unit (shown in the graph as the height of the marginal revenue line at that point). The marginal revenues for the 12th, 13th and 14th units are £14, £10 and £6 respectively. The marginal cost is calculated by assessing the cost of one extra unit (or batch, etc.), and this information is presented in Exhibit 7.2. For example, the marginal cost is £4 for the eleventh unit and £6 for the twelfth unit. The marginal cost is plotted in Figure 7.3, and the optimum price is determined by the intersection of the marginal revenue and marginal cost curves; this is at a price of £34, when sales demand will be 13 units. Note that the intersection of the graphs occurs at a demand just in excess of 13 units. Clearly, we must work in whole units demanded, and therefore the optimal output is 13 units.

The demand curve is also included in the lower part of Figure 7.3, and to obtain the optimum price it is necessary to extend a vertical line upwards from the intersection of the marginal cost and marginal revenue curves. The point where this line cuts the demand curve provides us with the optimum selling price.

Note that if the vertical line at the point of intersection of the marginal cost and marginal revenue curve is extended further upwards into the top part of the graph, it will cut the total cost and the total revenue curves at the point where the difference between these two lines is the greatest. In other words, it cuts the total cost and total revenue curves at the points where the profits are maximized. The graphs in the lower and upper sections of Figure 7.3 are therefore related, and this dual presentation clearly indicates that the point where the difference between total cost and total revenue is the greatest is where marginal revenue is equal to marginal cost. The selling price that causes marginal revenue to be equal to marginal cost represents the optimum selling price.

Difficulties with applying economic theory

Economic theory is extremely difficult to apply in practice. The difficulties can be grouped into three categories. First, economic theory assumes that a firm can estimate a demand curve for its products. Techniques have been developed for estimating demand curves at the industry, or aggregate level for undifferentiated products such as automobiles, coffee and crude oil but consider the difficulties of estimating demand curves below the aggregate level. Most firms have hundreds of different products and varieties, some with complex inter-relationships, and it is therefore an extremely difficult task to estimate demand curves at the individual product level. The problem becomes even more complex when competitive reactions are taken into account since these are likely to impact on the price/demand estimates that have been incorporated in the demand curve.

Secondly, the basic model of economic theory assumes only price influences the quantity demanded. In practice, product quality and packaging, advertising and promotion, the credit terms offered and the after-sales service provided all have an important influence on price. Thus a model that includes only price will fail to capture all of the factors that determine customer demand.

Thirdly, the marginal cost curve for each individual product can only be determined after considerable analysis and the final result may only represent an approximation of the true marginal cost function particularly where significant joint product costs exist. However, whilst an approximation of the cost function may suffice for the application of economic theory the estimation of demand curves for each major product represents the major reason why many firms do not directly apply economic theory in practice.

Nevertheless, economic theory does provide useful insights and stresses the need for managers to think about price/demand relationships, even if the relationships cannot be precisely measured. For example, we shall see that many firms add a profit margin to a product's cost. If managers can identify products or customers where demand is inelastic they can add higher margins to a product's costs. Alternatively, where demand is elastic price changes are likely to be crucial and accurate cost measurement becomes vital. There is a danger where profit margins are reduced to minimal percentage figures that any undercosting of products may result in acceptance of unprofitable business whereas overcosting may result in the loss of profitable business to competitors.

The role of cost information in pricing decisions

Most organizations need to make decisions about setting or accepting selling prices for their products or services. In some firms prices are set by overall market supply and demand forces and the firm has little or no influence over the selling prices of its products or services. This situation is likely to occur where there are many firms in an industry and

there is little to distinguish their products from each other. No one firm can influence prices significantly by its own actions. For example, in commodity markets such as wheat, coffee, rice and sugar prices are set for the market as a whole based on the forces of supply and demand. Also, small firms operating in an industry where prices are set by the dominant market leaders will have little influence over the price of their products or services. Firms that have little or no influence over the prices of their products or services are described as **price takers**.

In contrast firms selling products or services which are highly customized or differentiated from each other by special features, or who are market leaders, have some discretion in setting prices. Here the pricing decision will be influenced by the cost of the product, the actions of competitors and the extent to which customers value the product. We shall describe those firms that have some discretion over setting the selling price of their products or services as **price setters**. In practice, firms may be price setters for some of their products and price takers for others.

Where firms are price setters cost information is often an important input into the pricing decision. Cost information is also of vital importance to price takers in deciding on the output and mix of products and services to which their marketing effort should be directed, given their market prices. For both price takers and price setters the decision time horizon determines the cost information that is relevant for product pricing or output-mix decisions. We shall therefore consider the following four different situations:

1. a price setting firm facing short-run pricing decisions;
2. a price setting firm facing long-run pricing decisions;
3. a price taker firm facing short-run product-mix decisions;
4. a price taker firm facing long-run product-mix decisions.

A price setting firm facing short-run pricing decisions

Companies can encounter situations where they are faced with the opportunity of bidding for a one-time special order in competition with other suppliers. In this situation only the incremental costs of undertaking the order should be taken into account. It is likely that most of the resources required to fill the order will have already been acquired and the cost of these resources will be incurred whether or not the bid is accepted by the customer. Typically, the incremental costs are likely to consist of:

- extra materials that are required to fulfil the order;
- any extra part-time labour, overtime or other labour costs;
- the extra energy and maintenance costs for the machinery and equipment required to complete the order.

The incremental costs of one-off special orders in service companies are likely to be minimal. For example, the incremental cost of accepting one-off special business for a hotel may consist of only the cost of additional meals, laundering and bathroom facilities. In most cases, incremental costs are likely to be confined to items within unit-level activities. Resources for batch, product and service-sustaining activities are likely to have already been acquired and in most cases no extra costs on the supply of activities are likely to be incurred.

Bids should be made at prices that exceed incremental costs. Any excess of revenues over incremental costs will provide a contribution to committed fixed costs which would

not otherwise have been obtained. Given the short-term nature of the decision long-term considerations are likely to be non-existent and, apart from the consideration of bids by competitors, cost data are likely to be the dominant factor in determining the bid price.

Any bid for one-time special orders that is based on covering only short-term incremental costs must meet all of the following conditions:

- Sufficient capacity is available for all resources that are required to fulfil the order. If some resources are fully utilized, opportunity costs (see Chapter 4 for an illustration) of the scarce resources must be covered by the bid price.
- The bid price will not affect the future selling prices and the customer will not expect repeat business to be priced to cover short-term incremental costs.
- The order will utilize unused capacity for only a short period and capacity will be released for use on more profitable opportunities. If more profitable opportunities do not exist and a short-term focus is always adopted to utilize unused capacity then the effect of pricing a series of special orders over several periods to cover incremental costs constitutes a long-term decision. Thus, the situation arises whereby the decision to reduce capacity is continually deferred and short-term incremental costs are incorrectly used for long-term decisions.

A price setting firm facing long-run pricing decisions

In this section we shall focus on three approaches that are relevant to a price setting firm facing long-run pricing decisions. They are:

1. Pricing customized products
2. Pricing non-customized products
3. Target costing for pricing non-customized products

PRICING CUSTOMIZED PRODUCTS

In the long-run firms can adjust the supply of virtually all of their activity resources. Therefore a product or service should be priced to cover all of the resources that are committed to it. If a firm is unable to generate sufficient revenues to cover the long-run costs of all its products, and its business sustaining costs, then it will make losses and will not be able to survive. Setting prices to cover all of the resources that are committed to each individual product (or service) requires a costing system that accurately measures resources consumed by each product. If inaccurate costs are used undercosting or overcosting will occur. In the former situation there is a danger that prices will be set that fail to cover the long-run resources committed to a product. Conversely, with the latter situation profitable business may be lost because overstated product costs have resulted in excessive prices being set that adversely affect sales volumes and revenues. Where firms are price setters there are stronger grounds for justifying the adoption of ABC systems.

The terms **full cost** or **long-run cost** are used to represent the sum of the cost of all those resources that are committed to a product in the long-term. The term is not precisely defined and may include or exclude facility/business sustaining costs. Let us now consider

EXAMPLE 7.1

The Kalahari Company has received a request for a price quotation from one of its regular customers for an order of 500 units with the following characteristics:

Direct labour per unit produced	2 hours
Direct materials per unit produced	£22
Machine hours per unit produced	1 hour
Number of component and material purchases	6
Number of production runs for the components prior to assembly	4
Average set-up time per production run	3 hours
Number of deliveries	1
Number of customer visits	2
Engineering design and support	50 hours
Customer support	50 hours

Details of the activities required for the order are as follows:

Activity	Activity cost driver rate
Direct labour processing and assembly activities	£10 per labour hour
Machine processing	£30 per machine hour
Purchasing and receiving materials and components	£100 per purchase order
Scheduling production	£250 per production run
Setting-up machines	£120 per set-up hour
Packaging and delivering orders to customers	£400 per delivery
Invoicing and accounts administration	£120 per customer order
Marketing and order negotiation	£300 per customer visit
Customer support activities including after sales service	£50 per customer service hour
Engineering design and support	£80 per engineering hour

a full cost computation for a product pricing decision using an ABC system. You should now refer to the data presented in Example 7.1.

The estimate of the cost of the resources required to fulfil the order is as follows:

Unit-level expenses		
Direct materials (500 × £22)	11 000	
Direct labour (500 × 2 hours × £10)	10 000	
Machining (500 × 1 hour × £30)	15 000	36 000
Batch-level expenses		
Purchasing and receiving materials and components (6 × £100)	600	
Scheduling production (4 production runs × £250)	1000	
Setting-up machines (4 production runs × 3 hours × £120)	1440	
Packaging and delivering (1 delivery at £400)	400	3 440
Product-sustaining expenses		
Engineering design and support (50 hours × £80)		4 000

Customer-sustaining expenses		
Marketing and order negotiation (2 visits × £300 per visit)	600	
Customer support (50 support hours × £50)	2500	3 100
Total cost of resources (excluding facility-sustaining costs)		46 540

The full cost (excluding facility-sustaining costs) of the order is £46 540. It was pointed out in the previous chapter that facility-sustaining costs are incurred to support the organization as a whole and not for individual products. Therefore they should not be allocated to products for most decisions. Any allocation will be arbitrary. However, such costs must be covered by sales revenues, and for pricing purposes their allocation can be justified as long as they are separately reported.

What allocation base should be used for facility-sustaining costs? The answer is a base that will influence behaviour that the organization wishes to encourage. For example, if the organization has adopted a strategy of standardizing and reducing the number of separate parts maintained it could choose the number of parts as the allocation base. Thus, the facility-sustaining costs allocated to a product would increase with the number of parts used for an order and product designers would be motivated to use standard parts.

To determine a proposed selling price an appropriate percentage mark-up is added to the estimated cost. In our example facility-sustaining costs have not been allocated to the order. Thus the mark-up that is added should be sufficient to cover a fair share of facility-sustaining costs and provide a profit contribution. Where facility-sustaining costs are allocated a smaller percentage mark-up would be added since the mark-up is required to provide only a profit contribution. Let us assume that the Kalahari Company adds a mark-up of 20%. This would result in a mark-up of £9308 (20% × £46 540) being added to the cost estimate of £46 540, giving a proposed selling price of £55 848. The approach that we have adopted here is called **cost-plus pricing**. We shall discuss cost-plus pricing and the factors influencing the determination of the profit mark-ups later in the chapter.

Note that the activity-based cost information provides a better understanding of cost behaviour. The batch, product and customer-sustaining costs are unrelated to quantity ordered whereas the unit-level costs are volume related. This provides useful information for salespersons in negotiations with the customer relating to the price and size of the order. Assume that the customer considers purchasing 3000 units, instead of the 500 units originally quoted. If the larger order will enable the company to order 3000 components, instead of 500, and each production run for a component processes 3000 units instead of 500, the batch-level expenses will remain unchanged. Also the cost of the product and customer-sustaining activities will be the same for the larger order but the cost of the unit-level activity resources required will increase by a factor of six because six times the amount of resources will be required for the larger order. Thus the cost of the resources used for an order of 3000 units will be:

	(£)
Unit-level expenses (6 × £36 000[a])	216 000
Batch-level expenses	3 440
Product-sustaining expenses	4 000
Customer-sustaining expenses	3 100
Total cost of resources (excluding facility-sustaining costs)	226 540

Note

[a]Unit-level expenses for an order of 500 units multiplied by a factor of 6.

The cost per unit for a 500 unit order size is £93.08 (£46 540/500) compared with £75.51 (£226 540/3000) for a 3000 unit order size and the resulting proposed unit selling prices are £111.70 (£93.08 × 120%) and £90.61 (£75.51 × 120%) respectively.

PRICING NON-CUSTOMIZED PRODUCTS

In Example 7.1 the Kalahari Company was faced with a pricing decision for the sale of a highly customized product to a single customer. The pricing decision would have been based on direct negotiations with the customer for a known quantity. In contrast, a market leader must make a pricing decision, normally for large and unknown volumes, of a single product that is sold to thousands of different customers. To apply cost-plus pricing in this situation an estimate is required of sales volume to determine a unit cost which will determine the cost-plus selling price. This circular process occurs because we are now faced with two unknowns which have a cause-and-effect relationship, namely selling price and sales volume. In this situation it is recommended that cost-plus selling prices are estimated for a range of potential sales volumes. Consider the information presented in Example 7.2 (Case A).

You will see that the Auckland Company has produced estimates of total costs for a range of activity levels. Ideally, the cost estimates should be built up in a manner similar to the activity-based cost estimates that were used by the Kalahari Company in Example 7.2. However, for brevity the cost build-up is not shown. Instead of adding a percentage profit margin the Auckland Company has added a fixed lump sum target profit contribution of £2 million.

The information presented indicates to management the sales volumes, and their accompanying selling prices, that are required to generate the required profit contribution. The unit cost calculation indicates the break-even selling price at each sales volume that is required to cover the cost of the resources committed at that particular volume. Management must assess the likelihood of selling the specified volumes at the designated prices and choose the price which they consider has the highest probability of generating at least the specified sales volume. If none of the sales volumes are likely to be achieved at the designated break-even selling prices management must consider how demand can be stimulated and/or costs reduced to make the product viable. If neither of these, or other strategies, are successful the product should not be launched. The final decision must be based on management judgement and knowledge of the market.

The situation presented in Example 7.2 represents the most extreme example of the lack of market data for making a pricing decision. If we reconsider the pricing decision faced by the company it is likely that similar products are already marketed and information may be available relating to their market shares and sales volumes. Assuming that Auckland's product is differentiated from other similar products a relative comparison should be possible of its strengths and weaknesses and whether customers would be prepared to pay a price in excess of the prices of similar products. It is therefore possible that Auckland may be able to undertake market research to obtain rough approximations of demand levels at a range of potential selling prices. Let us assume that Auckland adopts this approach, and apart from this, the facts are the same as those given in Example 7.2 (Case A).

Now look at Case B in Example 7.2. The demand estimates are given for a range of selling prices. In addition the projected costs, sales revenues and profit contribution are shown. You can see that profits are maximized at a selling price of £80. The information also shows the effect of pursuing other pricing policies. For example, a lower selling price of £70 might be selected to discourage competition and ensure that a larger share of the market is obtained in the future. Where demand estimates are available ABC cost information should be presented for different potential volume levels and compared with projected sales revenues derived from estimated price/output relationships. Ideally, the cost projections should be based on a life-cycle costing approach to ensure that costs incurred over the whole of a product's life cycle are taken into account in the pricing decision. We shall look at life-cycle costing in Chapter 15.

EXAMPLE 7.2

Case A

The Auckland Company is launching a new product. Sales volume will be dependent on the selling price and customer acceptance but because the product differs substantially from other products within the same product category it has not been possible to obtain any meaningful estimates of price/demand relationships. The best estimate is that demand is likely to range between 100 000 and 200 000 units provided that the selling price is less than £100. Based on this information the company has produced the following cost estimates and selling prices required to generate a target profit contribution of £2 million from the product.

Sales volume (000's)	100	120	140	160	180	200
Total cost (£000's)	10 000	10 800	11 200	11 600	12 600	13 000
Required profit contribution (£000's)	2 000	2 000	2 000	2 000	2 000	2 000
Required sales revenues (£000's)	12 000	12 800	13 200	13 600	14 600	15 000
Required selling price to achieve target profit contribution (£)	120.00	106.67	94.29	85.00	81.11	75.00
Unit cost (£)	100.00	90.00	80.00	72.50	70.00	65.00

Case B

Assume now an alternative scenario for the product in Case A. The same cost schedule applies but the £2 million minimum contribution no longer applies. In addition, Auckland now undertakes market research. Based on this research, and comparisons with similar product types and their current selling prices and sales volumes, estimates of sales demand at different selling prices have been made. These estimates, together with the estimates of total costs obtained in Case A are shown below:

Potential selling price	£100	£90	£80	£70	£60
Estimated sales volume at the potential selling price (000's)	120	140	180	190	200
Estimated total sales revenue (£000's)	12 000	12 600	14 400	13 300	12 000
Estimated total cost (£000's)	10 800	11 200	12 600	12 800	13 000
Estimated profit (loss) contribution (£000s)	1 200	1 400	1 800	500	(1 000)

TARGET COSTING

Instead of using cost-plus pricing whereby cost is used as the starting point to determine the selling price, target costing is the reverse of this process. With target costing the starting point is the determination of the target selling price. Next a standard or desired profit margin is deducted to get a target cost for the product. The aim is to ensure that the future cost will not be higher than the target cost. The stages involved in target costing can be summarized as follows:

Stage 1: determine the target price which customers will be prepared to pay for the product;

Stage 2: deduct a target profit margin from the target price to determine the target cost;

Stage 3: estimate the actual cost of the product;

Stage 4: if estimated actual cost exceeds the target cost investigate ways of driving down the actual cost to the target cost.

The first stage requires market research to determine the customers' perceived value of the product, its differentiation value relative to competing products and the price of competing products. The target profit margin depends on the planned return on investment for the organization as a whole and profit as a percentage of sales. This is then decomposed into a target profit for each product which is then deducted from the target price to give the target cost. The target cost is compared with the predicted actual cost. If the predicted actual cost is above the target cost intensive efforts are made to close the gap. Product designers focus on modifying the design of the product so that it becomes cheaper to produce. Manufacturing engineers also concentrate on methods of improving production processes and efficiencies.

The aim is to drive the predicted actual cost down to the target cost but if the target cost cannot be achieved at the pre-production stage the product may still be launched if management are confident that the process of continuous improvement and learning curve effects will enable the target cost to be achieved early in the product's life. If this is not possible the product will not be launched.

The major attraction of target costing is that marketing factors and customer research provide the basis for determining selling price whereas cost tends to be the dominant factor with cost-plus pricing. A further attraction is that the approach requires the collaboration of product designers, production engineers, marketing and finance staff whose focus is on managing costs at the product design stage. At this stage costs can be most effectively managed because a decision to committing the firm to incur costs will not have been made.

Target costing is most suited for setting prices for non-customized and high sales volume products. It is also an important mechanism for managing the cost of future products. We shall therefore look at target costing in more detail when we focus on cost management in Chapter 15.

A price taker firm facing short-run product-mix decisions

Price taking firms may be faced with opportunities of taking on short-term business at a market determined selling price. In this situation the cost information that is required is no different from that of a price setting firm making a short-run pricing decision. In other words, accepting short-term business where the incremental sales revenues exceed incremental short-run costs will provide a contribution towards committed fixed costs which would not otherwise have been obtained. However, such business is acceptable only if the same conditions as those specified for a price setting firm apply. You should remember that these conditions are:

- sufficient capacity is available for all resources that are required from undertaking the business (if some resources are fully utilized, opportunity costs of the scarce resources must be covered by the selling price);
- the company will not commit itself to repeat longer-term business that is priced to cover only short-term incremental costs;

- the order will utilize unused capacity for only a short period and capacity will be released for use on more profitable opportunities.

Besides considering new short-term opportunities organizations may, in certain situations, review their existing product-mix over a short-term time horizon. Consider a situation where a firm has excess capacity which is being retained for an expected upsurge in demand. If committed resources are to be maintained then the product profitability analysis of existing products should be based on a comparison of incremental revenues with short-term incremental costs. The same principle applies as that which applied for accepting new short-term business where spare capacity exists. That is, in the short term products should be retained if their incremental revenues exceed their incremental short-term costs.

Where short-term capacity constraints apply, such that the firm has profitable products whose sales demand exceeds its productive capacity, the product-mix should be based on maximizing contribution per limiting production factor as described in Chapter 4. You may wish to refer back to Example 4.2 for an illustration of this approach. Do note, however, that in the longer-term capacity constraints can be removed.

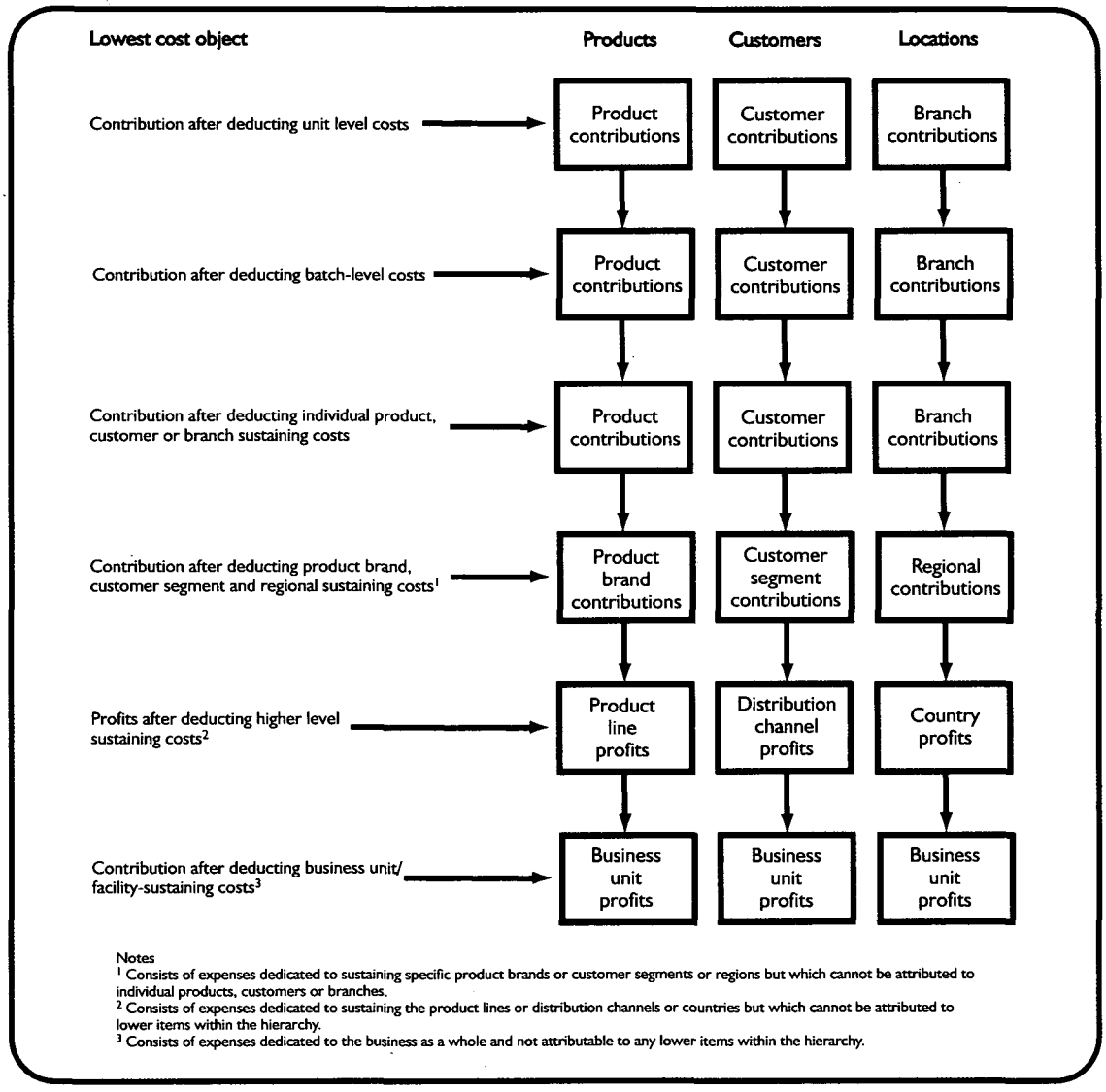
A price taker firm facing long-run product-mix decisions

When prices are set by the market a firm has to decide which products to sell given their market prices. In the longer-term a firm can adjust the supply of resources committed to a product. Therefore the sales revenue from a service or product should exceed the cost of all the resources that are committed to it. Hence there is a need to undertake periodic profitability analysis to distinguish between profitable and unprofitable products in order to ensure that only profitable products are sold. Activity-based profitability analysis should be used to evaluate each product's long-run profitability. In the previous chapter Figure 6.2 was used to illustrate ABC hierarchical profitability analysis. This diagram is repeated in the form of Figure 7.4. You will see that where products are the cost object four different hierarchical levels have been identified – the individual products, the product brand groupings, the product line and finally the whole business unit. At the individual product level all of the resources required for undertaking the unit, batch and product-sustaining activities that are associated with a product would no longer be required if that product were discontinued. Thus, if the product's sales revenues do not exceed the cost of the resources of these activities it should be subject to a special study for a discontinuation decision.

If product groups are marketed as separate brands the next level within the profitability hierarchy is brand profitability. The sum of the individual product profit contributions (that is, sales revenues less the cost of the unit, batch and product-sustaining activities) within a brand must be sufficient to cover those brand-sustaining expenses that can be attributed to the brand but not the individual products within the brand. Thus it is possible for each individual product within the product brand to generate positive contributions but for the brand grouping to be unprofitable because the brand-sustaining expenses exceed the sum of individual product contributions. In these circumstances a special study is required to consider alternative courses of action that can be undertaken to make the brand profitable.

Product line profitability is the next level in the hierarchy in Figure 7.4. The same principle applies. That is, if the product line consists of a number of separate groupings of branded and non-branded products the sum of their contributions (that is, sales revenues less the cost of the unit, batch, product-sustaining and brand-sustaining activities) should exceed those product-line sustaining expenses that are attributable to the product line as a

FIGURE 7.4 *An illustration of hierarchical profitability analysis.*



Notes
[1] Consists of expenses dedicated to sustaining specific product brands or customer segments or regions but which cannot be attributed to individual products, customers or branches.
[2] Consists of expenses dedicated to sustaining the product lines or distribution channels or countries but which cannot be attributed to lower items within the hierarchy.
[3] Consists of expenses dedicated to the business as a whole and not attributable to any lower items within the hierarchy.

whole but not the individual groupings of branded and non-branded products within the product line. Here a negative profit contribution would signal the need to undertake a major special study to investigate alternative courses of action relating to how the product line can be made profitable.

The final level in the profitability hierarchy shown in Figure 7.4 relates to the profitability of the business unit as a whole. Here the profit for the business unit can be determined by deducting the facility or business-sustaining expenses that are attributable to the business unit as a whole, but not to lower levels within the hierarchy, from the sum of the product line contributions. Clearly a business must generate profits in the long term if it is to survive. Note that the lower levels within the profit hierarchy are those above the final row in Figure 7.4.

Most of the decisions are likely to be made at the individual product level. Before discontinuing a product other alternatives or considerations must be taken into account at the special study stage. In some situations it is important to maintain a full product line for

> On the other hand, inability to estimate demand accurately scarcely excuses the substitution of cost information for demand information. Crude estimates of demand may serve instead of careful estimates of demand but cost gives remarkably little insight into demand.

It is often claimed that cost-based pricing formulae serve as a pricing 'floor' shielding the seller from a loss. This argument, however, is incorrect since it is quite possible for a firm to lose money even though every product is priced higher than the estimated unit cost. The reason for this is that if sales demand falls below the activity level that was used to calculate the fixed cost per unit, the total sales revenue may be insufficient to cover the total fixed costs. Cost-plus pricing will only ensure that all the costs will be met, and the target profits earned, if the sales volume is equal to, or more than, the activity level that was used to estimate total unit costs.

Consider a hypothetical situation where all of the costs attributable to a product are fixed in the short-term and amount to £1 million. Assume that the cost per unit is £100 derived from an estimated volume of 10 000 units. The selling price is set at £130 using the cost-plus method and a mark-up of 30%. If actual sales volume is 7000 units, sales revenues will be £910 000 compared with total costs of £1 million. Therefore the product will incur a loss of £90 000 even though it is priced above full cost.

REASONS FOR USING COST-PLUS PRICING

Considering the limitations of cost-plus pricing, why is it that these techniques are frequently used in practice? Baxter and Oxenfeldt (1961) suggest the following reasons:

> They offer a means by which plausible prices can be found with ease and speed, no matter how many products the firm handles. Moreover, its imposing computations look factual and precise, and its prices may well seem more defensible on moral grounds than prices established by other means. Thus a monopolist threatened by a public inquiry might reasonably feel that he is safeguarding his case by cost-plus pricing.

Another major reason for the widespread use of cost-plus pricing methods is that they may help a firm to predict the prices of other firms. For example, if a firm has been operating in an industry where average mark-ups have been 40% in the past, it may be possible to predict that competitors will be adding a 40% mark-up to their costs. Assuming that all the firms in the industry have similar cost structures, it will be possible to predict the price range within which competitors may price their products. If all the firms in an industry price their products in this way, it may encourage price stability.

In response to the main objection that cost-based pricing formulae ignore demand, we have noted that the actual price that is calculated by the formula is rarely adopted without amendments. The price is adjusted upwards or downwards after taking account of the number of sales orders on hand, the extent of competition from other firms, the importance of the customer in terms of future sales, and the policy relating to customer relations. Therefore it is argued that management attempts to adjust the mark-up based on the state of sales demand and other factors which are of vital importance in the pricing decision.

Pricing policies

Cost information is only one of many variables that must be considered in the pricing decision. The final price that is selected will depend upon the pricing policy of the company. A price-skimming or pricing penetration policy might be selected.

A **price-skimming policy** is an attempt to exploit those sections of the market that are relatively insensitive to price changes. For example, high initial prices may be charged to take advantage of the novelty appeal of a new product when demand is initially inelastic. A skimming pricing policy offers a safeguard against unexpected future increases in costs, or a large fall in demand after the novelty appeal has declined. Once the market becomes saturated, the price can be reduced to attract that part of the market that has not yet been exploited. A skimming pricing policy should not be adopted when a number of close substitutes are already being marketed. Here the demand curve is likely to be elastic, and any price in excess of that being charged for a substitute product by a competitor is likely to lead to a large reduction in sales.

A **penetration pricing policy** is based on the concept of charging low prices initially with the intention of gaining rapid acceptance of the product. Such a policy is appropriate when close substitutes are available or when the market is easy to enter. The low price discourages potential competitors from entering the market and enables a company to establish a large share of the market. This can be achieved more easily when the product is new, than later on when buying habits have become established.

Many products have a **product life cycle** consisting of four stages: introductory, growth, maturity and decline. At the introductory stage the product is launched and there is minimal awareness and acceptance of it. Sales begin to expand rapidly at the growth stage because of introductory promotions and greater customer awareness, but this begins to taper off at the maturity stage as potential new customers are exhausted. At the decline stage sales diminish as the product is gradually replaced with new and better versions.

Sizer (1989) suggests that in the introductory stage it may be appropriate to shade upwards or downwards the price found by normal analysis to create a more favourable demand in future years. For example, he suggests that limited production capacity may rule out low prices. Therefore a higher initial price than that suggested by normal analysis may be set and progressively reduced, if and when (a) price elasticity of demand increases or (b) additional capacity becomes available. Alternatively if there is no production capacity constraint, a lower price than that suggested by normal analysis may be preferred. Such a price may result in a higher sales volume and a slow competitive reaction, which will enable the company to establish a large market share and to earn higher profits in the long term.

At the maturity stage a firm will be less concerned with the future effects of current selling prices and should adopt a selling price that maximizes short-run profits.

Customer profitability analysis

In the past, management accounting reports have tended to concentrate on analysing profits by products. Increasing attention is now being given to analysing profits by customers using an activity-based costing approach. **Customer profitability analysis** provides important information that can be used to determine which classes of customers should be emphasized or de-emphasized and the price to charge for customer services. Kaplan and Cooper (1998) use Kanthal – a Harvard Business School case study – to illustrate the benefits of customer profitability analysis. Kanthal is a Swedish company that sells electric heating elements. Customer-related selling costs represent 34% of total costs. Until recently, Kanthal allocated these costs on the basis of sales value when special studies of customer profitability analysis were undertaken. An activity-based costing system was introduced that sought to explain the resources consumed by different customers. A detailed study of the resources used to service different types of customers identified two cost drivers:

1. Number of orders placed: each order had a large fixed cost, which did not vary with the quantity of items purchased. Thus a customer who placed 10 orders of 100 items per order generated 10 times more ordering cost than a customer who placed a single order of 1000 units.
2. Non-standard production items: these items were more costly to produce than standard items.

Kanthal estimated the cost per order and the cost of handling standard and non-standard items. A customer profitability analysis was prepared based on the sales for the previous year. This analysis revealed that only 40% of its customers were profitable and a further 10% lost 120% of the profits. In other words, 10% incurred losses equal to 120% of Kanthal's total profits. Two of the most unprofitable customers turned out to be among the top three in total sales volume. These two companies made many small orders of non-standard items.

Let us now look at an illustration of customer profitability analysis. Consider the information presented in Example 7.3. The profitability analysis in respect of the four customers is as follows:

	A	B	Y	Z
Customer attributable costs:				
Sales order processing	60 000	30 000	15 000	9 000
Sales visits	4 000	2 000	1 000	1 000
Normal deliveries	30 000	10 000	2 500	1 250
Special (urgent) deliveries	10 000	2 500	0	0
Credit collection[a]	24 658	8 220	1 370	5 480
	128 658	52 720	19 870	16 730
Operating profit contribution	90 000	120 000	70 000	200 000
Contribution to higher level sustaining expenses	(38 658)	67 280	50 130	183 270

Note

[a](Annual sales revenue × 10%) × (Average collection period/365)

You can see from the above analysis that A and B are high cost to serve whereas Y and Z are low cost to serve customers. Customer A provides a positive operating profit contribution but is unprofitable when customer attributable costs are taken into account. This is because customer A requires more sales orders, sales visits and normal and urgent deliveries than the other customers. In addition, the customer is slow to pay and has higher delivery costs than the other customers. Customer profitability analysis identifies the characteristics of high cost and low cost to serve customers and shows how customer profitability can be increased. The information should be used to persuade high cost to serve customers to modify their buying behaviour away from placing numerous small orders and/or purchasing non-standard items that are costly to make. For example, customer A can be made profitable if action is taken to persuade the customer to place a smaller number of larger quantity orders, avoid special deliveries and reduce the credit period. If unprofitable customers cannot be persuaded to change their buying behaviour selling prices should be increased (or discounts on list prices reduced) to cover the extra resources consumed. Thus ABC is required for customer profitability analysis so that the resources consumed by customers can be accurately measured.

The customer profitability analysis can also be used to rank customers by order of profitability based on **Pareto analysis**. This type of analysis is based on observations by Pareto that a very small proportion of items usually account for the majority of the value. For example, the Darwin Company might find that 20% of the customers account for 80%

EXAMPLE 7.3

The Darwin Company has recently adopted customer profitability analysis. It has undertaken a customer profitability review for the past 12 months. Details of the activities and the cost driver rates relating to those expenses that can be attributed to customers are as follows:

Activity	Cost driver rate
Sales order processing	£300 per sales order
Sales visits	£200 per sales visit
Normal delivery costs	£1 per delivery kilometre travelled
Special (urgent) deliveries	£500 per special delivery
Credit collection costs	10% per annum on average payment time

Details relating to four of the firm's customers are as follows:

Customer	A	B	Y	Z
Number of sales orders	200	100	50	30
Number of sales visits	20	10	5	5
Kilometres per delivery	300	200	100	50
Number of deliveries	100	50	25	25
Total delivery kilometres	30 000	10 000	2 500	1 250
Special (urgent deliveries)	20	5	0	0
Average collection period (days)	90	30	10	10
Annual sales	£1 million	£1 million	£0.5 million	£2 million
Annual operating profit contribution[a]	£90 000	£120 000	£70 000	£200 000

Note

[a]Consists of sales revenues less cost of unit-level and batch-related activities

EXHIBIT 7.4

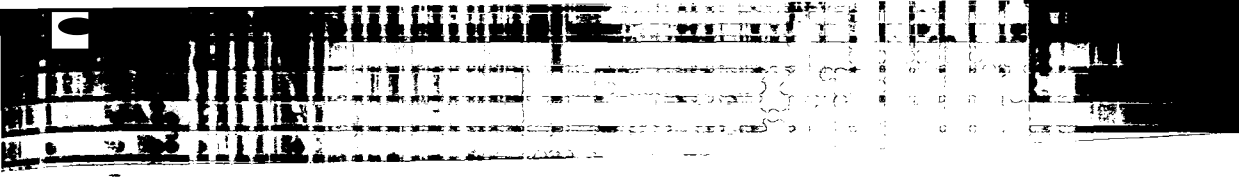
Surveys of practice

A survey of 187 UK organizations by Drury and Tayles (2000) indicated that 60% used cost-plus pricing. Most of the organizations that used cost-plus pricing indicated that it was applied selectively. It accounted for less than 10% of total sales revenues for 26% of the respondents and more than 50% for 39% of the organizations. Most of the firms (85%) used full cost and the remaining 15% used direct cost as the pricing base. The survey also indicated that 74% analysed profits either by customers or customer categories.

An earlier UK study by Innes and Mitchell (1995a) reported that 50% of the respondents had used customer profitability analysis and a further 12% planned to do so in the future. Of those respondents that ranked customer profitability 60% indicated that the Pareto 80/20 rule broadly applied (that, is 20% of the customers were generating 80% of the profits).

of the profits. Special attention can then be given to enhancing the relationships with the most profitable customers to ensure that they do not migrate to other competitors. In addition greater emphasis can be given to attracting new customers that have the same attributes as the most profitable customers.

Organizations, such as banks, often with a large customer base in excess of one million customers cannot apply customer profitability analysis at the individual customer level. Instead, they concentrate on customer segment profitability analysis by combining groups of customers into meaningful segments. This enables profitable segments to be highlighted where customer retention is particularly important and provides an input for determining the appropriate marketing strategies for attracting the new customers that have the most profit potential. Segment groupings that are used by banks include income classes, age bands, socio-economic categories and family units.



Summary

Many firms are price takers and do not have to make pricing decisions. Prices are set by overall market supply and demand forces. Here accounting information plays an important role in determining the mix of products to sell, given their market prices. Other firms are price setters. They sell highly customized or differentiated products and have some discretion over setting selling prices. For both price takers and price setters the decision time horizon determines the cost information that is relevant for product pricing or output-mix decisions. The accounting information that is required for the following four situations was therefore described:

1. a price setting firm facing short-run pricing decisions;
2. a price setting firm facing long-run pricing decisions;
3. a price taker firm facing short-run product-mix decisions;
4. a price taker firm facing long-run product-mix decisions.

For long-run pricing decisions cost-plus pricing and target costing were examined and for long-run product- and customer-mix decisions product and customer profitability analysis were described.

The optimal selling price is the price that determines the optimal volume at which total profits are maximized. This is where marginal revenue equals marginal cost. However, optimal selling prices are not easy to determine in practice because of the difficulty in estimating a product demand curve. Consequently many firms use cost-based pricing formulae even though they are subject to a number of limitations. First, demand is ignored and, secondly, the approach requires that some assumption be made about future volume prior to ascertaining the cost and calculating the selling prices. This may lead to an increase in the selling price when demand is declining, and vice versa. Thirdly, there is no guarantee that the total sales revenue will be in excess of total costs, even when each product is priced above 'Cost'.

There are several reasons why cost-based pricing formulae are frequently used in practice. One possible justification is that cost-based pricing methods encourage price stability by enabling firms to predict the prices of their competitors. Also, target mark-ups can be adjusted upwards or downwards according to expected demand, thus ensuring that demand is indirectly taken into account.

Note

1 In a monopolistic competitive market there are many sellers of similar but not necessarily identical products, with no single seller having a large enough share of the market to permit competitors to identify the effect of other individual sellers' pricing decisions on their sales.

Key Terms and Concepts

cost-plus pricing (p. 198)
customer profitability analysis (p. 207)
full cost (p. 196)
long-run cost (p. 196)
monopolistic/imperfect competition (p. 190)
Pareto analysis (p. 208)
penetration pricing policy (p. 207)
price elasticity of demand (p. 190)
price setters (p. 195)
price-skimming policy (p. 207)
price takers (p. 195)
product life cycle (p. 207)
target costing (p. 200)

Recommended Reading

Sizer (1989) has written extensively on pricing, and you are recommended to read Chapters 11 and 12 of his book. These chapters focus on different pricing policies and the information that management requires to make sound pricing decisions. For a review of the empirical studies on pricing decisions you should read Mills (1988). A more detailed description of target costing can be found in the article by Kato (1993) and the book written by Yoshikawa *et al.* (1993).

Review Problem

Wright is a builder. His business will have spare capacity over the coming six months and he has been investigating two projects.

Project A

Wright is tendering for a school extension contract. Normally he prices a contract by adding 100% to direct costs, to cover overheads and profit. He calculates direct costs as the actual cost of materials valued on a first-in-first-out basis, plus the estimated wages of direct labour. But for this contract he has prepared more detailed information.

Four types of material will be needed:

	Quantity (units):		Price per unit:		
Material	Needed for contract	Already in stock	Purchase price of units in stock (£)	Current purchase price (£)	Current resale price (£)
Z	1100	100	7.00	10.00	8.00
Y	150	200	40.00	44.00	38.00
X	600	300	35.00	33.00	25.00
W	200	400	20.00	21.00	10.00

Z and Y are in regular use. Neither X nor W is currently used; X has no foreseeable use in the business, but W could be used on other jobs in place of material currently costing £16 per unit.

The contract will last for six months and requires two craftsmen, whose basic annual wage cost is £16 000 each. To complete the contract in time it will also be necessary to pay them a bonus of £700 each. Without the contract they would be retained at their normal pay rates, doing work which will otherwise be done by temporary workers engaged for the contract period at a total cost of £11 800.

Three casual labourers would also be employed specifically for the contract at a cost of £4000 each.

The contract will require two types of equipment: general-purpose equipment already owned by Wright, which will be retained at the end of the contract, and specialized equipment to be purchased second-hand, which will be sold at the end of the contract.

The general-purpose equipment cost £21 000 two years ago and is being depreciated on a straight-line basis over a seven-year life (with assumed zero scrap value). Equivalent new equipment can be purchased currently for £49 000. Second-hand prices for comparable general-purpose equipment, and those for the relevant specialized equipment, are shown below.

	General-purpose equipment		Specialized equipment	
	Purchase price	Resale price (£)	Purchase price (£)	Resale price (£)
Current	20 000	17 200	9000	7400
After 6 months:				
if used for 6 months	15 000	12 600	7000	5800
if not used	19 000	16 400	8000	6500

The contract will require the use of a yard on which Wright has a four-year lease at a fixed rental of £2000 per year. If Wright does not get the contract the yard will probably remain empty. The contract will also incur administrative expenses estimated at £5000.

Project B

If Wright does not get the contract he will buy a building plot for £20 000 and build a house. Building costs will depend on weather conditions:

Weather condition	A	B	C
Probability	0.4	0.4	0.2
Building costs (excluding land)	£60 000	£80 000	£95 000

Similarly the price obtained for the house will depend on market conditions:

Market condition	D	E
Probability	0.7	0.3
Sale price (net of selling expenses)	£100 000	£120 000

Wright does not have the resources to undertake both projects.

The costs of his supervision time can be ignored.

Requirements

(a) Ignoring the possibility of undertaking project B, calculate:
  (i) the price at which Wright would tender for the school extension contract if he used his normal pricing method, and
  (ii) the tender price at which you consider Wright would neither gain nor lose by taking the contract. (10 marks)

(b) Explain, with supporting calculations, how the availability of project B should affect Wright's tender for the school extension contract. (5 marks)

(c) Discuss the merits and limitations of the pricing methods used above, and identify the circumstances in which they might be appropriate. (10 marks)

(Total 25 marks)

ICAEW

Solution to Review Problem

(a) (i) Contract price for contract A using the normal pricing method.

Materials	**(£)**
Z (100 × £7) + (1000 + £10)	10 700
Y (150 × £40)	6 000
X (300 × £35) + (300 × £33)	20 400
W (200 × £20)	4 000
	41 100
Labour: Craftsmen 2 × ($\frac{1}{2}$ × £16 000) + £700)	17 400
Labourers 3 × £4000	12 000
	70 500
Add 100% mark-up	70 500
Contract price	£141 000

(ii) Minimum price based on relevant costs

	(£)
Materials: Z (1100 × £10)	11 000
Y (150 × £44)	6 600
X (300 × £25) + (300 × £33)	17 400
W (200 × £16)	3 200
	38 200
Labour: Craftsmen (£11 800 + 2 × £700)	13 200
Labourers (3 × £4000)	12 000
Equipment: General purpose (£16 400 − £12 600)	3 800
Specialized (£9000 − £5800)	3 200
Administrative expenses	5 000
Contract price	75 400

It is assumed that the specialized equipment would be purchased new for £9000.

(b)

	(£)
Expected sales value (0.7 × £100 000) + (0.3 × £120 000)	106 000
Expected building costs (0.4 × £60 000) + (0.4 × £80 000) + (0.2 × £95 000)	(75 000)
Building plot	(20 000)
Expected profit	11 000

Using expected profit as a measure of the alternative use of the capacity, the minimum price using the relevant cost approach would be £86 400 (£75 400 + £11 000). In other words, Wright would wish to ensure that the contract price is in excess of the profit available from the alternative use of the facilities, and this would depend on his assessment of the 'utility value' of project B. Note that the expected value approach is covered in Chapter 8.

(c) This question requires a discussion of cost-plus pricing and the relevant cost (that is, opportunity cost) approach to pricing. For a discussion of the limitations and merits of cost-plus pricing see 'Limitations of cost-plus pricing' and 'Reasons for using cost-based pricing formulae' in Chapter 7. The advantages of basing selling prices on relevant costs include:

(i) The alternative uses of resources are incorporated into the analysis.
(ii) It distinguishes between relevant and irrelevant costs and indicates the incremental cash flows incurred in manufacturing and selling a product.
(iii) It provides the information to enable tenders to be made at more competitive prices.

The limitations include:

(i) It is a cost-based pricing method that ignores demand.
(ii) It may provide an incentive to sell at low prices, resulting in total sales revenue being insufficient to cover total fixed costs.
(iii) There is difficulty in determining the opportunity cost of resources because information on available opportunities may not be known.
(iv) Where special contracts are negotiated that are in excess of relevant (incremental) costs but less than full costs, there is a danger that customers will expect repeat business at this selling price. Care must be taken to ensure that negotiating 'special one-off' contracts does not affect the demand for other products.

Relevant cost pricing is more appropriate for 'one-off' pricing decisions. It is also appropriate in situations where a firm has unutilized capacity or can sell in differentiated markets at different prices. Relevant cost pricing may also be appropriate where the policy is to sell certain products as 'loss leaders'. It is important that cost information be used in a flexible manner and that product costs not be seen as the only factor that should determine the final selling price.

Questions

7.1

Discuss the extent to which cost data is useful in the determination of pricing policy. Explain the advantages and disadvantages of presenting cost data for possible utilization in pricing policy determination using an absorption, rather than a direct, costing basis. (14 marks)

ACCA

7.2

'In providing information to the product manager, the accountant must recognize that decision-making is essentially a process of choosing between competing alternatives, each with its own combination of income and costs; and that the relevant concepts to employ are future incremental costs and revenues and opportunity cost, not full cost which includes past or sunk costs.' (Sizer)

Descriptive studies of pricing decisions taken in practice have, on the other hand, suggested that the inclusion of overhead and joint cost allocations in unit product costs is widespread in connection with the provision of information for this class of decision. Furthermore, these costs are essentially historic costs.

You are required to:

(a) explain the reasoning underlying the above quotation; (10 marks)
(b) suggest reasons why overhead and joint cost allocation is nevertheless widely used in practice in connection with information for pricing decisions; (10 marks)
(c) set out your own views as to the balance of these arguments. (5 marks)

(Total 25 marks)

ICAEW

7.3

It has been stated that companies do not have profitable products, only profitable customers. Many companies have placed emphasis on the concept of Customer Account Profitability (CAP) analysis in order to increase their earnings and returns to shareholders. Much of the theory of CAP draws from the view that the main strategic thrust operated by many companies is to encourage the

development and sale of new products to existing customers.

Requirements:

(a) Briefly explain the concept of CAP analysis. (5 marks)

(b) Critically appraise the value of CAP analysis as a means of increasing earnings per share and returns to shareholders. (15 marks)

(Total 20 marks)

CIMA

7.4 Discussion of pricing strategies

A producer of high quality executive motor cars has developed a new model which it knows to be very advanced both technically and in style by comparison with the competition in its market segment.

The company's reputation for high quality is well-established and its servicing network in its major markets is excellent. However, its record in timely delivery has not been so good in previous years, though this has been improving considerably.

In the past few years it has introduced annual variations/improvements in its major models. When it launched a major new vehicle some six years ago the recommended retail price was so low in relation to the excellent specification of the car that a tremendous demand built up quickly and a two-year queue for the car developed within six months. Within three months a second-hand model had been sold at an auction for nearly 50% more than the list price and even after a year of production a sizeable premium above list price was being obtained.

The company considers that, in relation to the competition, the proposed new model will be as attractive as was its predecessor six years ago. Control of costs is very good so that accurate cost data for the new model are to hand. For the previous model, the company assessed the long-term targeted annual production level and calculated its prices on that basis. In the first year, production was 30% of that total.

For the present model the company expects that the relationship between first-year production and longer-term annual production will also be about 30%, though the absolute levels in both cases are expected to be higher than previously.

The senior management committee, of which you are a member, has been asked to recommend the pricing approach that the company should adopt for the new model.

You are required

(a) to list the major pricing approaches available in this situation and discuss in some detail the relative merits and disadvantages to the company of each approach in the context of the new model; (15 marks)

(b) to recommend which approach you would propose, giving your reasons; (5 marks)

(c) to outline briefly in which ways, if any, your answers to (a) and (b) above would differ if, instead of a high quality executive car, you were pricing a new family model of car with some unusual features that the company might introduce. (5 marks)

(Total 25 marks)

CIMA

7.5 Limiting factor analysis and a discussion of cost-plus pricing

AB p.l.c. makes two products, Alpha and Beta. The company made a £500 000 profit last year and proposes an identical plan for the coming year. The relevant data for last year are summarized in Table 1.

Table 1: Actuals for last year

	Product Alpha	**Product Beta**
Actual production and sales (units)	20 000	40 000
Total costs per unit	£20	£40
Selling prices per unit (25% on cost)	£25	£50
Machining time per unit (hours)	2	1
Potential demand at above selling prices (units)	30 000	50 000

Fixed costs were £480 000 for the year, absorbed on machining hours which were fully utilized for the production achieved.

A new Managing Director has been appointed and he is somewhat sceptical about the plan being proposed. Furthermore, he thinks that additional machining capacity should be installed to remove any production bottlenecks and wonders whether a more flexible pricing policy should be adopted.

Table 2 summarizes the changes in costs involved for the extra capacity and gives price/demand data, supplied by the Marketing Department, applicable to the conditions expected in the next period.

Table 2:

Costs

Extra machining capacity would increase fixed costs by 10% in total. Variable costs and machining times per unit would remain unchanged.

Price/demand data	Product Alpha	Product Beta
Price range (per unit)	£20–30	£45–55
Expected demand (000 units)	45–15	70–30

You are required to

(a) calculate the plan to maximize profits for the coming year based on the data and selling prices in Table 1; (7 marks)

(b) comment on the pricing system for the existing plan used in Table 1. (3 marks)

7.6 Computation of minimum selling price and optimum price from price–demand relationships

In an attempt to win over key customers in the motor industry and to increase its market share, BIL Motor Components plc has decided to charge a price lower than its normal price for component TD463 when selling to the key customers who are being targeted. Details of component TD463's standard costs are as follows:

	Component TD463 Batch size 200 units			
	Machine Group 1 (£)	Machine Group 7 (£)	Machine Group 29 (£)	Assembly (£)
Materials (per unit)	26.00	17.00	—	3.00
Labour (per unit)	2.00	1.60	0.75	1.20
Variable overheads (per unit)	0.65	0.72	0.80	0.36
Fixed overheads (per unit)	3.00	2.50	1.50	0.84
	31.65	21.82	3.05	5.40
Setting-up costs per batch of 200 units	£10.00	£6.00	£4.00	—

Required:

(a) Compute the lowest selling price at which one batch of 200 units could be offered, and critically evaluate the adoption of such a pricing policy. (8 marks)

(b) The company is also considering the launch of a new product, component TDX489, and has provided you with the following information:

	Standard cost per box (£)
Variable cost	6.20
Fixed cost	1.60
	7.80

Market research forecast of demand:

Selling price (£)	13	12	11	10	9
Demand (boxes)	5000	6000	7200	11 200	13 400

The company only has enough production capacity to make 7000 boxes. However, it would be possible to purchase product TDX489 from a subcontractor at £7.75 per box for orders up to 5000 boxes and £7 per box if the orders exceed 5000 boxes.

Required:

Prepare and present a computation which illustrates which price should be selected in order to maximise profits. (8 marks)

(c) Where production capacity is the 'limiting factor', explain briefly the ways in which management can increase it without having to acquire more plant and machinery. (4 marks)

(Total 20 marks)

ACCA

7.7 Calculation of cost-plus selling price and an evaluation of pricing decisions

A firm manufactures two products EXE and WYE in departments dedicated exclusively to them. There are also three service departments, stores, maintenance and administration. No stocks are held as the products deteriorate rapidly.

Direct costs of the products, which are variable in the context of the whole business, are identified to each department. The step-wise apportionment of service department costs to the manufacturing departments is based on estimates of the usage of the service provided. These are expressed as percentages and assumed to be reliable over the current capacity range. The general factory overheads of £3.6m, which are fixed, are apportioned based on floor space occupied. The company establishes product costs based on budgeted

volume and marks up these costs by 25% in order to set target selling prices.

Extracts from the budgets for the forthcoming year are provided below:

	Annual volume (units)	
	EXE	WYE
Max capacity	200 000	100 000
Budget	150 000	70 000

	EXE	WYE	Stores	Maintenance	Admin
Costs (£m)					
Material	1.8	0.7	0.1	0.1	
Other variable	0.8	0.5	0.1	0.2	0.2
Departmental usage (%)					
Maintenance	50	25	25		
Administration	40	30	20	10	
Stores	60	40			
Floor space (sq m)	640	480	240	80	160

Required:

Workings may be £000 with unit prices to the nearest penny.

(a) Calculate the budgeted selling price of one unit of EXE and WYE based on the usual mark up. (5 marks)

(b) Discuss how the company may respond to each of the following independent events, which represent additional business opportunities.

(i) an enquiry from an overseas customer for 3000 units only of WYE where a price of £35 per unit is offered

(ii) an enquiry for 50 000 units of WYE to be supplied in full at regular intervals during the forthcoming year at a price which is equivalent to full cost plus 10%

In both cases support your discussion with calculations and comment on any assumptions or matters on which you would seek clarification. (11 marks)

(Total 16 marks)

ACCA

7.8 Cost-plus and relevant cost information for pricing decisions

Josun plc manufactures cereal based foods, including various breakfast cereals under private brand labels. In March the company had been approached by Cohin plc, a large national supermarket chain, to tender for the manufacture and supply of a crunchy style breakfast cereal made from oats, nuts, raisins, etc. The tender required Josun to quote prices for a 1.5 kg packet at three different weekly volumes: 50 000, 60 000 and 70 000. Josun plc had, at present, excess capacity on some of its machines and could make a maximum of 80 000 packets of cereal a week.

Josun's management accountant is asked to prepare a costing for the Cohin tender. The company prepares its tender prices on the basis of full cost plus 15% of cost as a profit margin. The full cost is made up of five elements: raw materials per packet of £0.30p; operating wages £0.12p per packet; manufacturing overheads costed at 200% of operating wages; administration and other corporate overheads at 100% of operating wages; and packaging and transport costing £0.10p per packet. The sales manager has suggested that as an incentive to Cohin, the profit margin be cut on the 60 000 and 70 000 tenders by $\frac{1}{2}$% and 1% to $14\frac{1}{2}$% and 14% respectively. The manufacturing and administration overheads are forecast as fixed at £12 500 per week, unless output drops to 50 000 units or below per week, when a saving of £1000 per week can be made. If no contract is undertaken then all the manufacturing and administration overheads will be saved except for £600 per week. If the tender is accepted the volume produced and sold will be determined by the sales achieved by Cohin.

A week before the Cohin tender is to be presented for negotiation, Josun receives an enquiry from Stamford plc, a rival supermarket chain, to produce, weekly, 60 000 packets of a similar type of breakfast cereal of slightly superior quality at a price of £1.20 per 1.5 kg packet, the quality and mix of the cereal constituents being laid down by Stamford. This product will fill a gap in Stamford's private label range of cereals. The estimated variable costs for this contract would be: raw materials £0.40p per packet, operating labour £0.15p per packet and packaging and transport £0.12p per packet. None of the 80 000 weekly capacity could be used for another product if either of these contracts were taken up.

You are required to:

(a) compute the three selling prices per packet for the Cohin tender using Josun's normal pricing method; (3 marks)

(b) advise Josun, giving your financial reasons, on the relative merits of the two contracts; (6 marks)

(c) discuss the merits of full-cost pricing as a method of arriving at selling prices; (5 marks)

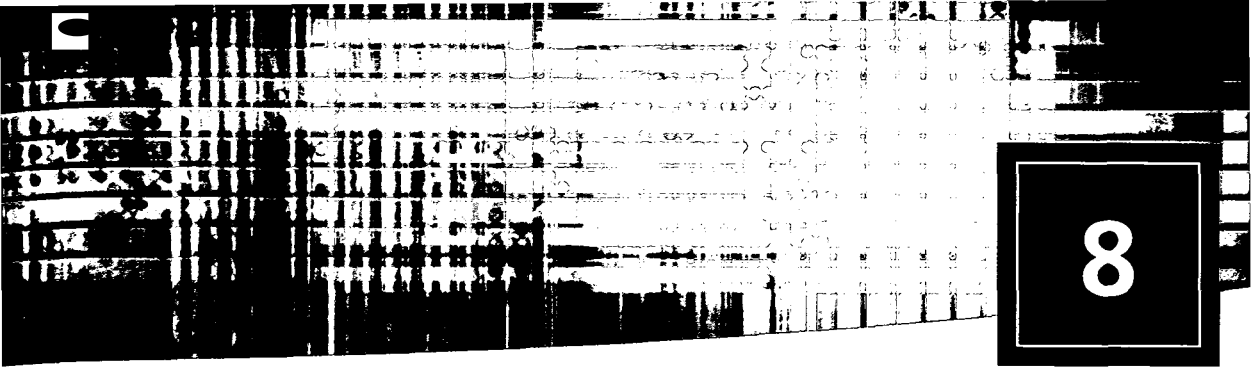
(d) make recommendations to Josun as to the method it might use to derive its selling prices in future; (3 marks)

(e) calculate the expected value of each tender given the following information and recommend which potential customer should receive the greater sales effort. It is estimated that there is a 70% chance of Stamford signing the contract for the weekly production of 60 000 packets, while there is a 20% chance of Cohin not accepting the tender. It is also estimated that the probabilities of Cohin achieving weekly sales volumes of 50 000, 60 000 or 70 000 are 0.3, 0.5 and 0.2 respectively. The two sets of negotiations are completely independent of each other; (4 marks)

(f) provide, with reasons, for each of the two contracts under negotiation, a minimum and a recommended price that Josun could ask for the extra quantity that could be produced under each contract and which would ensure the full utilization of Josun's weekly capacity of 80 000 packets. (4 marks)

(Total 25 marks)

ICAEW



8

Decision-making under conditions of risk and uncertainty

In Chapters 3, 4 and 7 we considered the use of a single representative set of estimates for predicting future costs and revenues when alternative courses of action are followed. For example, in Chapter 7 we used a single representative estimate of demand for each selling price. However, the outcome of a particular decision may be affected by an uncertain environment that cannot be predicted, and a single representative estimate does not therefore convey all the information that might reasonably influence a decision.

Let us now look at a more complicated example; consider a situation where a company has two mutually exclusive potential alternatives, A and B, which each yield receipts of £50 000. The estimated costs of alternative A can be predicted with considerable confidence, and are expected to fall in the range of £40 000–£42 000; £41 000 might be considered a reasonable estimate of cost. The estimate for alternative B is subject to much greater uncertainty, since this alternative requires high-precision work involving operations that are unfamiliar to the company's labour force. The estimated costs are between £35 000 and £45 000, but £40 000 is selected as a representative estimate. If we consider single representative estimates alternative B appears preferable, since the estimated profit is £10 000 compared with an estimated profit of £9000 for alternative A; but a different picture may emerge if we take into account the range of possible outcomes.

Alternative A is expected to yield a profit of between £8000 and £10 000 whereas the range of profits for alternative B is between £5000 and £15 000. Management may consider it preferable to opt for a fairly certain profit of between £8000 and £10 000 for alternative A rather than take the chance of earning a profit of £5000 from alternative B (even though there is the possibility of earning a profit of £15 000 at the other extreme).

This example demonstrates that there is a need to incorporate the uncertainty relating to each alternative into the decision-making process, and in this chapter we shall consider the various methods of doing this.

Learning objectives

After studying this chapter, you should be able to:

- calculate and explain the meaning of expected values;
- explain the role and limitation of standard deviation and coefficient of variation as a measure of risk;
- construct a decision tree when there is a range of alternatives and possible outcomes;
- calculate the value of perfect information;
- apply the maximin, maximax and regret criteria;
- explain the implications of portfolio analysis.

Risk and uncertainty

A distinction is often drawn by decision theorists between risk and uncertainty. **Risk** is applied to a situation where there are several possible outcomes and there is relevant past experience to enable statistical evidence to be produced for predicting the possible outcomes. **Uncertainty** exists where there are several possible outcomes, but there is little previous statistical evidence to enable the possible outcomes to be predicted. Most business decisions can be classified in the uncertainty category, but the distinction between risk and uncertainty is not essential for our analysis and we shall use the terms interchangeably.

Probabilities

The likelihood that an event or state of nature will occur is known as its **probability**, and this is normally expressed in decimal form with a value between 0 and 1. A value of 0 denotes a nil likelihood of occurrence whereas a value of 1 signifies absolute certainty – a definite occurrence. A probability of 0.4 means that the event is expected to occur four times out of ten. The total of the probabilities for events that can possibly occur must sum to 1.0. For example, if a tutor indicates that the probability of a student passing an examination is 0.7 then this means that the student has a 70% chance of passing the examination. Given that the pass/fail alternatives represent an exhaustive listing of all possible outcomes of the event, the probability of not passing the examination is 0.3.

The information can be presented in a **probability distribution**. A probability distribution is a list of all possible outcomes for an event and the probability that each will occur. The probability distribution for the above illustration is as follows:

Outcome	Probability
Pass examination	0.7
Do not pass examination	0.3
Total	1.0

Some probabilities are know as **objective probabilities** because they can be established mathematically or compiled from historical data. Tossing a coin and throwing a die are examples of objective probabilities. For example, the probability of heads occurring when tossing a coin logically must be 0.5. This can be proved by tossing the coin many times and observing the results. Similarly, the probability of obtaining number 1 when a die is thrown is 0.166 (i.e. one-sixth). This again can be ascertained from logical reasoning or recording the results obtained from repeated throws of the dice.

It is unlikely that objective probabilities can be established for business decisions, since many past observations or repeated experiments for particular decisions are not possible; the probabilities will have to be estimated based on managerial judgement. Probabilities established in this way are known as **subjective probabilities** because no two individuals will necessarily assign the same probabilities to a particular outcome. Subjective probabilities are based on an individual's expert knowledge, past experience, and observations of current variables which are likely to have an impact on future events. Such probabilities are unlikely to be estimated correctly, but any estimate of a future uncertain event is bound to be subject to error.

The advantage of this approach is that it provides more meaningful information than stating the most likely outcome. Consider, for example, a situation where a tutor is asked to state whether student A and student B will pass an examination. The tutor may reply that both students are expected to pass the examination. This is the tutor's estimate of the most likely outcome. However, the following probability distributions are preferable:

Outcome	Student A probability	Student B probability
Pass examination	0.9	0.6
Do not pass examination	0.1	0.4
Total	1.0	1.0

Such a probability distribution requires the tutor to specify the degree of confidence in his or her estimate of the likely outcome of a future event. This information is clearly more meaningful than a mere estimate of the most likely outcome that both students are expected to pass the examination, because it indicates that it is most unlikely that A will fail, whereas there is a possibility that B will fail. Let us now apply the principles of probability theory to business decision-making.

Probability distributions and expected value

The presentation of a probability distribution for each alternative course of action can provide useful additional information to management, since the distribution indicates the degree of uncertainty that exists for each alternative course of action. Probability distributions enable management to consider not only the possible profits (i.e. the payoff) from each alternative course of action but also the amount of uncertainty that applies to each alternative. Let us now consider the situation presented in Example 8.1.

From the probability distributions shown in Example 8.1 you will see that there is a 1 in 10 chance that profits will be £6000 for product A, but there is also a 4 in 10 chance that profits will be £8000. A more useful way of reading the probability distribution is to state that there is a 7 in 10 chance that profits will be £8000 or less. This is obtained by adding together the probabilities for profits of £6000, £7000 and £8000. Similarly, there is a 3 in 10 chance that profits will be £9000 or more.

EXPECTED VALUES

The expected value (sometimes called expected payoff) is calculated by weighting each of the profit levels (i.e. possible outcomes) in Example 8.1 by its associated probability. The sum of these weighted amounts is called the expected value of the probability distribution. In other words, the expected value is the weighted arithmetic mean of the possible outcomes. The expected values of £8000 and £8900 calculated for products A and B take into account a range of possible outcomes rather than using a single most likely estimate. For example, the single most likely estimate is the profit level with the highest probability attached to it. For both products A and B in Example 8.1 the single most likely estimate is £8000, which appears to indicate that we may be indifferent as to which product should be made. However the expected value calculation takes into account the possibility that a range of different profits are possible and weights these profits by the probability of their

EXAMPLE 8.1

A manager is considering whether to make product A or product B, but only one can be produced. The estimated sales demand for each product is uncertain. A detailed investigation of the possible sales demand for each product gives the following probability distribution of the profits for each product.

Product A probability distribution

(1) Outcome	(2) Estimated probability	(3) Weighted (col. 1 amount × col. 2) (£)
Profits of £6000	0.10	600
Profits of £7000	0.20	1400
Profits of £8000	0.40	3200
Profits of £9000	0.20	1800
Profits of £10 000	0.10	1000
	1.00	
	Expected value	8000

Product B probability distribution

(1) Outcome	(2) Estimated probability	(3) Weighted (col. 1 amount × col. 2) (£)
Profits of £4000	0.05	200
Profits of £6000	0.10	600
Profits of £8000	0.40	3200
Profits of £10 000	0.25	2500
Profits of £12 000	0.20	2400
	1.00	
	Expected value	8900

Which product should the company make?

occurrence. The weighted calculation indicates that product B is expected to produce the highest average profits in the future.

The expected value of a decision represents the long-run average outcome that is expected to occur if a particular course of action is undertaken many times. For example, if the decision to make products A and B is repeated on, say, 100 occasions in the future then product A will be expected to give an average profit of £8000 whereas product B would be expected to give an average profit of £8900. The expected values are the averages of the possible outcomes based on management estimates. There is no guarantee that the actual outcome will equal the expected value. Indeed, the expected value for product B does not appear in the probability distribution.

Measuring the amount of uncertainty

In addition to the expected values of the profits for the various alternatives, management is also interested in the degree of uncertainty of the expected future profits. For example, let us assume that another alternative course of action, say, product C, is added to the alternatives in Example 8.1 and that the probability distribution is as follows:

Product C probability distribution

Outcome	Estimated probability	Weighted amount (£)
Loss of £4000	0.5	(2 000)
Profit of £22 000	0.5	11 000
	Expected value	9 000

Product C has a higher expected value than either product A or product B, but it is unlikely that management will prefer product C to product B, because of the greater variability of the possible outcomes. In other words, there is a greater degree of uncertainty attached to product C.

The conventional measure of the dispersion of a probability distribution is the **standard deviation**. The standard deviation (σ) is the square root of the mean of the squared deviations from the expected value and is calculated from the following formula:

$$\sigma = \sqrt{\sum_{x=1}^{n}(A_x - \bar{A})^2 P_x} \tag{8.1}$$

where A_x are the profit-level observations, $\bar{A}$ is the expected or mean value, P_x is the probability of each outcome, and the summation is over all possible observations, where n is the total number of possibilities.

The square of the standard deviation σ^2 is known as the statistical variance of the distribution, and should not be confused with the variance from budget or standard cost, which will be discussed in subsequent chapters. The calculations of the standard deviations for products A and B in Example 8.1 are set out in Exhibit 8.1.

If we are comparing the standard deviations of two probability distributions with different expected values, we cannot make a direct comparison. Can you see why this should be so? Consider the following probability distribution for another product, say product D.

Product D probability distribution

Outcome	Estimated probability	Weighted amount (£)
Profits of £40 000	0.05	2 000
Profits of £60 000	0.10	6 000
Profits of £80 000	0.40	32 000
Profits of £100 000	0.25	25 000
Profits of £120 000	0.20	24 000
	Expected value	89 000

EXHIBIT 8.1

Calculation of standard deviations

The standard deviation for product D is £21 424, but all of the possible outcomes are ten times as large as the corresponding outcomes for product B. The outcomes for product D also have the same pattern of probabilities as product B, and we might conclude that the two projects are equally risky. Nevertheless,

Product A

(1) Profit (£)	(2) Deviation from expected value, $A_x - \overline{A}$ (£)	(3) Squared deviation $(A_x - \overline{A})^2$ (£)	(4) Probability	(5) Weighted amount (col. 3 × col. 4) (£)
6 000	–2000	4 000 000	0.1	400 000
7 000	–1000	1 000 000	0.2	200 000
8 000	0	—	0.4	—
9 000	+1000	1 000 000	0.2	200 000
10 000	+2000	4 000 000	0.1	400 000
			Sum of squared deviations	1 200 000
			Standard deviation	£1095.40
			Expected value	£8000

Product B

(1) Profit (£)	(2) Deviation $A_x - \overline{A}$ (£)	(3) Squared deviation $(A_x - \overline{A})^2$ (£)	(4) Probability	(5) Weighted amount (col. 3 × col. 4) (£)
4 000	–4900	24 010 000	0.05	1 200 500
6 000	–2900	8 410 000	0.10	841 000
8 000	–900	810 000	0.40	324 000
10 000	1 100	1 210 000	0.25	302 500
12 000	3100	9 610 000	0.20	1 922 000
			Sum of squared deviations	4 590 000
			Standard deviation	£2142.40
			Expected value	£8900

the standard deviation for product D is ten times as large as that for product B. This scale effect can be removed be replacing the standard deviation with a relative measure of dispersion. The relative amount of dispersion can be expressed by the coefficient of variation, which is simply the standard deviation divided by the expected value. The coefficient of variation for product B is 2142.40/8900 = 0.241 (or 24.1%), and for product D it is also 0.241 (21 424/89 000), thus indicating that the relative amount of dispersion is the same for both products.

In our discussion so far we have defined risk in terms of the spread of possible outcomes, so that risk may be large even if all the possible outcomes involve earning high profits. However, the risk attached to possible profits/losses obtained from alternative courses of action is not dispersion *per se* but the possibility of deviations *below* the

expected value of the profits. A decision-maker would hardly consider large possible deviations *above* the expected value undesirable. Consider the following probability distributions:

Product X probability distribution

Outcome	Estimated probability	Weighted amount (£)
Profits of £4000	0.1	400
Profits of £6000	0.3	1800
Profits of £8000	0.6	4800
	Expected value	7000

Product Y probability distribution

Outcome	Estimated probability	Weighted amount (£)
Profits of £6000	0.2	1200
Profits of £8000	0.5	4000
Profits of £12 000	0.3	3600
	Expected value	8800

The standard deviations are £1342 for X and £2227 for Y, giving coefficients of variations of 0.19 for X and 0.28 for Y. These measures indicate that the estimates of product Y are subject to a greater variability, but product X appears to be the riskier product since the probability of profits being less that £7000 (the expected value of X) is 0.4 for product X but only 0.2 for product Y. Clearly, the standard deviation and coefficient of variation are not perfect measures of risk, but the mathematical complexities of measuring only those deviations below the expected value are formidable for anything beyond the simplest situation. Measures such as expected values, standard deviations or coefficient of variations are used to summarize the characteristics of alternative courses of action, but they are poor substitutes for representing the probability distributions, since they do not provide the decision-maker with all the relevant information. There is an argument for presenting the entire probability distribution directly to the decision-maker. Such an approach is appropriate when management must select one from a small number of alternatives, but in situations where many alternatives need to be considered the examination of many probability distributions is likely to be difficult and time-consuming. In such situations management may have no alternative but to compare the expected values and coefficients of variation.

Attitudes to risk by individuals

How do we determine whether or not a risky course of action should be undertaken? The answer to this question depends on the decision-maker's attitude to risk. We can identify three possible attitudes: an aversion to risk, a desire for risk and an indifference to risk. Consider two alternatives, A and B, which have the following possible outcomes, depending on the state of the economy (i.e. the state of nature):

	Possible returns	
State of the economy	**A (£)**	**B (£)**
Recession	90	0
Normal	100	100
Boom	110	200

If we assume that the three states of the economy are equally likely then the expected value for each alternative is £100. A risk-seeker is one who, given a choice between more or less risky alternatives with identical expected values, prefers the riskier alternative (alternative B). Faced with the same choice, a risk-averter would select the less risky alternative (alternative A). The person who is indifferent to risk (risk neutral) would be indifferent to both alternatives because they have the same expected values. With regard to investors in general, studies of the securities markets provide convincing evidence that the majority of investors are risk-averse.

Let us now reconsider how useful expected value calculations are for choosing between alternative courses of action. Expected values represent a long-run average solution, but decisions should not be made on the basis of expected values alone, since they do not enable the decision-maker's attitude towards risk to be taken into account. Consider for example, a situation where two individuals play a coin-tossing game, with the loser giving the winner £5000. The expected value to the player who calls heads is as follows:

Outcome	**Cash flow (£)**	**Probability**	**Weighted amount (£)**
Heads	+5000	0.5	+2500
Tails	−5000	0.5	−2500
		Expected value	0

The expected value is zero, but this will not be the actual outcome if only one game is played. The expected-value calculation represents the average outcome only if the game is repeated on many occasions. However, because the game is to be played only once, it is unlikely that each player will find the expected value calculation on its own to be a useful calculation for decision-making. In fact, the expected value calculation implies that each player is indifferent to playing the game, but this indifference will only apply if the two players are neutral to risk. However, a risk-averter will find the game most unattractive. As most business managers are unlikely to be neutral towards risk, and business decisions are rarely repeated, it is unwise for decisions to be made solely on the basis of expected values. At the very least, expected values should be supplemented with measures of dispersion and, where possible, decisions should be made after comparing the probability distributions of the various alternative courses of action.

Decision-tree analysis

In the examples earlier in this chapter we have assumed that profits were uncertain because of the uncertainty of sales demand. In practice, more than one variable may be uncertain (e.g. sales and costs), and also the value of some variables may be dependent on the values of other variables. Many outcomes may therefore be possible, and some outcomes may be

EXAMPLE 8.2

A company is considering whether to develop and market a new product. Development costs are estimated to be £180 000, and there is a 0.75 probability that the development effort will be successful and a 0.25 probability that the development effort will be unsuccessful. If the development is successful, the product will be marketed, and it is estimated that:

1. if the product is very successful profits will be £540 000;
2. if the product is moderately successful profits will be £100 000;
3. if the product is a failure, there will be a loss of £400 000.

Each of the above profit and loss calculations is after taking into account the development costs of £180 000. The estimated probabilities of each of the above events are as follows:

1. Very successful	0.4
2. Moderately successful	0.3
3. Failure	0.3

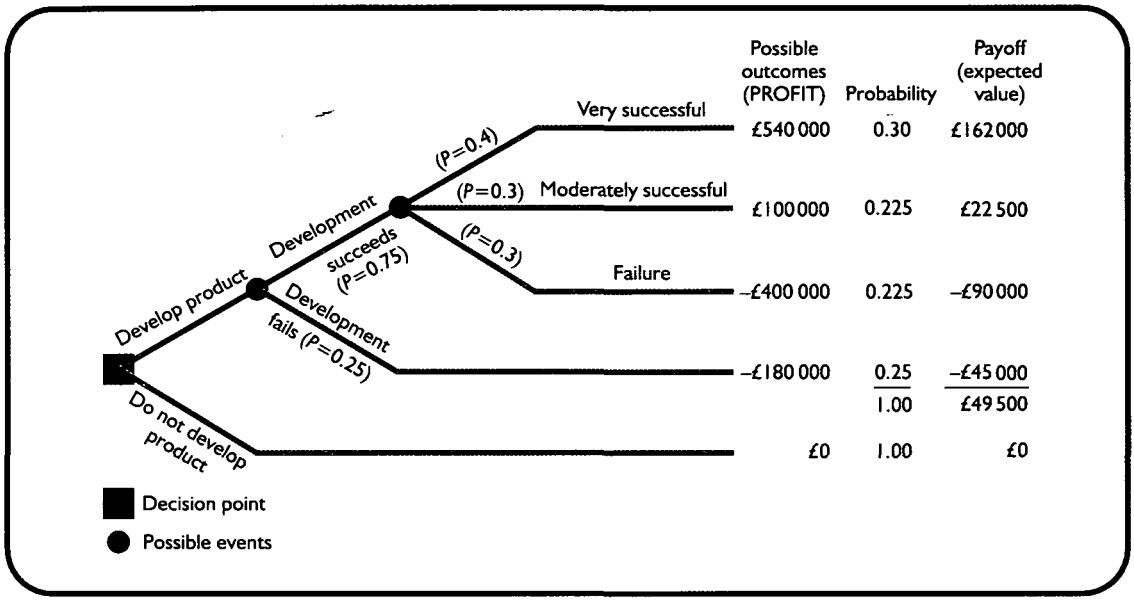
dependent on previous outcomes. A useful analytical tool for clarifying the range of alternative courses of action and their possible outcomes is a **decision tree**.

A decision tree is a diagram showing several possible courses of action and possible events (i.e. states of nature) and the potential outcomes for each course of action. Each alternative course of action or event is represented by a branch, which leads to subsidiary branches for further courses of action or possible events. Decision trees are designed to illustrate the full range of alternatives and events that can occur, under all envisaged conditions. The value of a decision tree is that its logical analysis of a problem enables a complete strategy to be drawn up to cover all eventualities before a firm becomes committed to a scheme. Let us now consider Example 8.2. This will be used to illustrate how decision trees can be applied to decision-making under conditions of uncertainty.

The decision tree for Example 8.2 is set out in Figure 8.1. The boxes indicate the point at which decisions have to be taken, and the branches emanating from it indicate the available alternative courses of action. The circles indicate the points at which there are environmental changes that affect the consequences of prior decisions. The branches from these points indicate the possible types of environment (**states of nature**) that may occur.

Note that the joint probability of two events occurring together is the probability of one event times the probability of the other event. For example, the probability of the development effort succeeding and the product being very successful consists of the products of the probabilities of these two events, i.e. 0.75 times 0.4, giving a probability of 0.30. Similarly, the probability of the development effort being successful and the product being moderately successful is 0.225 (0.75×0.3). The total expected value for the decision to develop the product consists of the sum of all the items in the expected value column on the 'Develop product' branch of the decision tree, i.e. £49 500. If we assume that there are no other alternatives available, other than the decision not to develop, the expected value of £49 500 for developing the product can be compared with the expected value of zero for not developing the product. Decision theory would suggest that the product should be developed because a positive expected value occurs. However, this does not mean that an outcome of £49 500 profit is guaranteed. The expected-value

FIGURE 8.1 *A simple decision tree.*



calculation indicates that if the probabilities are correct and this decision was repeated on many occasions an average profit of £49 500 would result.

Unfortunately, the decision will not be repeated on many occasions, and a run of repeated losses could force a company out of business before it has the chance to repeat similar decisions. Management may therefore prefer to examine the following probability distribution for developing the product that has been derived from Example 8.1:

Outcome	Probability
Loss of £400 000	0.225
Loss of £180 000	0.25
Profit of £100 000	0.225
Profit of £540 000	0.30

Management may decide that the project is too risky, since there is nearly a 0.5 probability of a loss occurring.

The decision tree provides a convenient means of identifying all the possible alternative courses of action and their interdependencies. This approach is particularly useful for assisting in the construction of probability distributions when many combinations of events are possible.

Buying perfect and imperfect information

When a decision-maker is faced with a series of uncertain events that might occur, he or she should consider the possibility of obtaining additional information about which event is likely to occur. This section considers how we can calculate the maximum amount it would be worth paying to acquire additional information from a particular source. The approach we shall take is to compare the expected value of a decision if the information is

acquired against the expected value with the absence of the information. The difference represents the maximum amount it is worth paying for the additional information. Consider Example 8.3.

Without the additional information, machine A will be purchased using the expected-value decision rule. If the additional information is obtained then this will give a perfect prediction of the level of demand, and the size of the machine can be matched with the level of demand. Therefore if demand is predicted to be low, machine A will be purchased, whereas if demand is predicted to be high, machine B will be purchased. The revised expected value is

$$(0.5 \times £100\,000) + (0.5 \times £200\,000) = £150\,000$$

You can see that the expected value is calculated by taking the highest profit in the case of low and high demand. When the decision to employ the market consultants is being taken, it is not known which level of demand will be predicted. Therefore the best estimate of the outcome from obtaining the additional information is a 0.5 probability that it will predict a low demand and a 0.5 probability that it will predict a high demand. (These are the probabilities that are currently associated with low and high demand.)

The value of the additional information is ascertained by deducting the expected value without the market survey (£130 000) from the expected value with the survey (£150 000). Thus the additional information increases expected value from £130 000 to £150 000 and the **expected value of perfect information** is £20 000. As long as the cost of obtaining the information is less than £20 000, the firm of market consultants should be employed.

In the above illustration it was assumed that the additional information would give a 100% accurate prediction of the expected demand. In practice, it is unlikely that *perfect* information is obtainable, but *imperfect* information (for example, predictions of future demand may be only 80% reliable) may still be worth obtaining. However, the value of imperfect information will always be less than the value of perfect information except when both equal zero. This would occur where the additional information would not change the decision. Note that the principles that are applied for calculating the value of imperfect information are the same as those we applied for calculating the value of perfect information, but the calculations are more complex. For an illustration see Scapens (1991).

Maximin, maximax and regret criteria

In some situations it might not be possible to assign meaningful estimates of probabilities to possible outcomes. Where this situation occurs managers might use any of the following criteria to make decisions: maximin, maximax or the criterion of regret.

The assumption underlying the **maximin criterion** is that the worst possible outcome will always occur and the decision-maker should therefore select the largest payoff under this assumption. Consider the Boston Company in Example 8.3. You can see that the worst outcomes are £100 000 for machine A and £10 000 for machine B. Consequently, machine A should be purchased using the maximin decision rule.

The **maximax criterion** is the opposite of maximin, and is based on the assumption that the best payoff will occur. Referring again to Example 8.3, the highest payoffs are £160 000 for machine A and £200 000 for machine B. Therefore machine B will be selected under the maximax criterion.

The **regret criterion** is based on the fact that, having selected an alternative that does not turn out to be the best, the decision-maker will regret not having chosen another

EXAMPLE 8.3

The Boston Company must choose between one of two machines – machine A has low fixed costs and high unit variable costs whereas machine B has high fixed costs and low unit variable costs. Consequently, machine A is most suited to low-level demand whereas machine B is suited to high-level demand. For simplicity assume that there are only two possible demand levels – low and high – and the estimated probability of each of these events is 0.5. The estimated profits for each demand level are as follows:

	Low demand (£)	High demand (£)	Expected value (£)
Machine A	100 000	160 000	130 000
Machine B	10 000	200 000	105 000

There is a possibility of employing a firm of market consultants who would be able to provide a perfect prediction of the actual demand. What is the maximum amount the company should be prepared to pay the consultants for the additional information?

alternative when he or she had the opportunity. Thus if in Example 8.3 machine B has been selected on the assumption that the high level of demand would occur, and the high level of demand actually did occur, there would be no regret. However, if machine A has been selected, the company would lose £40 000 (£200 000 – £160 000). This measures the amount of the regret. Similarly, if machine A was selected on the assumption that demand would be low, and the low level of demand actually did occur, there would be no regret; but if machine B was selected, the amount of the regret would be £90 000 (£100 000 – £10 000). This information is summarized in the following regret matrix:

	State of nature	
	Low demand (£)	High demand (£)
Choose machine A	0	40 000
Choose machine B	90 000	0

The aim of the regret criterion is to minimize the maximum possible regret. The maximum regret for machine A is £40 000 while that for Machine B is £90 000. Machine A would therefore be selected using the regret criterion.

Portfolio analysis

It is unwise for a firm to invest all its funds in a single project, since an unfavourable event may occur that will affect this project and have a dramatic effect on the firm's total financial position. A better approach would be for the firm to invest in a number of different projects. If this strategy is followed, an unfavourable event that affects one project may have relatively less effect on the remaining projects and thus have only a small impact on the firm's overall financial position. That is, a firm should not put all of its eggs in one

EXAMPLE 8.4

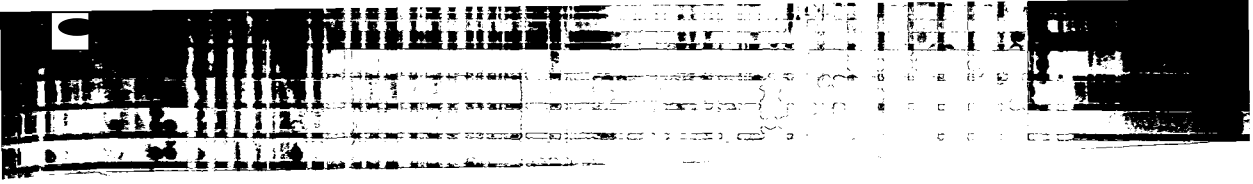
A firm which currently manufactures umbrellas is considering diversifying and investing in the manufacture of ice-cream. The predicted cash flows for the existing activities and the new project are shown below.

States of nature	Existing activities (Umbrella manufacturing) (£)	Proposed project (Ice-cream manufacturing) (£)	Combination of existing activities and the proposed project (£)
Sunshine	−40 000	+60 000	+20 000
Rain	+60 000	−40 000	+20 000

To simplify the illustration it is assumed that only two states of nature exist (rain or sunshine) and each has a probability of 0.5.

basket, but should try to minimize risk by spreading its investments over a variety of projects.

The collection of investments held by an individual investor or the collection of projects in which a firm invests is known as a **portfolio**. The objective in selecting a portfolio is to achieve certain desirable characteristics regarding risk and expected return. Let us now consider Example 8.4. From Example 8.4 it can be seen that both the existing activities (umbrella manufacturing) and the proposed new project (ice-cream manufacturing) are risky when considered on their own, but when they are combined, the risk is eliminated because whatever the outcome the cash inflow will be £20 000. Example 8.4 tells us that we should not only consider the risk of individual projects but should also take into account how the risks of potential new projects and existing activities co-vary with each other. Risk is eliminated completely in Example 8.4 because perfect negative correlation (i.e. where the correlation coefficient is −1) exists between the cash flows of the proposed project and the cash flows of the existing activities. When the cash flows are perfectly positively correlated (where the correlation is +1), risk reduction cannot be achieved when the projects are combined. For all other correlation values risk reduction advantages can be obtained by investing in projects that are not perfectly correlated with existing activities. The important point that emerges from the above discussion is that it is not the risk of individual projects in isolation that is of interest but rather the incremental risk that each project will contribute to the overall risk of the firm.



Summary

In this chapter we have considered some of the important methods of incorporating risk and uncertainty into the decision-making process. We have established that estimates incorporating a range of possible outcomes with probabilities attached to each outcome are preferable to a single estimate based on the most likely outcome.

The term 'expected value' refers to the weighted average (or mean) outcome of a range of possible values that are assigned to a particular alternative course of action. Because expected values represent a long-run average solution, based on the assumption that decisions are repeated many times, and do not take risk attitudes into account, it has been suggested that decisions should not be taken solely on the basis of expected values.

At the very least expected values should be supplemented by measures of dispersion such as the standard deviation and the coefficient of variation. However, measures of dispersion are imperfect measures of business risk; wherever possible probability distributions for various alternatives should be compared.

Where there are many possible outcomes for various alternatives, and where some outcomes are dependent on previous outcomes, decision trees are a useful tool for analysing each alternative.

Finally, it was pointed out that the degree of uncertainty attached to various alternatives should not be considered in isolation. Instead, how an alternative interacts with existing activities should be considered. The aim should be to measure the incremented, rather than the total risk, of a project.

Key Terms and Concepts

coefficient of variation (p. 226)
decision tree (p. 229)
expected value (p. 223)
expected value of perfect information (p. 231)
maximax criterion (p. 231)
maximin criterion (p. 231)
objective probabilities (p. 222)
portfolio (p. 233)
portfolio analysis (p. 232)
probability (p. 222)
probability distribution (p. 222)
regret criterion (p. 231)
risk (p. 222)
risk-averter (p. 228)
risk neutral (p. 228)
risk-seeker (p. 228)
single most likely estimate (p. 223)
standard deviation (p. 225)
states of nature (p. 229)
subjective probabilities (p. 222)
uncertainty (p. 222)

Recommended Reading

A more detailed treatment of decision trees can be found in Chapter 4 of Moore and Thomas (1991). For an explanation and illustration of how imperfect information can be valued you should refer to Chapter 7 of Scapens (1991).

Review Problem

Siteraze Ltd is a company which engages in site clearance and site preparation work. Information concerning its operations is as follows:

(i) It is company policy to hire all plant and machinery required for the implementation of all orders obtained, rather than to purchase its own plant and machinery.

(ii) Siteraze Ltd will enter into an advance hire agreement contract for the coming year at one of three levels – high, medium or low, which correspond to the requirements of a high, medium or low level of orders obtained.

(iii) The level of orders obtained will not be known when the advance hire agreement contract is entered into. A set of probabilities have been estimated by management as to the likelihood of the orders being at a high, medium or low level.

(iv) Where the advance hire agreement entered into is lower than that required for the level of orders actually obtained, a premium rate must be paid to obtain the additional plant and machinery required.

(v) No refund is obtainable where the advance hire agreement for plant and machinery is at a level in excess of that required to satisfy the site clearance and preparation orders actually obtained.

A summary of the information relating to the above points is as follows:

Level of orders	Turnover (£000)	Probability	Plant and machinery hire costs: Advance hire (£000)	Plant and machinery hire costs: Conversion premium (£000)
High	15 000	0.25	2300	
Medium	8 500	0.45	1500	
Low	4 000	0.30	1000	
Low to medium				850
Medium to high				1300
Low to high				2150

Variable cost (as percentage of turnover) 70%

Required: Using the information given above:

(a) Prepare a summary which shows the forecast net margin earned by Siteraze Ltd for the coming year for each possible outcome. (6 marks)

(b) On the basis of maximizing expected value, advise Siteraze whether the advance contract for the hire of plant and machinery should be at the low, medium or high level. (5 marks)

(c) Explain how the risk preferences of the management members responsible for the choice of advance plant and machinery hire contract may alter the decision reached in (b) above. (6 marks)

(d) Siteraze Ltd are considering employing a market research consultant who will be able to say with certainty in advance of the placing of the plant and machinery hire contract, which level of site clearance and preparation orders will be obtained. On the basis of expected value, determine the maximum sum which Siteraze Ltd should be willing to pay the consultant for this information. (5 marks)

(Total 22 marks)

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Solution to Review Problem

(a)

Alternative types of machine hire	Possible outcomes (level of orders)	Probability of outcomes	Payoff (£000)
High	High	0.25	2200 [(0.3 × £15 000) − £2300]
	Medium	0.45	250 [(0.3 × £8500) − £2300]
	Low	0.30	− 1100 [(0.3 × £4000) − £2300]
Medium	High	0.25	[1700 (0.3 × £15 000) − £1500] − £1300]
	Medium	0.45	1050 [(0.3 × £8500) − £1500]
	Low	0.30	− 300 [(0.3 × £4000) − £1500]
Low	High	0.25	[1350 (0.3 × £15 000) − £1000] − £2150]
	Medium	0.45	[700 (0.3 × £8500) − £1000 − £850]
	Low	0.30	200 [(0.3 × £4000) − £1000]

(b) Expected values:

$$\begin{aligned}\text{High hire level} &= (0.25 \times £2200) + (0.45 \times £250) - (0.3 \times £1100)\\ &= £332\,500\\ \text{Medium hire level} &= (0.25 \times £1700) + (0.45 \times £1050) - (0.3 \times £300)\\ &= £807\,500\\ \text{Low hire level} &= (0.25 \times £1350) + (0.45 \times £700) - (0.3 \times £200)\\ &= £721\,500\end{aligned}$$

Using the expected value decision rule, the medium hire contract should be entered into.

(c) Managers may be risk-averse, risk-neutral or risk-seeking. A risk-averse manager might adopt a maximin approach and focus on the worst possible outcome for each alternative and then select the alternative with the largest payoff. This approach would lead to the selection of the low initial hire level. A risk-seeking manager might adopt a maximiax approach and focus on the best possible outcomes. This approach would lead to choosing the high initial hire contract, since this has the largest payoff when only the most optimistic outcomes are considered.

(d) With perfect information, the company would select the advance plant and machinery hire alternative that would maximize the payoff. The probabilities of the consultants predicting high, medium and low demand are respectively 0.25, 0.45 and 0.30. The expected value calculation with the consultant's information would be:

	Advance hire level	Payoff (000)	Probability	Expected value (£000)
High market	high	2200	0.25	550
Medium market	medium	1050	0.45	472.5
Low market	low	200	0.30	60
				1082.5

	(£)
Expected value with consultant's information	1 082 500
Expected value without consultant's information	807 500
Maximum amount payable to consultant	275 000

Questions

8.1 Preparation of project statements for different demand levels and calculations of expected profit

Seeprint Limited is negotiating an initial one year contract with an important customer for the supply of a specialized printed colour catalogue at a fixed contract price of £16 per catalogue. Seeprint's normal capacity for producing such catalogues is 50 000 per annum.

Last year Seeprint Limited earned £11 000 profit per month from a number of small accounts requiring specialized colour catalogues. If the contract under negotiation is not undertaken, then a similar profit might be obtained from these customers next year, but, if it is undertaken, there will be no profit from such customers.

The estimated costs of producing colour catalogues of a specialized nature are given below.

The costs below are considered certain with the exception of the direct materials price.

Cost data:

	(£)
Variable costs per catalogue	
Direct materials	4.50
Direct wages	3.00
Direct expenses	1.30

Semi-variable costs	Output levels (capacity utilization) 80% (£)	100% (£)	120% (£)
Indirect materials	46 800	47 000	74 400
Indirect wages	51 200	55 000	72 000
Indirect expenses	6 000	8 000	9 600

Estimated fixed costs per annum:

Depreciation of specialist equipment	£ 8 000
Supervisory and management salaries	£20 000
Other fixed costs allocated to specialist colour catalogues production	£32 000

You are required to:

(a) Tabulate the costs and profits per unit and in total and the annual profits, assuming that the contract orders in the year are: (i) 40 000, (ii) 50 000 and (iii) 60 000 catalogues, at a direct material cost of £4.50 per catalogue. Comment on the tabulation you have prepared. (10 marks)

(b) Calculate the expected profit for the year if it is assumed that the probability of the total order is:

0.4 for 40 000 catalogues
0.5 for 50 000 catalogues
0.1 for 60 000 catalogues

and that the probability of direct material cost is:

0.5 at £4.50 per catalogue
0.3 at £5.00 per catalogue
0.2 at £5.50 per catalogue. (6 marks)

(c) Discuss the implications for Seeprint Limited of the acceptance or otherwise of the contract with the important customer. (6 marks)

(Total 22 marks)

ACCA

8.2 CVP analysis and uncertainty

(a) The accountant of Laburnum Ltd is preparing documents for a forthcoming meeting of the budget committee. Currently, variable cost is 40% of selling price and total fixed costs are £40 000 per year.

The company uses an historical cost accounting system. There is concern that the

level of costs may rise during the ensuing year and the chairman of the budget committee has expressed interest in a probabilistic approach to an investigation of the effect that this will have on historic cost profits. The accountant is attempting to prepare the documents in a way which will be most helpful to the committee members. He has obtained the following estimates from his colleagues:

	Average inflation rate over ensuing year	Probability
Pessimistic	10%	0.4
Most likely	5%	0.5
Optimistic	1%	0.1
		1.0

	Demand at current selling prices	Probability
Pessimistic	£50 000	0.3
Most likely	£75 000	0.6
Optimistic	£100 000	0.1
		1.0

The demand figures are given in terms of sales value at the current level of selling prices but it is considered that the company could adjust its selling prices in line with the inflation rate without affecting customer demand in real terms.

Some of the company's fixed costs are contractually fixed and some are apportionments of past costs; of the total fixed costs, an estimated 85% will remain constant irrespective of the inflation rate.

You are required to analyse the foregoing information in a way which you consider will assist management with its budgeting problem. Although you should assume that the directors of Laburnum Ltd are solely interested in the effect of inflation on historic cost profits, you should comment on the validity of the accountant's intended approach. As part of your analysis you are required to calculate:

(i) the probability of at least breaking even, and

(ii) the probability of achieving a profit of at least £20 000. (16 marks)

(b) It can be argued that the use of point estimate probabilities (as above) is too unrealistic because it constrains the demand and cost variables to relatively few values. Briefly describe an alternative simulation approach which might meet this objection. (6 marks)

(Total 22 marks)

ACCA

8.3 Pricing decision and the calculation of expected profit and margin of safety

E Ltd manufactures a hedge-trimming device which has been sold at £16 per unit for a number of years. The selling price is to be reviewed and the following information is available on costs and likely demand.

The standard variable cost of manufacture is £10 per unit and an analysis of the cost variances for the past 20 months show the following pattern which the production manager expects to continue in the future.

Adverse variances of +10% of standard variable cost occurred in ten of the months.

Nil variances occurred in six of the months.

Favourable variances of −5% of standard variable cost occurred in four of the months.

Monthly data

Fixed costs have been £4 per unit on an average sales level of 20 000 units but these costs are expected to rise in the future and the following estimates have been made for the total fixed cost:

	(£)
Optimistic estimate (Probability 0.3)	82 000
Most likely estimate (Probability 0.5)	85 000
Pessimistic estimate (Probability 0.2)	90 000

The demand estimates at the two new selling prices being considered are as follows:

If the selling price/unit is demand would be:	£17	£18
Optimistic estimate (Probability 0.2)	21 000 units	19 000 units
Most likely estimate (Probability 0.5)	19 000 units	17 500 units
Pessimistic estimate (Probability 0.3)	16 500 units	15 500 units

It can be assumed that all estimates and probabilities are independent.

You are required to

(a) advise management, based only on the information given above, whether they should alter the selling price and, if so, the price you would recommend; (6 marks)

(b) calculate the expected profit at the price you recommend and the resulting margin of safety, expressed as a percentage of expected sales; (6 marks)

(c) criticise the method of analysis you have used to deal with the probabilities given in the question; (4 marks)

(d) describe briefly how computer assistance might improve the analysis. (4 marks)

(Total 20 marks)

CIMA

8.4 Output decision based on expected values

A ticket agent has an arrangement with a concert hall that holds pop concerts on 60 nights a year whereby he receives discounts as follows per concert:

For purchase of:	He receives a discount of:
200 tickets	20%
300 tickets	25%
400 tickets	30%
500 tickets or more	40%

Purchases must be in full hundreds. The average price per ticket is £3.

He must decide in advance each year the number of tickets he will purchase. If he has any tickets unsold by the afternoon of the concert he must return them to the box office. If the box office sells any of these he receives 60% of their price.

His sales records over a few years show that for a concert with extremely popular artistes he can be confident of selling 500 tickets, for one with lesser known artistes 350 tickets, and for one with relatively unknown artistes 200 tickets.

His records also show that 10% of tickets he returns are sold by the box office.

His administration costs incurred in selling tickets are the same per concert irrespective of the popularity of the artistes.

There are two possible scenarios in which his sales records can be viewed:

Scenario 1: that, on average, he can expect concerts with lesser known artistes

Scenario 2: that the frequency of concerts will be:

	(%)
with popular artistes	45
with lesser known artistes	30
with unknown artistes	25
	100

You are required to calculate:

A. separately for each of Scenarios 1 and 2:
   (a) the expected demand for tickets per concert;
   (b) (i) the level of his purchases of tickets per concert that will give him the largest profit over a long period of time;
   (ii) the profit per concert that this level of purchases of tickets will yield;

B. for Scenario 2 only: the maximum sum per annum that the ticket agent should pay to a pop concert specialist for 100% correct predictions as to the likely success of each concert. (25 marks)

CIMA

8.5 Pricing decision based on competitor's response

In the market for one of its products, MD and its two major competitors (CN and KL) together account for 95% of total sales.

The quality of MD's products is viewed by customers as being somewhat better than that of its competitors and therefore at similar prices it has an advantage.

During the past year, however, when MD raised its price to £1.2 per litre, competitors kept their prices at £1.0 per litre and MD's sales declined even though the total market grew in volume.

MD is now considering whether to retain or reduce its price for the coming year. Its expectations about its likely volume at various prices charged by itself and its competitors are as follows:

Prices per litre			
MD (£)	CN (£)	KL (£)	MD's expected sales million litres
1.2	1.2	1.2	2.7
1.2	1.2	1.1	2.3

1.2	1.2	1.0	2.2
1.2	1.1	1.1	2.4
1.2	1.1	1.0	2.2
1.2	1.1	1.0	2.1
1.1	1.1	1.1	2.8
1.1	1.0	1.0	2.4
1.1	1.0	1.0	2.3
1.0	1.0	1.0	2.9

Experience has shown that CN tends to react to MD's price level and KL tends to react to CN's price level. MD therefore assesses the following probabilities:

If MD's price per litre is (£)	there is a probability of	that CN's price per litre will be (£)
1.2	0.2	1.2
	0.4	1.1
	0.4	1.0
	1.0	
1.1	0.3	1.1
	0.7	1.0
	1.0	
1.0	1.0	1.0

If CN's price per litre is (£)	there is a probability of	that KL's price per litre will be (£)
1.2	0.1	1.2
	0.6	1.1
	0.3	1.0
	1.0	
1.1	0.3	1.1
	0.7	1.0
	1.0	
1.0	1.0	1.0

Costs per litre of the product are as follows:

Direct wages	£0.24
Direct materials	£0.12
Departmental expenses:	
Indirect wages, maintenance and supplies	$16\frac{2}{3}$% of direct wages
Supervision and depreciation	£540 000 per annum
General works expenses (allocated)	$16\frac{2}{3}$% of prime cost
Selling and administration expenses (allocated)	50% of manufacturing cost

You are required to state whether, on the basis of the data given above, it would be most advantageous for MD to fix its price per litre for the coming year at £1.2, £1.1 or £1.0.

Support your answer with relevant calculations. (20 marks)

CIMA

8.6 Expected value, maximin and regret criterion

Stow Health Centre specialises in the provision of sports/exercise and medical/dietary advice to clients. The service is provided on a residential basis and clients stay for whatever number of days suits their needs.

Budgeted estimates for the next year ending 30 June are as follows:

(i) The maximum capacity of the centre is 50 clients per day for 350 days in the year.

(ii) Clients will be invoiced at a fee per day. The budgeted occupancy level will vary with the client fee level per day and is estimated at different percentages of maximum capacity as follows:

Client fee per day	Occupancy level	Occupancy as percentage of maximum capacity
£180	High	90%
£200	Most likely	75%
£220	Low	60%

(iii) Variable costs are also estimated at one of three levels per client day. The high, most likely and low levels per client day are £95, £85 and £70 respectively.

The range of cost levels reflect only the possible effect of the purchase prices of goods and services.

Required:

(a) Prepare a summary which shows the budgeted contribution earned by Stow Health Centre for the year ended 30 June for each of nine possible outcomes. (6 marks)

(b) State the client fee strategy for the next year to 30 June which will result from the use of each

of the following decision rules: (i) *maximax*; (ii) *maximin*; (iii) *minimax* regret.

Your answer should explain the basis of operation of each rule. Use the information from your answer to (a) as relevant and show any additional working calculations as necessary. (9 marks)

(c) The probabilities of variable cost levels occurring at the high, most likely and low levels provided in the question are estimated as 0.1, 0.6 and 0.3 respectively.

Using the information available, determine the client fee strategy which will be chosen where maximisation of expected value of contribution is used as the decision basis. (5 marks)

(d) The calculations in (a) to (c) concern contribution levels which may occur given the existing budget.

Stow Health Centre has also budgeted for fixed costs of £1 200 000 for the next year to 30 June.

Discuss ways in which Stow Health Centre may instigate changes, in ways other than through the client fee rate, which may influence client demand, cost levels and profit.

Your answer should include comment on the existing budget and should incorporate illustrations which relate to each of four additional performance measurement areas appropriate to the changes you discuss. (15 marks)

(Total 35 marks)

ACCA

8.7 Decision tree, expected value and maximin criterion

(a) The Alternative Sustenance Company is considering introducing a new franchised product, Wholefood Waffles.

Existing ovens now used for making some of the present 'Half-Baked' range of products could be used instead for baking the Wholefood Waffles. However, new special batch mixing equipment would be needed. This cannot be purchased, but can be hired from the franchiser in three alternative specifications, for batch sizes of 200, 300 and 600 units respectively. The annual cost of hiring the mixing equipment would be £5000, £15 000 and £21 500 respectively.

The 'Half-Baked' product which would be dropped from the range currently earns a contribution of £90 000 per annum, which it is confidently expected could be continued if the product were retained in the range.

The company's marketing manager considers that, at the market price for Wholefood Waffles of £0.40 per unit, it is equally probable that the demand for this product would be 600 000 or 1 000 000 units per annum.

The company's production manager has estimated the variable costs per unit of making Wholefood Waffles and the probabilities of those costs being incurred, as follows:

Batch size: Cost per unit (pence)	200 units Probability if annual sales are either 600 000 or 1 000 000 units	300 units Probability if annual sales are either 600 000 or 1 000 000 units	600 units Probability if annual sales are 600 000 units	600 units Probability if annual sales are 1 000 000
£0.20	0.1	0.2	0.3	0.5
£0.25	0.1	0.5	0.1	0.2
£0.30	0.8	0.3	0.6	0.3

You are required:

(i) to draw a decision tree setting out the problem faced by the company, (12 marks)

(ii) to show in each of the following three independent situations which size of mixing machine, if any, the company should hire:

(1) to satisfy a 'maximin' (or 'minimax' criterion),

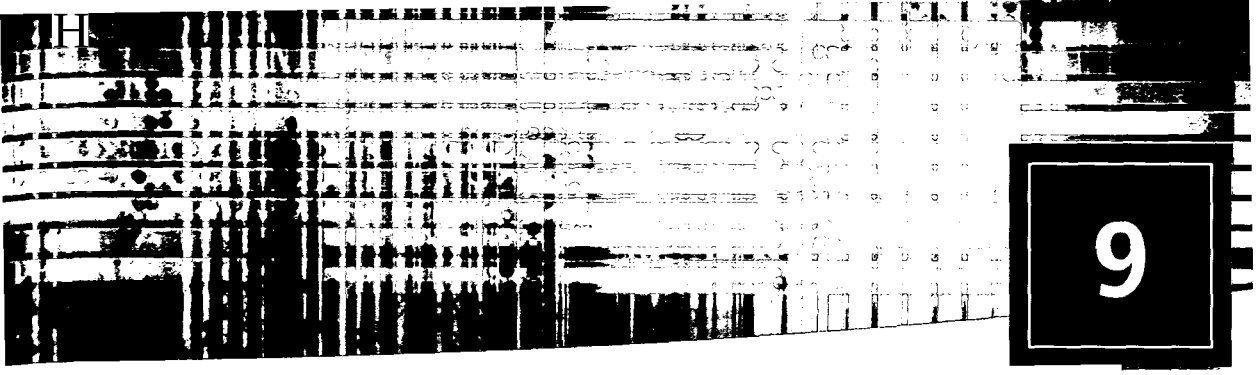
(2) to maximize the expected value of contribution per annum,

(3) to minimize the probability of earning an annual contribution of less than £100 000. (7 marks)

(b) You are required to outline briefly the strengths and limitations of the methods of analysis which you have used in part (a) above. (6 marks)

(Total 25 marks)

ICAEW



9

Capital investment decisions

Capital investment decisions are those decisions that involve current outlays in return for a stream of benefits in future years. It is true to say that all of the firm's expenditures are made in expectation of realizing future benefits. The distinguishing feature between short-term decisions and capital investment (long-term) decisions is time. Generally, we can classify short-term decisions as those that involve a relatively short time horizon, say one year, from the commitment of funds to the receipt of the benefits. On the other hand, capital investment decisions are those decisions where a significant period of time elapses between the outlay and the recoupment of the investment. We shall see that this commitment of funds for a significant period of time involves an interest cost, which must be brought into the analysis. With short-term decisions, funds are committed only for short periods of time, and the interest cost is normally so small that it can be ignored.

Capital investment decisions normally represent the most important decisions that an organization makes, since they commit a substantial proportion of a firm's resources to actions that are likely to be irreversible. Such decisions are applicable to all sectors of society. Business firms' investment decisions include investments in plant and machinery, research and development, advertising and warehouse facilities. Investment decisions in the public sector include new roads, schools and airports. Individuals' investment decisions include house-buying and the purchase of consumer durables. In this and the following chapter we shall examine the economic evaluation of the desirability of investment proposals. We shall concentrate on the investment decisions of business firms, but the same principles, with modifications, apply to individuals, and the public sector.

For most of the chapter we shall assume that the investments appraised are in firms that are all equity financed. In other words, projects are financed by either an issue of ordinary share capital or retained earnings. Later in the chapter we shall relax this assumption and assume that projects are financed by a combination of debt and equity capital.

Learning objectives

After studying this chapter, you should be able to:

- explain the opportunity cost of an investment;
- distinguish between compounding and discounting;
- explain the concept of net present value (NPV) and internal rate of return (IRR);
- calculate NPV, IRR, payback period and accounting rate of return;
- justify the superiority of NPV over the IRR;
- explain the limitations of payback and the accounting rate of return methods;
- describe the effect of performance measurement on capital investment decisions;
- calculate the incremental taxation payments arising from a proposed investment.

The opportunity cost of an investment

You will recall that in Chapter 1 we adopted the view that, broadly, firms seek to maximize the present value of future net cash inflows. It is therefore important that you acquire an intuitive understanding of the term 'present value'.

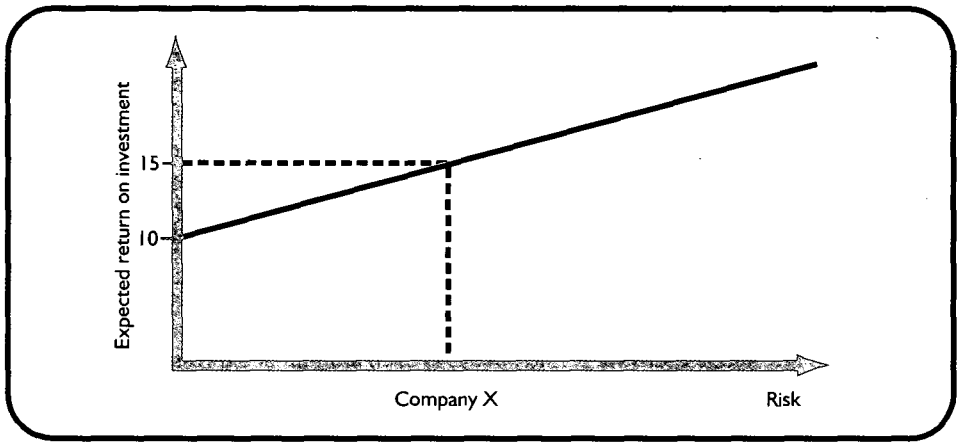
Investors can invest in securities traded in financial markets. If you prefer to avoid risk, you can invest in government securities, which will yield a *fixed interest* return. On the other hand, you may prefer to invest in *risky* securities such as the ordinary shares of companies quoted on the stock exchange. If you invest in the ordinary shares of a company, you will find that the return will vary from year to year, depending on the performance of the company and its future expectations. Investors normally prefer to avoid risk if possible, and will generally invest in risky securities only if they believe that they will obtain a greater return for the increased risk. Suppose that risk-free gilt-edged securities issued by the government yield a return of 10%. You will therefore be prepared to invest in ordinary shares only if you expect the return to be greater than 10%; let us assume that you require an *expected* return of 15% to induce you to invest in ordinary shares in preference to a risk-free security.

Suppose you invest in company X ordinary shares. Would you want company X to invest your money in a capital project that gives less than 15%? Surely not, assuming the project has the same risk as the alternative investments in shares of other companies that are yielding a return of 15%. You would prefer company X to invest in other companies' ordinary shares at 15% or, alternatively, to repay your investment so that you could invest yourself at 15%.

The rates of return that are available from investments in securities in financial markets such as ordinary shares and government gilt-edged securities represent the **opportunity cost of an investment** in capital projects; that is, if cash is invested in the capital project, it cannot be invested elsewhere to earn a return. A firm should therefore invest in capital projects only if they yield a return in excess of the opportunity cost of the investment. The opportunity cost of the investment is also known as the **minimum required rate of return**, **cost of capital**, **discount rate** or **interest rate**.

The return on securities traded in financial markets provides us with the opportunity costs, that is the required rates of return available on securities. The expected returns that investors require from the ordinary shares of different companies vary because some companies' shares are more risky than others. The greater the risk, the greater the expected returns. Consider Figure 9.1. You can see that as the risk of a security increases the return that investors require to compensate for the extra risk increases. Consequently, investors will expect to receive a return in excess of 15% if they invest in securities that have a higher risk than company X ordinary shares. If this return was not forthcoming, investors would not purchase high-risk securities. It is therefore important that companies investing in high-risk capital projects earn higher returns to compensate investors for this risk. You can also see that a risk-free security such as a gilt-edged government security yields the lowest return, i.e. 10%. Consequently, if a firm invests in a project with zero risk, it should earn a return in excess of 10%. If the project does not yield this return and no other projects are available then the funds earmarked for the project should be repaid to the shareholders as dividends. The shareholders could then invest the funds themselves at 10%.

FIGURE 9.1 *Risk–return trade-off.*



Compounding and discounting

Our objective is to calculate and compare returns on an investment in a capital project with an alternative equal risk investment in securities traded in the financial markets. This comparison is made using a technique called **discounted cash flow (DCF)** analysis. Because a DCF analysis is the opposite of the concept of **compounding interest**, we shall initially focus on compound interest calculations.

EXHIBIT 9.1

The value of £100 000 invested at 10%, compounded annually, for four years

Suppose you are investing £100 000 in a risk-free security yielding a return of 10% payable at the end of each year. Exhibit 9.1 shows that if the interest is reinvested, your investment will accumulate to £146 410 by the end of year 4. Period 0 in the first column of Exhibit 9.1 means that no time has elapsed or the time is *now*, period 1 means one year later, and so on. The values in Exhibit 9.1 can also be obtained by using the formula:

$$FV_n = V_0 (1 + K)^n \qquad (9.1)$$

End of year	Interest earned (£)	Total investment (£)
0		100 000
	0.10 × 100 000	10 000
1		110 000
	0.10 × 110 000	11 000
2		121 000
	0.10 × 121 000	12 100
3		133 100
	0.10 × 133 100	13 310
4		146 410

where FV_n denotes the future value of an investment in n years, V_0 denotes the amount invested at the beginning of the period (year 0), K denotes the rate of return on the investment and n denotes the number of years for which the money is invested. The calculation for £100 000 invested at 10% for two years is

$$FV_2 = £100\,000\,(1 + 0.10)^2 = £121\,000$$

In Exhibit 9.1 all of the year-end values are equal as far as the time value of money is concerned. For example, £121 000 received at the end of year 2 is equivalent to £100 000 received today and invested at 10%. Similarly, £133 100 received at the end of year 3 is equivalent to £121 000 received at the end of year 2, since £121 000 can be invested at the end of year 2 to accumulate to £133 100. Unfortunately, none of the amounts are directly comparable at any single moment in time, because each amount is expressed at a different point in time.

When making capital investment decisions, we must convert cash inflows and outflows for different years into a common value. This is achieved by converting the cash flows into their respective values at the same point in time. Mathematically, any point in time can be chosen, since all four figures in Exhibit 9.1 are equal to £100 000 at year 0, £110 000 at year 1, £121 000 at year 2, and so on. However, it is preferable to choose the point in time at which the decision is taken, and this is the present time or year 0. All of the values in Exhibit 9.1 can therefore be expressed in values at the present time (i.e. '**present value**') of £100 000.

The process of converting cash to be received in the future into a value at the present time by the use of an interest rate is termed **discounting** and the resulting present value is the **discounted present value**. Compounding is the opposite of discounting, since it is the future value of present value cash flows. Equation (9.1) for calculating future values can be rearranged to produce the present value formula:

$$V_0 \text{ (present value)} = \frac{FV_n}{(1 + K)^n} \tag{9.2}$$

By applying this equation, the calculation for £121 000 received at the end of year 2 can be expressed as

$$\text{present value} = \frac{£121\,000}{(1 + 0.10)^2} = £100\,000$$

You should now be aware that £1 received today is not equal to £1 received one year from today. No rational person will be equally satisfied with receiving £1 a year from now as opposed to receiving it today, because money received today can be used to earn interest over the ensuing year. Thus one year from now an investor can have the original £1 plus one year's interest on it. For example, if the interest rate is 10% each £1 invested now will yield £1.10 one year from now. That is, £1 received today is equal to £1.10 one year from today at 10% interest. Alternatively, £1 one year from today is equal to £0.9091 today, its present value because £0.9091, plus 10% interest for one year amounts to £1. The concept that £1 received in the future is not equal to £1 received today is known as the **time value of money**.

We shall now consider four different methods of appraising capital investments: the net present value, internal rate of return, accounting rate of return and payback methods. We shall see that the first two methods take into account the time value of money whereas the accounting rate of return and payback methods ignore this factor.

The concept of net present value

By using discounted cash flow techniques and calculating present values, we can compare the return on an investment in capital projects with an alternative equal risk investment in securities traded in the financial market. Suppose a firm is considering four projects (all of which are risk-free) shown in Exhibit 9.2. You can see that each of the projects is identical with the investment in the risk-free security shown in Exhibit 9.1 because you can cash in this investment for £110 000 in year 1, £121 000 in year 2, £133 100 in year 3 and £146 410 in year 4. In other words your potential cash receipts from the risk-free security are identical to the net cash flows for projects A, B, C and D shown in Exhibit 9.2. Consequently, the firm should be indifferent as to whether it uses the funds to invest in the projects or invests the funds in securities of identical risk traded in the financial markets.

The most straightforward way of determining whether a project yields a return in excess of the alternative equal risk investment in traded securities is to calculate the net present value (NPV). This is the present value of the net cash inflows less the project's initial investment outlay. If the rate of return from the project is greater than the return from an equivalent risk investment in securities traded in the financial market, the NPV will be positive. Alternatively, if the rate of return is lower, the NPV will be negative. A positive NPV therefore indicates that an investment should be accepted, while a negative value indicates that it should be rejected. A zero NPV calculation indicates that the firm should be indifferent to whether the project is accepted or rejected.

You can see that the present value of each of the projects shown in Exhibit 9.2 is £100 000. You should now deduct the investment cost of £100 000 to calculate the project's NPV. The NPV for each project is zero. The firm should therefore be indifferent to whether it accepts any of the projects or invests the funds in an equivalent risk-free security. This was our conclusion when we compared the cash flows of the projects with the investments in a risk-free security shown in Exhibit 9.1.

You can see that it is better for the firm to invest in any of the projects shown in Exhibit 9.2 if their initial investment outlays are less than £100 000. This is because we have to pay £100 000 to obtain an equivalent stream of cash flows from a security traded in the financial markets. Conversely, we should reject the investment in the projects if their initial investment outlays are greater than £100 000. You should now see that the NPV rule leads to a direct comparison of a project with an equivalent risk security

EXHIBIT 9.2

Evaluation of four risk-free projects

	A (£)	B (£)	C (£)	D (£)
Project investment outlay	100 000	100 000	100 000	100 000
End of year cash flows:				
Year 1	110 000	0	0	0
2	0	121 000	0	0
3	0	0	133 100	0
4	0	0	0	146 410
present value =	$\frac{110\,000}{1.10}$	$\frac{121\,000}{(1.10)^2}$	$\frac{133\,000}{(1.10)^3}$	$\frac{146\,410}{(1.10)^4}$
	= 100 000	= 100 000	= 100 000	= 100 000

traded in the financial market. Given that the present value of the net cash inflows for each project is £100 000, their NPVs will be positive (thus signifying acceptance) if the initial investment outlay is less than £100 000 and negative (thus signifying rejection) if the initial outlay is greater than £100 000.

Calculating net present values

You should now have an intuitive understanding of the NPV rule. We shall now learn how to calculate NPVs. The NPV can be expressed as:

$$\text{NPV} = \frac{FV_1}{1+K} + \frac{FV_2}{(1+K)^2} + \frac{FV_3}{(1+K)^3} + \cdots + \frac{FV_n}{(1+K)^n} - I_0 \qquad (9.3)$$

where I_0 represents the investment outlay and FV represents the future values received in years 1 to n. The rate of return K used is the return available on an equivalent risk security in the financial market. Consider the situation in Example 9.1.

EXAMPLE 9.1

The Bothnia Company is evaluating two projects with an expected life of three years and an investment outlay of £1 million. The estimated net cash inflows for each project are as follows:

	Project A (£)	Project B (£)
Year 1	300 000	600 000
Year 2	1 000 000	600 000
Year 3	400 000	600 000

The opportunity cost of capital for both projects is 10%. You are required to calculate the net present value for each project.

The net present value calculation for Project A is:

$$\text{NPV} = \frac{£300\,000}{(1.10)} + \frac{£1\,000\,000}{(1.10)^2} + \frac{£400\,000}{(1.10)^3} - £1\,000\,000 = +£399\,700$$

Alternatively, the net present value can be calculated by referring to a published table of present values. You will find examples of such a table if you refer to Appendix A (see pages 522–5). To use the table, simply find the discount factors by referring to each year of the cash flows and the appropriate interest rate.

For example, if you refer to year 1 in Appendix A, and the 10% column, this will show a discount factor of 0.9091. For years 2 and 3 the discount factors are 0.8264 and 0.7513. You then multiply the cash flows by the discount factors to find the present value of the cash flows. The calculation is as follows:

Year	Amount (£000s)	Discount factor	Present value (£)
1	300	0.9091	272 730
2	1000	0.8264	826 400
3	400	0.7513	300 520
			1 399 650
		Less initial outlay	1 000 000
		Net present value	399 650

The difference between the two calculations is due to rounding differences.

Note that the discount factors in the present value table are based on £1 received in n years time calculated according to the present value formula (equation 9.2). For example, £1 received in years 1, 2 and 3 when the interest rate is 10% is calculated as follows:

$$\text{Year } 1 = £1/1.10 = 0.9091$$
$$\text{Year } 2 = £1(1.10)^2 = 0.8264$$
$$\text{Year } 3 = £1(1.10)^3 = 0.7513$$

The positive net present value from the investment indicates the increase in the market value of the shareholders' funds which should occur once the stock market becomes aware of the acceptance of the project. The net present value also represents the potential increase in present consumption that the project makes available to the ordinary shareholders, after any funds used have been repaid with interest. For example, assume that the firm finances the investment of £1 million in Example 9.1 by borrowing £1 399 700 at 10% and repays the loan and interest out of the project's proceeds as they occur. You can see from the repayment schedule in Exhibit 9.3 that £399 700 received from the loan is available for current consumption, and the remaining £1 000 000 can be invested in the project. The cash flows from the project are just sufficient to repay the loan. Therefore acceptance of the project enables the ordinary shareholders' present consumption to be increased by the net present value of £399 700. Hence the acceptance of all available projects with a positive net present value should lead to the maximization of shareholders' wealth.

Let us now calculate the net present value for Project B. When the annual cash flows are constant, the calculation of the net present value is simplified. The discount factors when the cash flows are the same each year (that is, an annuity) are set out in Appendix B (see pages 526–9). We need to find the discount factor for 10% for three years. If you refer to Appendix B, you will see that it is 2.487. The NPV is calculated as follows:

Annual cash inflow	Discount factor	Present value (£)
£600 000	2.487	1 492 200
	Less investment cost	1 000 000
	Net present value	492 200

You will see that the total present value for the period is calculated by multiplying the cash inflow by the discount factor. It is important to note that the annuity tables shown in Appendix B can only be applied when the annual cash flows are the same each year.

The internal rate of return

The **internal rate of return** (IRR) is an alternative technique for use in making capital investment decisions that also takes into account the time value of money. The internal rate of return represents the true interest rate earned on an investment over the course of its

EXHIBIT 9.3

The pattern of cash flows assuming that the loan is repaid out of the proceeds of the project

Year	Loan outstanding at start of year (1) (£)	Interest at 10% (2) (£)	Total amount owed before repayment (3) = (1)+(2) (£)	Proceeds from project (4) (£)	Loan outstanding at year end (5) = (3)−(4) (£)
1	1 399 700	139 970	1 539 670	300 000	1 239 670
2	1 239 670	123 967	1 363 637	1 000 000	363 637
3	363 637	36 363	400 000	400 000	0

economic life. This measure is sometimes referred to as the **discounted rate of return**. The internal rate of return is the interest rate K that when used to discount all cash flows resulting from an investment, will equate the present value of the cash receipts to the present value of the cash outlays. In other words, it is the discount rate that will cause the net present value of an investment to be zero. Alternatively, the internal rate of return can be described as the maximum cost of capital that can be applied to finance a project without causing harm to the shareholders. The internal rate of return is found by solving for the value of K from the following formula:

$$I_0 = \frac{FV_1}{1+K} + \frac{FV_2}{(1+K)^2} + \frac{FV_3}{(1+K)^3} + \cdots + \frac{FV_n}{(1+K)^n} \tag{9.4}$$

It is easier, however, to use the discount tables. Let us now calculate the internal rate of return for Project A in Example 9.1.

The IRR can be found by trial and error by using a number of discount factors until the NPV equals zero. For example, if we use a 25% discount factor, we get a positive NPV of £84 800. We must therefore try a higher figure. Applying 35% gives a negative NPV of £66 530. We know then that the NPV will be zero somewhere between 25% and 35%. In fact, the IRR is approximately 30%, as indicated in the following calculation:

Year	Net cash flow (£)	Discount factor (30%)	Present value of cash flow (£)
1	300 000	0.7692	230 760
2	1 000 000	0.5917	591 700
3	400 000	0.4552	182 080
		Net present value	1 004 540
		Less initial outlay	1 000 000
		Net present value	4 540

It is claimed that the calculation of the IRR does not require the prior specification of the cost of capital. The decision rule is that if the IRR is greater than the opportunity cost of capital, the investment is profitable and will yield a positive NPV. Alternatively, if the IRR is less than the cost of capital, the investment is unprofitable and will result in a negative

NPV. Therefore any interpretation of the significance of the IRR will still require that we estimate the cost of capital. The calculation of the IRR is illustrated in Figure 9.2.

The dots in the graph represent the NPV at different discount rates. The point where the line joining the dots cuts the horizontal axis indicates the IRR (the point at which the NPV is zero). Figure 9.2 indicates that the IRR is 30%, and you can see from this diagram that the interpolation method can be used to calculate the IRR without carrying out trial and error calculations. When we use interpolation, we infer the missing term (in this case the discount rate at which NPV is zero) from a known series of numbers. For example, at a discount rate of 25% the NPV is +£84 800 and for a discount rate of 35% the NPV is −£66 530. The total distance between these points is £151 330 (+£84 800 and −£66 530). The calculation for the approximate IRR is therefore

$$25\% + \frac{84\,800}{151\,330} \times (35\% - 25\%) = 30.60\%$$

In other words, if you move down line A in Figure 9.2 from a discount rate of 25% by £84 800, you will reach the point at which NPV is zero. The distance between the two points on line A is £151 330, and we are given the discount rates of 25% and 35% for these points. Therefore 84 800/151 330 represents the distance that we must move between these two points for the NPV to be zero. This distance in terms of the discount rate is 5.60% [(84 800/151 330) × 10%], which, when added to the starting point of 25%, produces an IRR of 30.60%. The formula using the interpolation method is as follows:

$$A + \frac{C}{C - D}(B - A) \tag{9.5}$$

where A is the discount rate of the low trial, B is the discount rate of the high trial, C is the NPV of cash inflow of the low trial and D is the NPV of cash inflow of the high trial. Thus

$$\begin{aligned} 25\% &+ \left[\frac{84\,800}{84\,800 - (-66\,530)} \times 10\%\right] \\ &= 25\% + \left[\frac{84\,800}{151\,330} \times 10\%\right] \\ &= 30.60\% \end{aligned}$$

Note that the interpolation method only gives an approximation of the IRR. The greater the distance between any two points that have a positive and a negative NPV, the less accurate is the IRR calculation. Consider line B in Figure 9.2. The point where it cuts the horizontal axis is approximately 33%, whereas the actual IRR is 30.60%.

The calculation of the IRR is easier when the cash flows are of a constant amount each year. Let us now calculate the internal rate of return for project B in Example 9.1. Because the cash flows are equal each year, we can use the annuity table in Appendix B. When the cash flows are discounted at the IRR, the NPV will be zero. The IRR will therefore be at the point where

$$[\text{annual cash flow}] \times \left[\begin{array}{c}\text{discount factor for number of years} \\ \text{for which cash flow is received}\end{array}\right] - \left[\begin{array}{c}\text{investment} \\ \text{cost}\end{array}\right] = 0$$

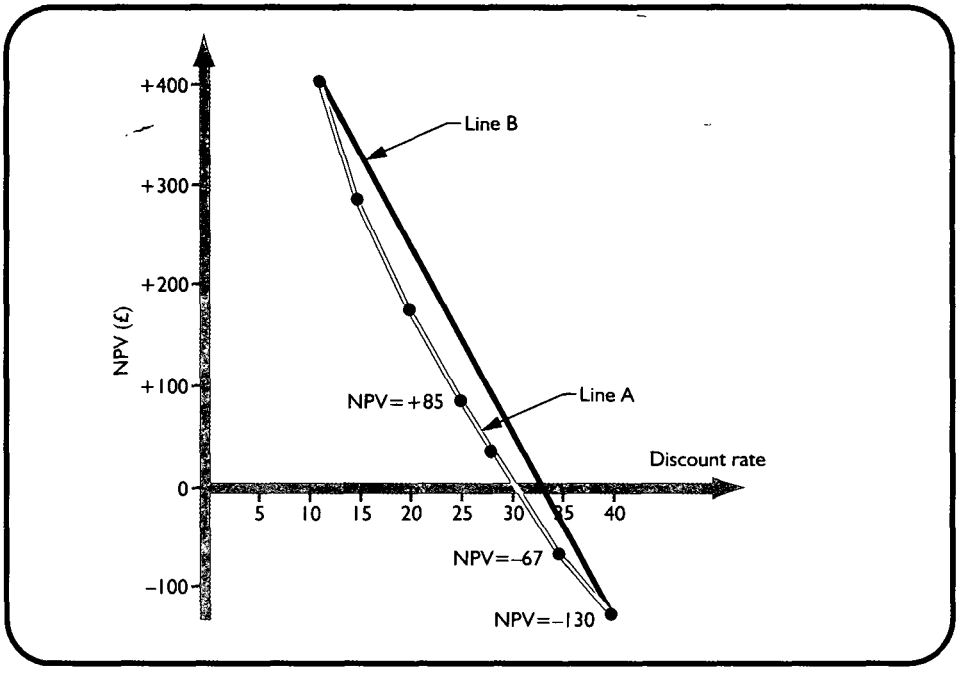
Rearranging this formula, the internal rate of return will be at the point where

$$\text{discount factor} = \frac{\text{investment cost}}{\text{annual cash flow}}$$

Substituting the figures for project B in Example 9.1,

$$\text{discount factor} = \frac{£1\,000\,000}{£600\,000} = 1.666$$

FIGURE 9.2 *Interpretation of the internal rate of return.*



We now examine the entries for the year 3 row in Appendix B to find the figures closest to 1.666. They are 1.673 (entered in the 36% column) and 1.652 (entered in the 37% column). We can therefore conclude that the IRR is between 36% and 37%. However, because the cost of capital is 10%, an accurate calculation is unnecessary; the IRR is far in excess of the cost of capital.

The calculation of the IRR can be rather tedious (as the cited examples show), but the trial-and-error approach can be programmed for fast and accurate solution by a computer or calculator. The calculation problems are no longer a justification for preferring the NPV method of investment appraisal. Nevertheless, there are theoretical justifications, which we shall discuss later in this chapter, that support the NPV method.

Relevant cash flows

Investment decisions, like all other decisions, should be analysed in terms of the cash flows that can be directly attributable to them. These cash flows should include the incremental cash flows that will occur in the future following acceptance of the investment. The cash flows will include cash inflows and outflows, or the inflows may be represented by savings in cash outflows. For example, a decision to purchase new machinery may generate cash savings in the form of reduced out-of-pocket operating costs. For all practical purposes such cost savings are equivalent to cash receipts.

It is important to note that depreciation is not included in the cash flow estimates for capital investment decisions, since it is a non-cash expense. This is because the capital investment cost of the asset to be depreciated is included as a cash outflow at the start of the project, and depreciation is merely a financial accounting method for allocating past capital costs to future accounting periods. Any inclusion of depreciation will lead to double counting.

Timing of cash flows

Our calculations have been based on the assumption that any cash flows in future years will occur in one lump sum at the year end. Obviously, this is an unrealistic assumption, since cash flows are likely to occur at various times throughout the year, and a more accurate method is to assume monthly cash flows and the monthly discount rates or continuous compounding. However, the use of annual cash flows enables all cash flows which occur in a single year to be combined and discounted in one computation. Even though the calculated results that are obtained are not strictly accurate, they are normally accurate enough for most decisions.

Comparison of net present value and internal rate of return

In many situations the internal rate of return method will result in the same decision as the net present value method. In the case of conventional projects (in which an initial cash outflow is followed by a series of cash inflows) that are independent of each other (i.e. where the selection of a particular project does not preclude the choice of the other), both NPV and IRR rules will lead to the same accept/reject decisions. However, there are also situations where the IRR method may lead to different decisions being made from those that would follow the adoption of the NPV procedure.

MUTUALLY EXCLUSIVE PROJECTS

Where projects are mutually exclusive, it is possible for the NPV and the IRR methods to suggest different rankings as to which project should be given priority. Mutually exclusive projects exist where the acceptance of one project excludes the acceptance of another project, for example the choice of one of several possible factory locations, or the choice of one of many different possible machines. When evaluating mutually exclusive projects the IRR method can incorrectly rank the projects, because of its reinvestment assumptions, and in these circumstances it is recommended that the NPV method is used.

PERCENTAGE RETURNS

A problem with the IRR rule is that it expresses the result as a percentage rather than in monetary terms. Comparison of percentage returns can be misleading; for example, compare an investment of £10 000 that yields a return of 50% with an investment of £100 000 that yields a return of 25%. If only one of the investments can be undertaken, the first investment will yield £5000 but the second will yield £25 000. If we assume that the cost of capital is 10%, and that no other suitable investments are available, any surplus funds will be invested at the cost of capital (i.e. the returns available from equal risk securities traded in financial markets). Choosing the first investment will leave a further £90 000 to be invested, but this can only be invested at 10%, yielding a return of £9000. Adding this to the return of £5000 from the £10 000 investment gives a total return of £14 000. Clearly, the second investment, which yields a return of £25 000, is preferable. Thus, if the objective is to maximize shareholders' wealth then NPV provides the correct measure.

REINVESTMENT ASSUMPTIONS

The assumption concerning the reinvestment of interim cash flows from the acceptance of projects provides another reason for supporting the superiority of the NPV method. The implicit assumption if the NPV method is adopted is that the cash flows generated from an investment will be reinvested at the cost of capital (i.e. the returns available from equal risk securities traded in financial markets). However, the IRR method makes a different implicit assumption about the reinvestment of the cash flows. It assumes that all the proceeds from a project can be reinvested to earn a return equal to the IRR of the original project. In theory, a firm will have accepted all projects which offer a return in excess of the cost of capital, and any other funds that become available can only be reinvested at the cost of capital. This is the assumption that is implicit in the NPV rule.

UNCONVENTIONAL CASH FLOWS

Where a project has unconventional cash flows, the IRR has a technical shortcoming. Most projects have conventional cash flows that consist of an initial negative cash flow followed by positive cash inflows in later years. In this situation the algebraic sign changes, being negative at the start and positive in all future periods. If the sign of the net cash flows changes in successive periods, it is possible for the calculations to produce as many internal rates of return as there are sign changes. While multiple rates of return are mathematically possible, only one rate of return is economically significant in determining whether or not the investment is profitable.

Fortunately, the majority of investment decisions consist of conventional cash flows that produce a single IRR calculation. However, the problem cannot be ignored, since unconventional cash flows are possible and, if the decision-maker is unaware of the situation, serious errors may occur at the decision-making stage. Example 9.2 illustrates a situation where two internal rates of return occur.

EXAMPLE 9.2

The Bothnia Company has the following series of cash flows for a specific project:

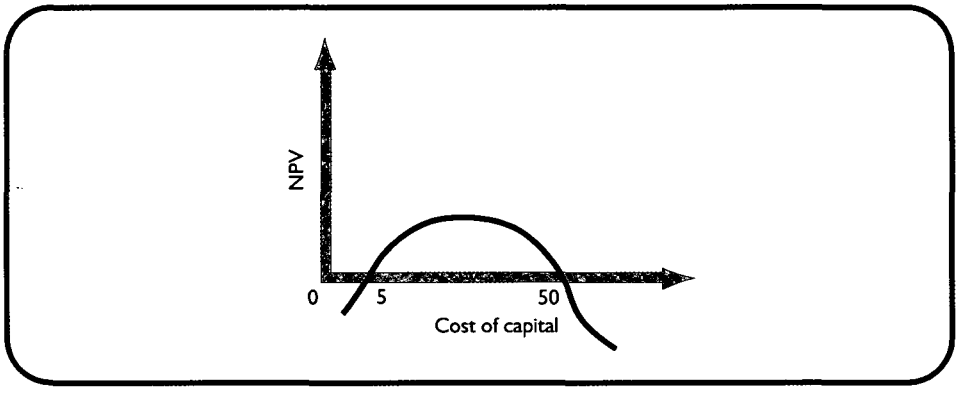
Year 0	−£400 000 (Investment outlay)
Year 1	+£1 020 000 (Net cash inflows)
Year 2	−£630 000 (Environmental and disposal costs)

You are required to calculate the internal rate of return.

You will find that the cash flows in Example 9.2 give internal rates of return of 5% and 50%. The effect of multiple rates of return on the NPV calculations is illustrated in Figure 9.3.

When the cost of capital is between 5% and 50%, the NPV is positive and, following the NPV rule, the project should be accepted. However, if the IRR calculation of 5% is used, the project may be incorrectly rejected if the cost of capital is in excess of 5%. You can see that the graph of the NPV in Figure 9.3 indicates that this is an incorrect decision when the cost of capital is between 5% and 50%. Alternatively, if the IRR of 50% is used, this will lead to the same decision being made as if the NPV rule were adopted, provided that the cost of capital is greater than 5%. Note that the NPV is negative if the cost of capital is less than 5%.

FIGURE 9.3 *Net present values for unconventional cash flows.*



Techniques that ignore the time value of money

In addition to those methods that take into account the time value of money two other methods that ignore this factor are frequently used in practice. These are the payback method and the accounting rate of return method. Methods that ignore the time value of money are theoretically weak, and they will not necessarily lead to the maximization of the market value of ordinary shares. Nevertheless, the fact that they are frequently used in practice means that we should be aware of these techniques and their limitations.

Payback method

The payback method is one of the simplest and most frequently used methods of capital investment appraisal. It is defined as the length of time that is required for a stream of cash proceeds from an investment to recover the original cash outlay required by the investment. If the stream of cash flows from the investment is constant each year, the payback period can be calculated by dividing the total initial cash outlay by the amount of the expected annual cash proceeds. Therefore if an investment requires an initial outlay of £60 000 and is expected to produce annual cash inflows of £20 000 per year for five years, the payback period will be £60 000 divided by £20 000, or three years. If the stream of expected proceeds is not constant from year to year, the payback period is determined by adding up the cash inflows expected in successive years until the total is equal to the original outlay. Example 9.3 illustrates two projects, A and B, that require the same initial outlay of £50 000 but that display different time profiles of benefits.

In Example 9.3 project A pays back its initial investment cost in three years, whereas project B pays back its initial cost in four years so that project A would be ranked in preference to project B. However, project B has a higher NPV, and the payback method incorrectly ranks project A in preference to project B. Two obvious deficiencies are apparent from these calculations. First, the payback method does not take into account cash flows that are earned after the payback date and, secondly, it fails to take into account the differences in the timing of the proceeds which are earned before the payback date. Payback computations ignore the important fact that future cash receipts cannot be validly compared with an initial outlay until they are discounted to their present values.

Not only does the payback period incorrectly rank project A in preference to project B, but the method can also result in the acceptance of projects that have a negative NPV. Consider the cash flows for project C in Example 9.4.

EXAMPLE 9.3

The cash flows and NPV calculations for two projects are as follows:

	Project A		Project B	
	(£)	(£)	(£)	(£)
Initial cost		50 000		50 000
Net cash inflows				
Year 1	10 000		10 000	
Year 2	20 000		10 000	
Year 3	20 000		10 000	
Year 4	20 000		20 000	
Year 5	10 000		30 000	
Year 6	—		30 000	
Year 7	—	80 000	30 000	140 000
NPV at a 10% cost capital		10 500		39 460

The payback period for project C is three years, and if this was within the time limit set by management, the project would be accepted in spite of its negative NPV. Note also that the payback method would rank project C in preference to project B in Example 9.3, despite the fact that B would yield a positive NPV.

The payback period can only be a valid indicator of the time that an investment requires to pay for itself, if all cash flows are first discounted to their present values and the discounted values are then used to calculate the payback period. This adjustment gives rise to what is known as the adjusted or **discounted payback method**. Even when such an adjustment is made, the adjusted payback method cannot be a complete measure of an investment's profitability. It can estimate whether an investment is likely to be profitable, but it cannot estimate how profitable the investment will be.

Despite the theoretical limitations of the payback method it is the method most widely used in practice (see Exhibit 9.4). Why, then, is payback the most widely applied formal

EXAMPLE 9.4

The cash flows and NPV calculation for project C are as follows:

	(£)	(£)
Initial cost		50 000
Net cash inflows		
Year 1	10 000	
Year 2	20 000	
Year 3	20 000	
Year 4	3 500	
Year 5	3 500	
Year 6	3 500	
Year 7	3 500	64 000
NPV (at 10% cost of capital)		(– 1036)

EXHIBIT 9.4

Surveys of practice

Surveys conducted by Pike relating to the investment appraisal techniques by 100 large UK companies between 1975 and 1992 provide an indication of the changing trends in practice in large UK companies. Pike's findings relating to the percentage of firms using different appraisal methods are as follows:

	1975 %	1981 %	1986 %	1992 %
Payback	73	81	92	94
Accounting rate of return	51	49	56	50
DCF methods (IRR or NPV)	58	68	84	88
Internal rate of return (IRR)	44	57	75	81
Net present value (NPV)	32	39	68	74

Source: Pike (1996)

A study of 300 UK manufacturing organizations by Drury *et al.* (1993) sought to ascertain the extent to which particular techniques were used. The figures below indicate the percentage of firms that often or always used a particular technique:

	All organizations %	Smallest organizations %	Largest organizations %
Payback (unadjusted)	63	56	55
Discounted payback	42	30	48
Accounting rate of return	41	35	53
Internal rate of return	57	30	85
Net present value	43	23	80

Few studies have been undertaken in mainland Europe. The following usage rates relate to surveys undertaken in the USA and Belgium. For comparative purposes Pike's UK study is also listed:

	UK[a] %	USA[b] %	Belgium[c] %
Payback	94	72	50
Accounting rate of return	50	65	65
Internal rate of return	81	91	77
Net present value	74	88	60
Discounted payback		65	68

[a] Pike (1996)
[b] Trahan and Gitman (1995)
[c] Dardenne (1998)

It is apparent from the above surveys that firms use a combination of appraisal methods. The studies by Pike indicate a trend in the increasing usage of discount rates. The Drury *et al.* study suggests that larger organizations use net present value and internal rate of return to a greater extent than the smaller organizations. The Drury *et al.* study also asked the respondents to rank the appraisal methods in order of importance for evaluating major projects. The larger organizations ranked internal rate of return first, followed by payback and net present value whereas the smaller organizations ranked payback first, internal rate of return second and intuitive management judgement third.

The use of the accounting rate of return probably reflects the fact that it is a widely used external financial accounting measure by financial markets and managers therefore wish to assess what impact a project will have on the external reporting of this measure. Also it is a widely used measure for evaluating managerial performance.

investment appraisal technique? It is a particularly useful approach for ranking projects where a firm faces liquidity constraints and requires a fast repayment of investments. The payback method may also be appropriate in situations where risky investments are made in uncertain markets that are subject to fast design and product changes or where future cash flows are extremely difficult to predict. The payback method assumes that risk is time-related: the longer the period, the greater the chance of failure. By concentrating on the early cash flows, payback uses data in which managers have greater confidence. Thus, the payback period can be used as a rough measure of risk, based on the assumption that the longer it takes for a project to pay for itself, the riskier it is. Managers may also choose projects with quick payback periods because of self-interest. If a manager's performance is measured using short-term criteria, such as net profits, there is a danger that he or she may choose projects with quick paybacks to show improved net profits as soon as possible. The payback method is also frequently used in conjunction with the NPV or IRR methods. It serves as a simple first-level screening device that identifies those projects that should be subject to more rigorous investigation. A further attraction of payback is that it is easily understood by all levels of management and provides an important summary measure: how quickly will the project recover its initial outlay? Ideally, the payback method should be used in conjunction with the NPV method, and the cash flows discounted before the payback period is calculated.

Accounting rate of return

The **accounting rate of return** (also known as the **return on investment** and **return on capital employed**) is calculated by dividing the average annual profits from a project into the average investment cost. It differs from other methods in that profits rather than cash flows are used. Note that profits are not equal to cash flows because financial accounting profit measurement is based on the accruals concept. Assuming that depreciation represents the only non-cash expense, profit is equivalent to cash flows less depreciation. The use of accounting rate of return can be attributed to the wide use of the return on investment measure in financial statement analysis.

When the average annual net profits are calculated, only additional revenues and costs that follow from the investment are included in the calculation. The average annual net profit is therefore calculated by dividing the difference between incremental revenues and costs by the estimated life of the investment. The incremental costs include either the *net* investment cost or the total depreciation charges, these figures being identical. The average

investment figure that is used in the calculation depends on the method employed to calculate depreciation. If straight-line depreciation is used, it is presumed that investment will decline in a linear fashion as the asset ages. The average investment under this assumption is one-half of the amount of the initial investment plus one-half of the scrap value at the end of the project's life.[1]

For example, the three projects described in Examples 9.3 and 9.4 for which the payback period was computed required an initial outlay of £50 000. If we assume that the projects have no scrap values and that straight-line depreciation is used, the average investment for each project will be £25 000. The calculation of the accounting rate of return for each of these projects is as follows:

$$\text{accounting rate of return} = \frac{\text{average annual profits}}{\text{average investment}}$$

$$\text{project A} = \frac{6\,000}{25\,000} = 24\%$$

$$\text{project B} = \frac{12\,857}{25\,000} = 51\%$$

$$\text{project C} = \frac{2\,000}{25\,000} = 8\%$$

For project A the total profit over its five-year life is £30 000 (£80 000–£50 000), giving an average annual profit of £6000. The average annual profits for projects B and C are calculated in a similar manner.

It follows that the accounting rate of return is superior to the payback method in one respect; that is, it allows for differences in the useful lives of the assets being compared. For example, the calculations set out above reflect the high earnings of project B over the whole life of the project, and consequently it is ranked in preference to project A. Also, projects A and C have the same payback periods, but the accounting rate of return correctly indicates that project A is preferable to project C.

However, the accounting rate of return suffers from the serious defect that it ignores the time value of money. When the method is used in relation to a project where the cash inflows do not occur until near the end of its life, it will show the same accounting rate of return as it would for a project where the cash inflows occur early in its life, providing that the average cash inflows are the same. For this reason the accounting rate of return cannot be recommended. Nevertheless, the accounting rate of return is widely used in practice (see Exhibit 9.4). This is probably due to the fact that the annual accounting rate of return is widely used to measure divisional managerial performance. Therefore, managers are likely to be interested in how any new investment contributes to the division's overall accounting rate of return.

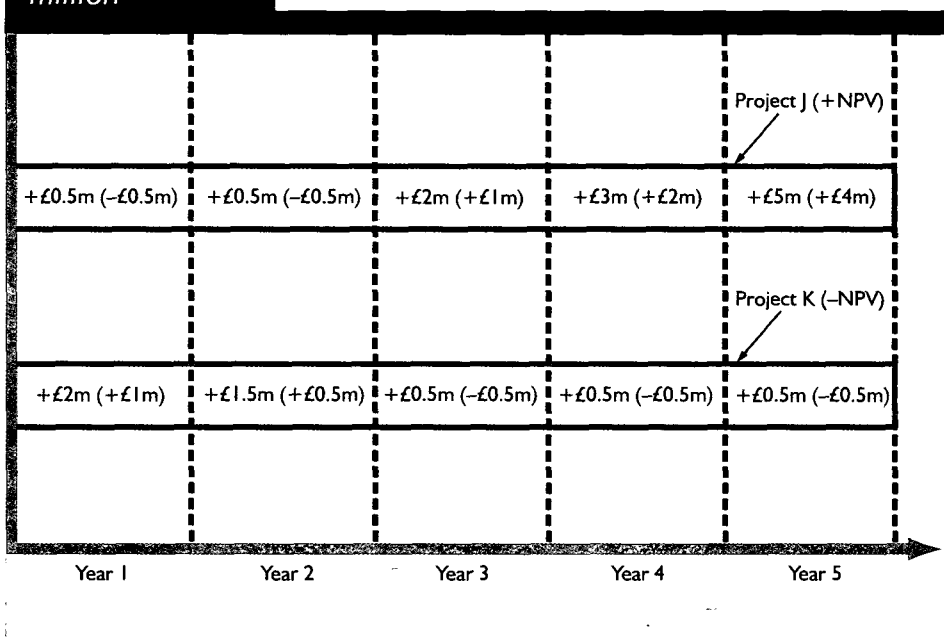
The effect of performance measurement on capital investment decisions

The way that the performance of a manager is measured is likely to have a profound effect on the decisions he or she will make. There is a danger that, because of the way performance is measured, a manager may be motivated to take the wrong decision and not follow the NPV rule. Consider the information presented in Exhibit 9.5 in respect of the net cash inflows and the annual reported profits or losses for projects J and K. The figures without the parentheses refer to the cash inflows whereas the figures within the parentheses

EXHIBIT 9.5

Annual net cash inflows (profits/losses) for two projects each with an initial out-ay of £5 million

refer to annual reported profit. You will see that the total cash inflows over the five year lives for projects J and K are £11 million and £5 million respectively. Both projects require an initial outlay of £5 million. Assuming a cost of capital of 10%, without undertaking any calculations it is clear that project J will have a positive NPV and project K will have a negative NPV.



If the straight line method of depreciation is used the annual depreciation for both projects will be £1 million (£5 million investment cost/5 years). Therefore the reported profits are derived from deducting the annual depreciation charge from the annual net cash inflows. For decision-making the focus is on the entire life of the projects. Our objective is to ascertain whether the present value of the cash inflows exceeds the present value of the cash outflows over the entire life of a project, and not allocate the NPV to different accounting periods as indicated by the dashed vertical lines in Exhibit 9.5. In other words we require an answer to the question will the project add value?

In contrast, a company is required to report on its performance externally at annual intervals and managerial performance is also often evaluated on an annual or more frequent basis. Evaluating managerial performance at the end of the five year project lives is clearly too long a time scale since managers are unlikely to remain in the same job for such lengthy periods. Therefore, if a manager's performance is measured using short-term criteria, such as annual profits, he or she may choose projects that have a favourable impact on short-term financial performance. Because project J will have a negative impact on performance in its early years (i.e. it contributes losses) there is a danger that a manager who is anxious to improve his or her short-term performance might reject project J even though it has a positive impact on the performance measure in the long-term.

The reverse may happen with project K. This has a favourable impact on the short-term profit performance measure in years one and two but a negative impact in the longer-term

so the manager might accept the project to improve his or her short-term performance measure.

It is thus important to avoid an excessive focus on short-term profitability measures since this can have a negative impact on long-term profitability. Emphasis should also be given to measuring a manager's contribution to an organization's long-term objectives. These issues are discussed in Chapter 13 when we shall look at performance measurement in more detail. However, at this point you should note that the way in which managerial performance is measured will influence their decisions and may motivate them to work in their own best interests, even when this is not in the best interest of the organization.

Qualitative factors

Not all investment projects can be described completely in terms of monetary costs and benefits (e.g. a new cafeteria for the employees or the installation of safety equipment). Nevertheless, the procedures described in this chapter may be useful by making the value placed by management on quantitative factors explicit. For example, if the present value of the cash outlays for a project is £100 000 and the benefits from the project are difficult to quantify, management must make a value judgement as to whether or not the benefits are in excess of £100 000. In the case of capital expenditure on facilities for employees, or expenditure to avoid unpleasant environmental effects from the company's manufacturing process, one can take the view that the present value of the cash outlays represents the cost to shareholders of the pursuit of goals other than the maximization of shareholders' funds. In other words, ordinary shareholders, as a group in the bargaining coalition, should know how much the pursuit of other goals is costing them.

Taxation and investment decisions

In our discussions so far we have ignored the impact of taxation. Taxation rules differ between countries but in most countries similar principles tend to apply relating to the taxation allowances available on capital investment expenditure. Companies rarely pay taxes on the profits that are disclosed in their annual published accounts, since certain expenses that are deducted in the published accounts are not allowable deductions for taxation purposes. For example, depreciation is not an allowable deduction; instead, taxation legislation enables **capital allowances** (also known as **writing-down allowances** or **depreciation tax shields**) to be claimed on capital expenditure that is incurred on plant and machinery and other fixed assets. Capital allowances represent standardized depreciation allowances granted by the tax authorities. These allowances vary from country to country but their common aim is to enable the *net* cost of assets to be deducted as an allowable expense, either throughout their economic life or on an accelerated basis which is shorter than an asset's economic life.

Taxation laws in different countries typically specify the amount of capital expenditure that is allowable (sometimes this exceeds the cost of the asset where a government wishes to stimulate investment), the time period over which the capital allowances can be claimed and the depreciation method to be employed. Currently in the UK, companies can claim annual capital allowances of 25% on the written-down value of plant and equipment based on the reducing balance method of depreciation. Different percentage capital allowances are also available on other assets such as industrial buildings where an allowance of 4% per annum based on straight line depreciation can be claimed.[2]

EXAMPLE 9.5

The Sentosa Company operates in Ruratania where investments in plant and machinery are eligible for 25% annual writing-down allowances on the written-down value using the reducing balance method of depreciation. The corporate tax rate is 35%. The company is considering whether to purchase some machinery which will cost £1 million and which is expected to result in additional net cash inflows and profits of £500 000 per annum for four years. It is anticipated that the machinery will be sold at the end of year 4 for its written-down value for taxation purposes. Assume a one year lag in the payment of taxes. Calculate the net present value.

Let us now consider how taxation affects the NPV calculations. You will see that the calculation must include the incremental tax cash flows arising from the investment. Consider the information presented in Example 9.5.

The first stage is to calculate the annual writing down allowances (i.e. the capital allowances). The calculations are as follows:

End of year	Annual writing-down allowance (£)	Written-down value (£)
0	0	1 000 000
1	250 000 (25% × £1 000 000)	750 000
2	187 500 (25% × £750 000)	562 500
3	140 630 (25% × £562 500)	421 870
4	105 470 (25% × £421 870)	316 400
	683 600	

Next we calculate the additional taxable profits arising from the project. The calculations are as follows:

	Year 1 (£)	Year 2 (£)	Year 3 (£)	Year 4 (£)
Incremental annual profits	500 000	500 000	500 000	500 000
Less annual writing-down allowance	250 000	187 500	140 630	105 470
Incremental taxable profits	250 000	312 500	359 370	394 530
Incremental tax at 35%	87 500	109 370	125 780	138 090

You can see that for each year the incremental tax payment is calculated as follows:

corporate tax rate × (incremental profits – capital allowance)

Note that depreciation charges should not be included in the calculation of incremental cash flows or taxable profits. We must now consider the timing of the taxation payments. In the UK taxation payments vary depending on the end of the accounting year, but they are generally paid approximately one year after the end of the company's accounting year. We shall apply this rule to our example. This means that the tax payment of £87 500 for year 1 will be paid at the end of year 2, £109 370 tax will be paid at the end of year 3 and so on.

The incremental tax payments are now included in the NPV calculation:

Year	Cash flow (£)	Taxation	Net cash flow (£)	Discount factor	Present value (£)
0	−1 000 000	0	−1 000 000	1.0000	−1 000 000
1	+500 000	0	+500 000	0.9091	+454 550
2	+500 000	−87 500	+412 500	0.8264	+348 090
3	+500 000	−109 370	+390 630	0.7513	+293 480
4	+500 000 +316,400[a]	−125 780	+690 620	0.6830	+471 690
5	0	−138 090	−138 090	0.6209	−85 740
				Net present value	+482 070

[a]Sale of machinery for written down value of £316 400.

The taxation rules in most countries allow capital allowances to be claimed on the *net* cost of the asset. In our example the machine will be purchased for £1 million and the estimated realizable value at the end of its life is its written-down value of £316 400. Therefore the estimated net cost of the machine is £683 600. You will see from the calculation of the writing-down allowances on page 262 that the total of the writing-down allowances amount to the net cost. How would the analysis change if the estimated realizable value for the machine was different from its written-down value, say £450 000? The company will have claimed allowances of £683 600 but the estimated net cost of the machine is £550 000 (£1 million – £450 000 estimated net realizable value). Therefore excess allowances of £133 600 (£683 600–£550 000) will have been claimed and an adjustment must be made at the end of year 4 so that the tax authorities can claim back the excess allowance. This adjustment is called a **balancing charge**.

Note that the above calculation of taxable profits for year 4 will now be as follows:

Incremental annual profits	500 000
Less annual writing-down allowance	(105 470)
Add balancing charge	133 600
Incremental taxable profits	528 130
Incremental taxation at 35%	184 845

Let us now assume that the estimated disposal value is less than the written-down value for tax purposes, say £250 000. The net investment cost is £750 000 (£1 000 000–£250 000), but you will see that our calculations at the start of this section indicate that estimated taxation capital allowances of £683 600 will have been claimed by the end of year 4. Therefore an adjustment of £66 400 (£750 000–£683 600) must be made at the end of year 4 to reflect the fact that insufficient capital allowances have been claimed. This adjustment is called a **balancing allowance**.

Thus in year 4 the total capital allowance will consist of an annual writing-down allowance of £105 470 plus a balancing allowance of £66 400, giving a total of £171 870. Taxable profits for year 4 are now £328 130 (£500 000–£171 870), and tax at the rate of 35% on these profits will be paid at the end of year 5.

Weighted average cost of capital

So far we have assumed that firms are financed only by equity finance (i.e. ordinary share capital and retained earnings). However, most companies are likely to be financed by a

combination of debt and equity capital. These companies aim to maintain target proportions of debt and equity.

The cost of *new* debt capital is simply the after tax interest cost of raising new debt. Assume that the after tax cost of new debt capital is 10% and the required rate of return on equity capital is 18% and that the company intends to maintain a capital structure of 50% debt and 50% equity. The overall cost of capital for the company is calculated as follows:

$$= \begin{pmatrix} \text{proportion of debt capital} \\ \times \text{ cost of debt capital} \\ (0.5 \times 10\%) \end{pmatrix} + \begin{pmatrix} \text{proportion of equity capital} \\ \times \text{ cost of equity capital} \\ (0.5 \times 18\%) \end{pmatrix} = 14\%$$

The overall cost of capital is also called the **weighted average cost of capital**. Can we use the weighted average cost of capital as the discount rate to calculate a project's NPV? The answer is yes, provided that the project is of equivalent risk to the firm's existing assets and the firm intends to maintain its target capital structure of 50% debt and 50% equity.

In practice, a firm will not finance every single project with 50% debt and 50% equity. For example, project X costing £5 million might be all equity financed. The firm should maintain its target capital structure by issuing debt to finance future projects of £5 million. In this way the firm maintains its target capital structure. Therefore the weighted average cost of capital that should be used for evaluating investment proposals should be an incremental cost based on the firm's target capital structure. Do not use the specific cost of the funds that have been used to finance the project.

We have now established how to calculate the discount rate for projects that are of similar risk to the firm's existing assets and to incorporate the financing aspects. It is the weighted average of the cost of equity and debt capital.

Summary

In this chapter we have noted that capital investment decisions are of vital importance, since they involve the commitment of large sums of money and they affect the whole conduct of the business for many future years. The commitment of funds for long periods of time entails a large interest cost, which must be incorporated into the analysis. We have seen that the rate of return that is required by investors can be incorporated by converting future cash flows to their present values. For business firms the rate of return includes a risk-free interest rate plus a risk premium to compensate for uncertainty. For certain cash flows, which we have assumed in this chapter, the required rate of return is the risk-free rate.

The assumed objective of capital investment appraisal is to maximize shareholders' wealth, and this is achieved by the acceptance of all projects that yield positive net present values. Two alternative methods of evaluating capital investment decisions that take into account the time value of money have been examined: the net present value, and the internal rate of return. We have seen that the internal rate of return cannot guarantee that the correct decision will be made when there is a choice between several mutually exclusive projects. In addition, the internal rate of return is theoretically unsound regarding the reinvestment assumptions of the interim cash flows. A further point is that more than one internal rate of return is possible in situations where mid-project negative unconventional cash flows occur. The net present value method is therefore recommended where a firm can obtain sufficient funds to accept all the projects with positive net present values.

We have also considered the payback and accounting rate of return methods for evaluating capital investment decisions, since these are frequently used in practice, but because neither incorporates the time value of money, we must conclude that they are theoretically unsound.

When taxation is included in the capital investment evaluation, the cash flows from a project must be reduced by the amount of taxation paid on these cash flows. In addition, the investment cost must be reduced by the taxation saving arising from the capital allowance. Because taxation payments do not occur at the same times as the associated cash inflows or outflows, the precise timing of the taxation payment must be identified.

Finally, you should note that we have not considered how the cost of capital (i.e. discount rate) can be derived. This is a complex topic which is beyond the scope of this book. For a discussion of how the cost of capital can be derived you should refer to Drury (2000, ch. 14).

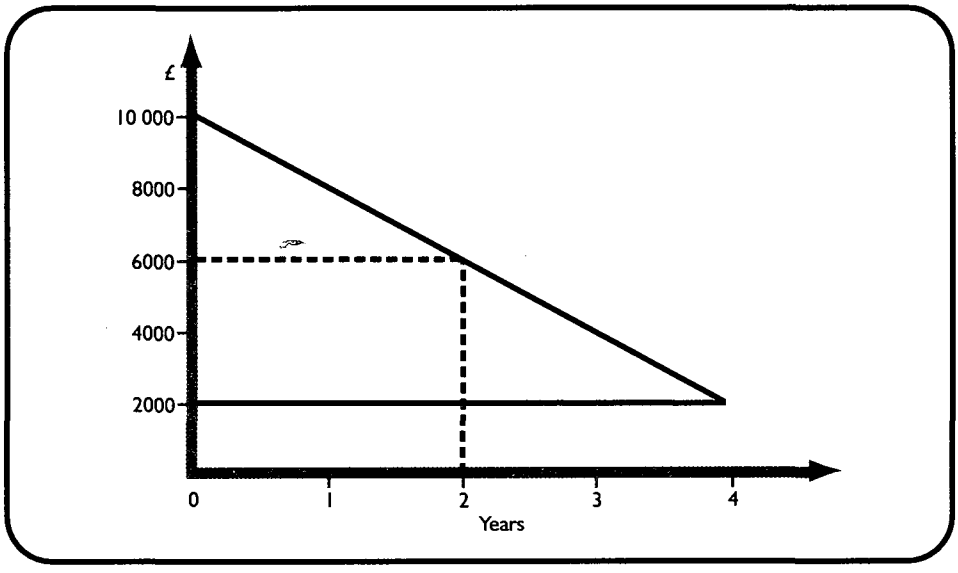


Figure for note 1 on next page

Notes

1 Consider a project that costs £10 000 and has a life of four years and an estimated scrap value of £2000. The diagram shown on page 265 illustrates why the project's scrap value is added to the initial outlay to calculate the average capital employed. You can see that at the mid-point of the project's life the capital employed is equal to £6000 (i.e. $\frac{1}{2}$(10 000 + £2000)).

2 In 2000 the profits of UK companies were subject to a corporate tax rate of 30%. For small companies with annual profits of less than £300 000 the corporate tax rate was 20%.

Key Terms and Concepts

accounting rate of return (p. 258)
balancing allowance (p. 263)
balancing charge (p. 263)
capital allowances (p. 261)
compounding interest (p. 245)
cost of capital (p. 244)
depreciation tax shields (p. 261)
discounted cash flow (p. 245)
discounted payback method (p. 256)
discounted present value (p. 246)
discounted rate of return (p. 250)
discounting (p. 246)
discount rate (p. 244)
interest rate (p. 244)
internal rate of return (p. 249)
minimum required rate of return (p. 244)
mutually exclusive projects (p. 253)
net present value (p. 247)
opportunity cost of an investment (p. 244)
payback method (p. 255)
present value (p. 246)
return on capital employed (p. 258)
return on investment (p. 258)
risk-free gilt-edged securities (p. 244)
time value of money (p. 246)
weighted average cost of capital (p. 264)
writing down allowances (p. 261)

Recommended Reading

The financing of capital projects is normally part of a corporate finance course. If you wish to undertake further reading relating to the financing of capital investments you should refer to Pike and Neale (1999) or Brealey and Myers (1999). For a discussion of the issues relating to appraising investments in advanced manufacturing technologies you should read the publications by Currie (1990, 1991a,b) and Sizer and Motteram, chapter 15 (1996).

Review Problems

1 A company is preparing its capital budget for the year. A question has arisen as to whether or not to replace a machine with a new and more efficient machine. An analysis of the situation reveals the following based on operations at a normal level of activity.

	Old machine	New machine
Cost new	£40 000	£80 000
Book value	£30 000	—
Estimated physical life remaining	10 years	10 years
Depreciation per year	£4 000	£8 000
Labour cost per year	£15 000	£5 000
Material cost per year	£350 000	£345 000
Power per year	£2 000	£4 500
Maintenance per year	£5 000	£7 500

The expected scrap value of both the new and the old machine in 10 years' time is estimated to be zero. The old machine could be sold now for £20 000.

The cost of capital and the investment cut-off rate for the company is 10%. Advise the company. (20 marks)

2 The following data is supplied relating to two investment projects, only one of which may be selected:

	Project A	Project B
	£	£
Initial capital expenditure	50 000	50 000
Profit (loss) year 1	25 000	10 000
2	20 000	10 000
3	15 000	14 000
4	10 000	26 000
Estimated resale value end of year 4	10 000	10 000

Notes:
(1) Profit is calculated after deducting straight-line depreciation
(2) The cost of capital is 10%.

Required:
(a) Calculate for each project:
(i) average annual rate of return on average capital invested;
(ii) payback period;
(iii) net present value.
(12 marks)

(b) Briefly discuss the relative merits of the three methods of evaluation mentioned in (a) above.
(10 marks)

(c) Explain which project you would recommend for acceptance.
(3 marks)
(Total 25 marks)

Solutions to Review Problems

SOLUTION 1

The analysis should be based on a comparison of the PV of the future cash outflows. The original cost of the old machine, the book value and the depreciation cost per year do not represent future cash outflows and should not therefore be included in the analysis. the additional cash outflows for each machine are as follows:

	Old machine	New machine
	£	£
Labour costs	15 000	5 000
Material costs	350 000	345 000
Power	2 000	4 500
Maintenance	5 000	7 500
	372 000	362 000

Because the cash outflows are identical each year the PV of an annuity can be used. The above cash outflows are therefore multiplied by a discount factor of 6.145:

	Old machine £		New machine £	
Operating costs	2 285 940	(372 000 × 6.145)	2 224 490	(362 000 × 6.145)
Purchase cost of new machine			80 000	
Sale of old machine			(20 000)	
	2 285 940		2 284 490	

The PV of the cash outflows is £1450 lower for the new machine. The new machine should therefore be purchased. Note that operating sales revenue is the same for both machines. Hence it is not relevant to the decision.

An alternative approach would be to compare the PV of the annual cost savings from the new machine (£10 000 × 6.145 = £61 450) with the new investment cost (£80 000–£20 000). The new machine yields a positive NPV of £1450 and should be purchased.

SOLUTION 2

(a) (i) Average capital invested $= \dfrac{£50\,000 + £10\,000}{2} = £30\,000.$

Figure 1 shows why the project's scrap value is added to the initial cost to calculate the average capital employed.

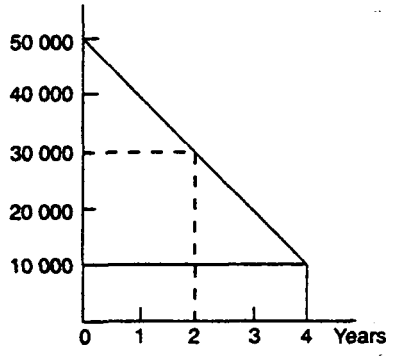


Figure 1

Note that the mid-point of the project's life is 2 years. From the graph you can read off the new investment cost at the end of year 2. It is £30 000 and this represents the average cost of the investment.

$$\text{Average annual profit (Project A)} = \frac{£25\,000 + £20\,000 + £15\,000 + £10\,000}{4}$$

$$= £17\,500$$

$$\text{Average annual profit (Project B)} = \frac{£10\,000 + £10\,000 + £14\,000 + £26\,000}{4}$$

$$= £15\,000$$

	A	B
Average annual return:	$58.33\%\left(\frac{£17\,500}{£30\,000}\times 100\right)$	$50\%\left(\frac{£15\,000}{£30\,000}\times 100\right)$

(ii)

	Project A	Project B
Payback period:	1.5 years $\left(1+\frac{£15\,000}{£30\,000}\right)$	2.4 years $\left(2+\frac{£10\,000}{£24\,000}\right)$

(iii)

Year	Project A Cash inflows (W1)	Project B Cash inflows (W1)	Discount factor	Project A PV	Project B PV
	£	£	£	£	£
1	35 000	20 000	0.909	31 815	18 180
2	30 000	20 000	0.826	24 780	16 520
3	25 000	24 000	0.751	18 775	18 024
4	20 000	36 000	0.683	13 660	24 588
4	10 000	10 000	0.683	6 830	6 830
				95 860	84 142
			Investment cost	(50 000)	(50 000)
			NPV	45 860	34 142

Workings

(W1) Cash flows = profit+depreciation

Note that the estimated resale value is included as a year 4 cash inflow.

(b) See Chapter 9 for the answer to this section of the problem.

(c) Project A is recommended because it has the highest NPV and also the shortest payback period.

Questions

9.1

The evidence of many recent studies suggests that there are major differences between current theories of investment appraisal and the methods which firms actually use in evaluating long-term investments.

You are required to:

(a) present theoretical arguments for the choice of net present value as the best method of investment appraisal;

(b) explain why in practice other methods of evaluating investment projects have proved to be more popular with decision-makers than the net present value method.

9.2

A machine with a purchase price of £14 000 is estimated to eliminate manual operations costing £4000 per year. The machine will last five years and have no residual value at the end of its life.

You are required to calculate:

(a) the discounted cash flow (DCF) internal rate of return;

(b) the level of annual saving necessary to achieve a 12% DCF internal rate of return;

(c) the net present value if the cost of capital is 10%.

9.3 Payback, accounting rate of return and NPV calculations plus a discussion of qualitative factors

The following information relates to three possible capital expenditure projects. Because of capital rationing only one project can be accepted.

	Project A	B	C
Initial Cost	£200 000	£230 000	£180 000
Expected Life	5 years	5 years	4 years
Scrap value expected	£10 000	£15 000	£8 000
Expected Cash Inflows	(£)	(£)	(£)
End Year 1	80 000	100 000	55 000
2	70 000	70 000	65 000
3	65 000	50 000	95 000
4	60 000	50 000	100 000
5	55 000	50 000	

The company estimates its cost of capital is 18%. Calculate

(a) The pay back period for each project. (4 marks)

(b) The Accounting Rate of Return for each project. (4 marks)

(c) The Net present value of each project. (8 marks)

(d) Which project should be accepted – give reasons. (5 marks)

(e) Explain the factors management would need to consider: in addition to the financial factors before making a final decision on a project. (4 marks)

(Total 25 marks)

AAT

9.4 Discussion of alternative investment appraisal techniques and the calculation of payback and NPV for two mutually exclusive projects

(a) Explain why Net Present Value is considered technically superior to Payback and Accounting Rate of Return as an investment appraisal technique even though the latter are said to be easier to understand by management. Highlight the strengths of the Net Present Value method and the weaknesses of the other two methods. (8 marks)

(b) Your company has the option to invest in projects T and R but finance is only available to invest in one of them.

You are given the following projected data:

Project	T £	R £
Initial Cost	70 000	60 000
Profits: Year 1	15 000	20 000
Year 2	18 000	25 000
Year 3	20 000	(50 000)
Year 4	32 000	10 000
Year 5	18 000	3 000
Year 6		2 000

You are told:

(1) All cash flows take place at the end of the year apart from the original investment in the project which takes place at the beginning of the project.

(2) Project T machinery is to be disposed of at the end of year 5 with a scrap value of £10 000.

(3) Project R machinery is to be disposed of at the end of year 3 with a nil scrap value and replaced with new project machinery that will cost £75 000.

(4) The cost of this additional machinery has been deducted in arriving at the profit projections for R for year 3. It is projected that it will last for three years and have a nil scrap value.

(5) The company's policy is to depreciate its assets on a straight line basis.

(6) The discount rate to be used by the company is 14%.

Required:

(i) If investment was to be made in project R determine whether the machinery should be replaced at the end of year 3. (4 marks)

(ii) Calculate for projects T and R, taking into consideration your decision in (i) above:

(a) Payback period

(b) Net present value and advise which project should be invested in, stating your reasons. (10 marks)

(c) Explain what the discount rate of 14% represents and state two ways how it might have been arrived at. (3 marks)

(Total 25 marks)

AAT

9.5 Calculation of payback, NPV and ARR for mutually exclusive projects

Your company is considering investing in its own transport fleet. The present position is that carriage is contracted to an outside organization. The life of the transport fleet would be five years, after which time the vehicles would have to be disposed of.

The cost to your company of using the outside organization for its carriage needs is £250 000 for this year. This cost, it is projected, will rise 10% per annum over the life of the project. The initial cost of the transport fleet would be £750 000 and it is estimated that the following costs would be incurred over the next five years:

	Drivers' Costs (£)	Repairs & Maintenance (£)	Other Costs (£)
Year 1	33 000	8 000	130 000
Year 2	35 000	13 000	135 000
Year 3	36 000	15 000	140 000
Year 4	38 000	16 000	136 000
Year 5	40 000	18 000	142 000

Other costs include depreciation. It is projected that the fleet would be sold for £150 000 at the end of year 5. It has been agreed to depreciate the fleet on a straight line basis.

To raise funds for the project your company is proposing to raise a long-term loan at 12% interest rate per annum.

You are told that there is an alternative project that could be invested in using the funds raised, which has the following projected results:

Payback = 3 years
Accounting rate of return = 30%
Net present value = £140 000.

As funds are limited, investment can only be made in one project.

Note: The transport fleet would be purchased at the beginning of the project and all other expenditure would be incurred at the end of each relevant year.

Required:

(a) Prepare a table showing the net cash savings to be made by the firm over the life of the transport fleet project. (5 marks)

(b) Calculate the following for the transport fleet project:
  (i) Payback period
  (ii) Accounting rate of return
  (iii) Net present value (13 marks)

(c) Write a short report to the Investment Manager in your company outlining whether investment should be committed to the transport fleet or the alternative project outlined. Clearly state the reasons for your decision. (7 marks)

(Total 25 marks)

AAT

9.6 NPV and payback calculations

You are employed as the assistant accountant in your company and you are currently working on an appraisal of a project to purchase a new machine. The machine will cost £55 000 and will have a useful life of three years. You have already estimated the cash flows from the project and their taxation effect, and the results of your estimates can be summarized as follows:

	Year 1	Year 2	Year 3
Post-tax cash inflow	£18 000	£29 000	£31 000

Your company uses a post-tax cost of capital of 8% to appraise all projects of this type.

Task 1

(a) Calculate the net present value of the proposal to purchase the machine. Ignore the effects of inflation and assume that all cash flows occur at the end of the year.

(b) Calculate the payback period for the investment in the machine.

Task 2

The marketing director has asked you to let her know as soon as you have completed your appraisal of the project. She has asked you to provide her with some explanation of your calculations and of how taxation affects the proposal.

Prepare a memorandum to the marketing director which answers her queries. Your memorandum should contain the following:

(a) your recommendation concerning the proposal;

(b) an explanation of the meaning of the net present value and the payback period;

(c) an explanation of the effects of taxation on the cash flows arising from capital expenditure.

AAT

9.7 Present value of purchasing or renting machinery

The Portsmere Hospital operates its own laundry. Last year the laundry processed 120 000 kilograms of washing and this year the total is forecast to grow to 132 000 kilograms. This growth in laundry processed is forecast to continue at the same percentage rate for the next seven years. Because of this, the hospital must immediately replace its existing laundry equipment. Currently, it is considering two options, the purchase of machine A or the rental of machine B. Information on both options is given below:

Machine A – purchase

Annual capacity (kilograms)	180 000
Material cost per kilogram	£2.00
Labour cost per kilogram	£3.00
Fixed costs per annum	£20 000
Life of machine	3 years
Capital cost	£60 000
Depreciation per annum	£20 000

Machine B – rent

Annual capacity (kilograms)	170 000
Material cost per kilogram	£1.80
Labour cost per kilogram	£3.40
Fixed costs per annum	£18 000
Rental per annum	£20 000
Rental agreement	3 years
Depreciation per annum	nil

Other information:

1. The hospital is able to call on an outside laundry if there is either a breakdown or any other reason why the washing cannot be undertaken in-house. The charge would be £10 per kilogram of washing.
2. Machine A, if purchased, would have to be paid for immediately. All other cash flows can be assumed to occur at the end of the year.
3. Machine A will have no residual value at any time.
4. The existing laundry equipment could be sold for £10 000 cash.
5. The fixed costs are a direct cost of operating the laundry.
6. The hospital's discount rate for projects of this nature is 15%.

Task 1

You are an accounting technician employed by the Portsmere Hospital and you are asked to write a brief report to its chief executive. Your report should:

(a) evaluate the two options for operating the laundry, using discounted cash flow techniques;
(b) recommend the preferred option and identify *one* possible non-financial benefit;
(c) justify your treatment of the £10 000 cash value of the existing equipment;
(d) explain what is meant by discounted cashflow.

Note:
Inflation can be ignored.

AAT

9.8 Comparison of NPV and IRR and relationship between profits and NPV

Khan Ltd is an importer of novelty products. The directors are considering whether to introduce a new product, expected to have a very short economic life. Two alternative methods of promoting the new product are available, details of which are as follows:

Alternative 1 would involve heavy initial advertising and the employment of a large number of agents. The directors expect that an immediate cash outflow of £100 000 would be required (the cost of advertising) which would produce a net cash inflow after one year of £255 000. Agents' commission, amounting to £157 500, would have to be paid at the end of two years.

Alternative 2 would involve a lower outlay on advertising (£50 000, payable immediately), and no use of agents. It would produce net cash inflows of zero after one year and £42 000 at the end of each of the subsequent two years.

Mr Court, a director of Khan Ltd, comments, 'I generally favour the payback method for choosing between investment alternatives such as these. However, I am worried that the advertising expenditure under the second alternative will reduce our reported profit next year by an amount not compensated by any net revenues from sale of the product in that year. For that reason I do not think we should even consider the second alternative.'

The cost of capital of Khan Ltd is 20% per annum. The directors do not expect capital or any other resource to be in short supply during the next three years.

You are required to:

(a) calculate the net present values and estimate the internal rates of return of the two methods of promoting the new product; (10 marks)

(b) advise the directors of Khan Ltd which, if either, method of promotion they should adopt, explaining the reasons for your advice and noting any additional information you think would be helpful in making the decision; (8 marks)

(c) comment on the views expressed by Mr Court. (7 marks)

Ignore taxation.

ICAEW

9.9 Evaluation of mutually exclusive projects using alternative appraisal methods

Stadler is an ambitious young executive who has recently been appointed to the position of financial director of Paradis plc, a small listed company. Stadler regards this appointment as a temporary one, enabling him to gain experience before moving to a larger organization. His intention is to leave Paradis plc in three years time, with its share price standing high. As a consequence, he is particularly concerned that the reported profits of Paradis plc should be as high as possible in his third and final year with the company.

Paradis plc has recently raised £350 000 from a rights issue, and the directors are considering three ways of using these funds. Three projects (A, B and C) are being considered, each involving the immediate purchase of equipment costing £350 000. One project only can be undertaken, and the equipment for each project will have a useful life equal to that of the project, with no scrap value. Stadler favours project C because it is expected to show the highest accounting profit in the third year. However, he does not wish to reveal his real reasons for favouring project C, and so, in his report to the chairman, he recommends project C because it shows the highest internal rate of return. The following summary is taken from his report:

Project	Net cash flows (£000) Years									Internal rate of return
	0	1	2	3	4	5	6	7	8	(%)
A	−350	100	110	104	112	138	160	180	—	27.5
B	−350	40	100	210	260	160	—	—	—	26.4
C	−350	200	150	240	40	—	—	—	—	33.0

The chairman of the company is accustomed to projects being appraised in terms of payback and accounting rate of return, and he is consequently suspicious of the use of internal rate of return as a method of project selection. Accordingly, the chairman has asked for an independent report on the choice of project. The company's cost of capital is 20% and a policy of straight-line depreciation is used to write off the cost of equipment in the financial statements.

Requirements:

(a) Calculate the payback period for each project. (3 marks)

(b) Calculate the accounting rate of return for each project. (5 marks)

(c) Prepare a report for the chairman with supporting calculations indicating which project should be preferred by the ordinary shareholders of Paradis plc. (12 marks)

(d) Discuss the assumptions about the reactions of the stock market that are implicit in Stadler's choice of project C. (5 marks)

Note: ignore taxation. (Total 25 marks)

ICAEW

9.10 Computation of NPV and tax payable

Sound Equipment Ltd was formed five years ago to manufacture parts for hi-fi equipment. Most of its customers were individuals wanting to assemble their own systems. Recently, however, the company has embarked on a policy of expansion and has been approached by JBZ plc, a multinational manufacturer of consumer electronics. JBZ has offered Sound Equipment Ltd a contract to build an amplifier for its latest consumer product. If accepted, the contract will increase Sound Equipment's turnover by 20%.

JBZ's offer is a fixed price contract over three years, although it is possible for Sound Equipment to apply for subsequent contracts. The contract will involve Sound Equipment purchasing a specialist machine for £150 000. Although the machine has a 10-year life, it would be written off over the three years of the initial contract as it can only be used in the manufacture of the amplifier for JBZ.

The production director of Sound Equipment has already prepared a financial appraisal of the proposal. This is reproduced below. With a capital cost of £150 000 and total profits of £60 300, the

production director has calculated the return on capital employed as 40.2%. As this is greater than Sound Equipment's cost of capital of 18%, the production director is recommending that the board accepts the contract.

	Year 1 (£)	Year 2 (£)	Year 3 (£)	Total
Turnover	180 000	180 000	180 000	540 000
Materials	60 000	60 000	60 000	180 000
Labour	40 000	40 000	40 000	120 000
Depreciation	50 000	50 000	50 000	150 000
Pre-tax profit	30 000	30 000	30 000	90 000
Corporation tax at 33%	9 900	9 900	9 900	29 700
After-tax profit	20 100	20 100	20 100	60 300

You are employed as the assistant accountant to Sound Equipment Ltd and report to John Green, the financial director, who asks you to carry out a full financial appraisal of the proposed contract. He feels that the production director's presentation is inappropriate. He provides you with the following additional information:

- Sound Equipment pays corporation tax at the rate of 33%;
- the machine will qualify for a 25% writing-down allowance on the reducing balance;
- the machine will have no further use other than in manufacturing the amplifier for JBZ;
- on ending the contract with JBZ, any outstanding capital allowances can be claimed as a balancing allowance;
- the company's cost of capital is 18%;
- the cost of materials and labour is forecast to increase by 5% per annum for years 2 and 3.

John Green reminds you that Sound Equipment operates a just-in-time stock policy and that production will be delivered immediately to JBZ, who will, under the terms of the contract, immediately pay for the deliveries. He also reminds you that suppliers are paid immediately on receipt of goods and that employees are also paid immediately.

Write a report to the financial director. Your report should:

(a) use the net present value technique to identify whether or not the initial three-year contract is worthwhile;
(b) explain your approach to taxation in your appraisal;
(c) identify *one* other factor to be considered before making a final decision.

Notes:
For the purpose of this task, you may assume the following:

- the machine would be purchased at the beginning of the accounting year;
- there is a one-year delay in paying corporation tax;
- all cashflows other than the purchase of the machine occur at the end of each year;
- Sound Equipment has no other assets on which to claim capital allowances.

AAT

9.11 NPV calculation and taxation

Data

Tilsley Ltd manufactures motor vehicle components. It is considering introducing a new product. Helen Foster, the production director, has already prepared the following projections for this proposal:

	Year 1 (£000)	2 (£000)	3 (£000)	4 (£000)
Sales	8 750	12 250	13 300	14 350
Direct materials	1 340	1 875	2 250	2 625
Direct labour	2 675	3 750	4 500	5 250
Direct overheads	185	250	250	250
Depreciation	2 500	2 500	2 500	2 500
Interest	1 012	1 012	1 012	1 012
Profit before tax	1 038	2 863	2 788	2 713
Corporation tax @ 30%	311	859	836	814
Profit after tax	727	2 004	1952	1 899

Helen Foster has recommended to the board that the project is not worthwhile because the cumulative after tax profit over the four years is less than the capital cost of the project.

As an assistant accountant at the company you have been asked by Philip Knowles, the chief accountant, to carry out a full financial appraisal of the proposal. He does not agree with Helen

Foster's analysis, and provides you with the following information:

- the initial capital investment and working capital will be incurred at the beginning of the first year. All other receipts and payments will occur at the end of each year.
- the equipment will cost £10 million;
- additional working capital of £1 million;
- this additional working capital will be recovered in full as cash at the end of the four-year period;
- the equipment will qualify for a 25% per annum reducing balance writing down allowance;
- any outstanding capital allowances at the end of the project can be claimed as a balancing allowance;
- at the end of the four-year period the equipment will be scrapped, with no expected residual value;
- the additional working capital required does not qualify for capital allowances, nor is it an allowable expense in calculating taxable profit;
- Tilsley Ltd pays corporation tax at 30% of chargeable profits;
- there is a one-year delay in paying tax;
- the company's cost of capital is 17%.

Task

Write a report to Philip Knowles. Your report should:

(a) evaluate the project using net present value techniques;
(b) recommend whether the project is worthwhile;
(c) explain how you have treated taxation in your appraisal;
(d) give *three* reasons why your analysis is different from that produced by Helen Foster, the production director.

Notes:

Risk and inflation can be ignored.

AAT

PART THREE

Information for Planning, Control and Performance Measurement

The objective in this section is to consider the implementation of decisions through the planning and control process. Planning involves systematically looking at the future, so that decisions can be made today which will bring the company its desired results. Control can be defined as the process of measuring and correcting actual performance to ensure that plans for implementing the chosen course of action are carried out.

Part Three contains five chapters. Chapter 10 considers the role of budgeting within the planning process and the relationship between the long-range plan and the budgeting process.

Chapters 11 and 12 are concerned with the control process. To fully understand the role that management accounting control systems play in the control process, it is necessary to be aware of how they relate to the entire array of control mechanisms used by organizations. Chapter 11 describes the different types of controls that are used by companies. The elements of management accounting control systems are described within the context of the overall control process. Chapter 12 focuses on the technical aspects of

accounting control systems. It describes the major features of a standard costing system: a system that enables the differences between the planned and actual outcomes to be analysed in detail. Chapter 12 also describes the operation of a standard costing system and explains the procedure for calculating the variances.

Chapters 13 and 14 examine the special problems of control and measuring performance of divisions and other decentralized units within an organization. Chapter 13 considers how divisional financial performance measures might be devised which will motivate managers to pursue overall organizational goals. Chapter 14 focuses on the transfer pricing problem and examines how transfer prices can be established that will motivate managers to make optimal decisions and also ensure that the performance measures derived from using the transfer prices represent a fair reflection of managerial performance.

CHAPTER 10 THE BUDGETING PROCESS
CHAPTER 11 MANAGEMENT CONTROL SYSTEMS
CHAPTER 12 STANDARD COSTING AND VARIANCE ANALYSIS
CHAPTER 13 DIVISIONAL FINANCIAL PERFORMANCE MEASURES
CHAPTER 14 TRANSFER PRICING IN DIVISIONALIZED COMPANIES

10

The budgeting process

In the previous seven chapters we have considered how management accounting can assist managers in making decisions. The actions that follow managerial decisions normally involve several aspects of the business, such as the marketing, production, purchasing and finance functions, and it is important that management should coordinate these various interrelated aspects of decision-making. If they fail to do this, there is a danger that managers may each make decisions that they believe are in the best interests of the organization when, in fact, taken together they are not; for example, the marketing department may introduce a promotional campaign that is designed to increase sales demand to a level beyond that which the production department can handle. The various activities within a company should be coordinated by the preparation of plans of actions for future periods. These detailed plans are usually referred to as budgets.

Our objective in this chapter is to focus on the planning process within a business organization and to consider the role of budgeting within this process. What do we mean by planning? Planning is the design of a desired future and of effective ways of bringing it about (Ackoff, 1981). A distinction is normally made between short-term planning (budgeting) and long-range planning, alternatively known as strategic or corporate planning. How is long-range planning distinguished from other forms of planning? Sizer (1989) defines long-range planning as a systematic and formalized process for purposely directing and controlling future operations towards desired objectives for periods extending beyond one year. Short-term planning or budgeting, on the other hand, must accept the environment of today, and the physical, human and financial resources at present available to the firm. These are to a considerable extent determined by the quality of the firm's long-range planning efforts.

Some of the material in this chapter relating to activity-based budgeting is complex and may not be appropriate for readers pursuing an introductory management accounting course. The section which relates to the more advanced reading is marked with the symbol AR and a vertical red line is used to highlight the section. If you are pursuing an introductory course you may prefer

Learning objectives

After studying this chapter, you should be able to:

- explain how budgeting fits into the overall framework of decision-making, planning and control;
- describe the six different purposes of budgets;
- describe the various stages in the budget process;
- prepare functional and master budgets;
- describe the limitations of incremental budgeting;
- describe activity-based budgeting;
- describe zero-base budgeting.

to omit the advanced reading section, or skim it, on your first reading. You should delay reading this section until you have a good understanding of activity-based costing.

Stages in the planning process

To help you understand the budgetary process we shall begin by looking at how it fits into an overall framework of planning, decision-making and control. A model of this process is presented in Figure 10.1. The framework outlined in this model will be used to illustrate the role of long-term and short-term planning within the overall planning and control process. The first stage involves establishing the objectives of the organization.

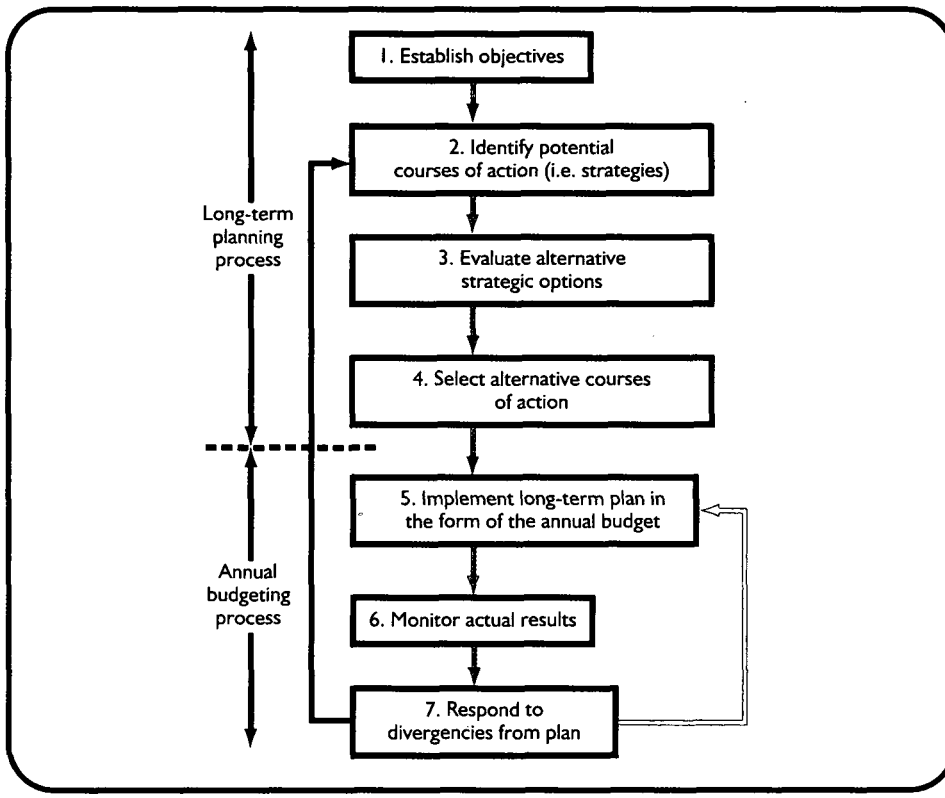
STAGE 1: ESTABLISHING OBJECTIVES

Establishing **objectives** is an essential pre-requisite of the planning process. In all organizations employees must have a good understanding of what the organization is trying to achieve. Strategic or long-range planning therefore begins with the specification of the objectives towards which future operations should be directed. The attainment of objectives should be measurable in some way and ideally people should be motivated by them. Johnson and Scholes (1999) distinguish between three different objectives, which form a hierarchy: the 'mission' of an organization, corporate objectives and unit objectives.

The **mission** of an organization describes in very general terms the broad purpose and reason for an organization's existence, the nature of the business(es) it is in and the customers it seeks to serve and satisfy. It is a visionary projection of the central and overriding concepts on which the organization is based. Objectives tend to be more specific, and represent desired states or results to be achieved.

Corporate objectives relate to the organization as a whole. They are normally measurable and are expressed in financial terms such as desired profits or sales levels, return on capital employed, rates of growth or market share. Corporate objectives are normally formulated by members of the board of directors and handed down to senior managers. It is important that senior managers in an organization understand clearly where their company is going and why and how their own role contributes to the attainment of corporate objectives. Once the overall objectives of the organization have been established they must be broken down into subsidiary objectives relating to areas such as product range, market segmentation, customer service and so on. Objectives must also be developed for the different parts of an organization. **Unit objectives** relate to the specific objectives of individual units within the organization, such as a division or one company within a holding company. Corporate objectives are normally set for the organization as a whole and are then translated into unit objectives, which become the targets for the individual units. You should note that the expression **aims** is sometimes used as an alternative to mission and the term **goals** is synonymous with objectives.

FIGURE 10.1 *The role of long- and short-term planning within the planning, decision-making and control process.*



STAGE 2: IDENTIFY POTENTIAL STRATEGIES

The next stage shown in Figure 10.1 is to identify a range of possible courses of action (or strategies) that might enable the company's objectives to be achieved. The corporate strategy literature advocates that, prior to developing strategies, it is necessary to undertake a strategic analysis to become better informed about the organization's present strategic situation. This involves understanding the company's present position, its strengths and weaknesses and its opportunities and risks.

Having undertaken a strategic analysis, the next stage is to identify alternative strategies. The identification of strategies should take into account the following:

1. the generic strategy to be pursued (i.e. the basis on which the organization will compete or sustain excellence).
2. the alternative directions in which the organization may wish to develop.

An organization should determine the basis on which it will compete and/or sustain a superior level of performance (i.e. the generic strategy that it will follow). The purpose is to ensure that deliberate choices are made regarding the type of competitive advantage it wishes to attain. Porter (1985) has identified three generic strategies that an organization can follow:

1. *cost leadership*, whereby the organization aims to be the lowest cost producer within the industry;
2. *differentiation*, through which the organization seeks some unique dimension in its product/service that is valued by consumers, and which can command a premium price;
3. *focus*, whereby the organization determines the way in which the strategy is focused at particular parts of the market. For example, a product or service may be aimed at a particular buyer group, segment of the product line or smaller geographical area. An organization that adopts a focused strategy aimed at narrow segments of the market to the exclusion of others also needs to determine whether within the segment it will compete through cost leadership or differentiation. Small companies often follow very focused or *niche* strategies by becoming so specialized in meeting the needs of a very small part of the market that they are secure against competition from large organizations.

Porter's view is that any organization seeking a sustainable competitive advantage must select an appropriate generic strategy rather than attempting to be 'all things to all people'.

Having identified the basis on which it will compete, an organization should determine the directions it wishes to take. The company should consider one or more of the following:

1. doing nothing;
2. withdrawing from some markets;
3. selling existing products more effectively in existing markets (market penetration);
4. selling existing products in new markets (market development);
5. developing new products for sale in existing markets (product development);
6. developing new products for sale in new markets (diversification).

STAGE 3: EVALUATION OF STRATEGIC OPTIONS

The alternative strategies should be examined based on the following criteria:[1]

1. *suitability*, which seeks to ascertain the extent to which the proposed strategies fit the situation identified in the strategic analysis. For example, does the strategy exploit the company strengths and environmental opportunities, avoid the weaknesses and counter the environmental threats?
2. *feasibility*, which focuses on whether the strategy can be implemented in resource terms. For example, can the strategy be funded? Can the necessary market position be achieved? Can the company cope with the competitive reactions?
3. *acceptability*, which is concerned with whether a particular strategy is acceptable. For example, will it be sufficiently profitable? Is the level of risk acceptable?

The above criteria represent a broad framework of general criteria against which strategic options can be judged. The criteria narrow down the options to be considered for a detailed evaluation. The evaluation of the options should be based on the approaches described in Chapter 9 and will not be repeated here. Management should select those strategic options that have the greatest potential for achieving the company's objectives. There could be just one strategy chosen or several.

STAGE 4: SELECT COURSE OF ACTION

When management has selected those strategic options that have the greatest potential for achieving the company's objectives, long-term plans should be created to implement the strategies. A **long-term plan** is a statement of the preliminary targets and activities required by an organization to achieve its strategic plans together with a broad estimate for each year of the resources required.

Because long-term planning involves 'looking into the future' for several years ahead the plans tend to be uncertain, general in nature, imprecise and subject to change.

STAGE 5: IMPLEMENTATION OF THE LONG-TERM PLANS

Budgeting is concerned with the implementation of the long-term plan for the year ahead. Because of the shorter planning horizon budgets are more precise and detailed. Budgets are a clear indication of what is expected to be achieved during the budget period whereas long-term plans represent the broad directions that top management intend to follow.

The budget is not something that originates 'from nothing' each year – it is developed within the context of ongoing business and is ruled by previous decisions that have been taken within the long-term planning process. When the activities are initially approved for inclusion in the long-term plan, they are based on uncertain estimates that are projected for several years. These proposals must be reviewed and revised in the light of more recent information. This review and revision process frequently takes place as part of the annual budgeting process, and it may result in important decisions being taken on possible activity adjustments within the current budget period. The budgeting process cannot therefore be viewed as being purely concerned with the current year – it must be considered as an integrated part of the long-term planning process.

STAGES 6 AND 7: MONITOR ACTUAL OUTCOMES AND RESPOND TO DIVERGENCIES FROM PLANNED OUTCOMES

The final stages in the decision-making, planning and control process outlined in Figure 10.1 are to compare the actual and the planned outcomes, and to respond to any divergencies from the plan. These stages represent the control process of budgeting, but a detailed discussion of this process will be deferred until Chapter 11. Let us now consider the short-term budgeting process in more detail.

The multiple functions of budgets

Budgets serve a number of useful purposes. They include:

1. *planning* annual operations;
2. *coordinating* the activities of the various parts of the organization and ensuring that the parts are in harmony with each other;
3. *communicating* plans to the various responsibility centre managers;
4. *motivating* managers to strive to achieve the organizational goals;

5. *controlling* activities;
6. *evaluating* the performance of managers.

Let us now examine each of these six factors.

PLANNING

The major planning decisions will already have been made as part of the long-term planning process. However, the annual budgeting process leads to the refinement of those plans, since managers must produce detailed plans for the implementation of the long-range plan. Without the annual budgeting process, the pressures of day-to-day operating problems may tempt managers not to plan for future operations. The budgeting process ensures that managers do plan for future operations, and that they consider how conditions in the next year might change and what steps they should take now to respond to these changed conditions. This process encourages managers to anticipate problems before they arise, and hasty decisions that are made on the spur of the moment, based on expediency rather than reasoned judgement, will be minimized.

COORDINATION

The budget serves as a vehicle through which the actions of the different parts of an organization can be brought together and reconciled into a common plan. Without any guidance, managers may each make their own decisions, believing that they are working in the best interests of the organization. For example, the purchasing manager may prefer to place large orders so as to obtain large discounts; the production manager will be concerned with avoiding high stock levels; and the accountant will be concerned with the impact of the decision on the cash resources of the business. It is the aim of budgeting to reconcile these differences for the good of the organization as a whole, rather than for the benefit of any individual area. Budgeting therefore compels managers to examine the relationship between their own operations and those of other departments, and, in the process, to identify and resolve conflicts.

COMMUNICATION

If an organization is to function effectively, there must be definite lines of communication so that all the parts will be kept fully informed of the plans and the policies, and constraints, to which the organization is expected to conform. Everyone in the organization should have a clear understanding of the part they are expected to play in achieving the annual budget. This process will ensure that the appropriate individuals are made accountable for implementing the budget. Through the budget, top management communicates its expectations to lower level management, so that all members of the organization may understand these expectations and can coordinate their activities to attain them. It is not just the budget itself that facilitates communication – much vital information is communicated in the actual act of preparing it.

MOTIVATION

The budget can be a useful device for influencing managerial behaviour and motivating managers to perform in line with the organizational objectives. A budget provides a

standard that under certain circumstances, a manager may be motivated to strive to achieve. However, budgets can also encourage inefficiency and conflict between managers. If individuals have actively participated in preparing the budget, and it is used as a tool to assist managers in managing their departments, it can act as a strong motivational device by providing a challenge. Alternatively, if the budget is dictated from above, and imposes a threat rather than a challenge, it may be resisted and do more harm than good. We shall discuss the dysfunctional motivational consequence of budgets in Chapter 11.

CONTROL

A budget assists managers in managing and controlling the activities for which they are responsible. By comparing the actual results with the budgeted amounts for different categories of expenses, managers can ascertain which costs do not conform to the original plan and thus require their attention. This process enables management to operate a system of **management by exception** which means that a manager's attention and effort can be concentrated on significant deviations from the expected results. By investigating the reasons for the deviations, managers may be able to identify inefficiencies such as the purchase of inferior quality materials. When the reasons for the inefficiencies have been found, appropriate control action should be taken to remedy the situation.

PERFORMANCE EVALUATION

A manager's performance is often evaluated by measuring his or her success in meeting the budgets. In some companies bonuses are awarded on the basis of an employee's ability to achieve the targets specified in the periodic budgets, or promotion may be partly dependent upon a manager's budget record. In addition, the manager may wish to evaluate his or her own performance. The budget thus provides a useful means of informing managers of how well they are performing in meeting targets that they have previously helped to set. The use of budgets as a method of performance evaluation also influences human behaviour, and for this reason we shall consider the behavioural aspects of performance evaluation in Chapter 11.

Conflicting roles of budgets

Because a single budget system is normally used to serve several purposes there is a danger that they may conflict with each other. For instance the planning and motivation roles may be in conflict with each other. Demanding budgets that may not be achieved may be appropriate to motivate maximum performance, but they are unsuitable for planning purposes. For these a budget should be set based on easier targets that are expected to be met.

There is also a conflict between the planning and performance evaluation roles. For planning purposes budgets are set in advance of the budget period based on an anticipated set of circumstances or environment. Performance evaluation should be based on a comparison of actual performance with an adjusted budget to reflect the circumstances under which managers actually operated. In practice, many firms compare actual performance with the original budget (adjusted to the actual level of activity, i.e. a flexible budget), but if the circumstances envisaged when the original budget was set have changed then there will be a planning and evaluation conflict.

The budget period

The conventional approach is that once per year the manager of each budget centre prepares a detailed budget for one year. The budget is divided into either twelve monthly or thirteen four-weekly periods for control purposes.

An alternative approach is for the annual budget to be broken down by months for the first three months, and by quarters for the remaining nine months.The quarterly budgets are then developed on a monthly basis as the year proceeds. For example, during the first quarter, the monthly budgets for the second quarter will be prepared; and during the second quarter, the monthly budgets for the third quarter will be prepared. The quarterly budgets may also be reviewed as the year unfolds. For example, during the first quarter, the budget for the next three quarters may be changed as new information becomes available. A new budget for a fifth quarter will also be prepared. This process is known as continuous or rolling budgeting, and ensures that a twelve month budget is always available by adding a quarter in the future as the quarter just ended is dropped. Contrast this with a budget prepared once per year. As the year goes by, the period for which a budget is available will shorten until the budget for next year is prepared. Rolling budgets also ensure that planning is not something that takes place once a year when the budget is being formulated. Instead, budgeting is a continuous process, and managers are encouraged to constantly look ahead and review future plans. Furthermore, it is likely that actual performance will be compared with a more realistic target, because budgets are being constantly reviewed and updated.

Irrespective of whether the budget is prepared on an annual or a continuous basis, it is important that monthly or four-weekly budgets be used for *control* purposes.

Administration of the budgeting process

It is important that suitable administration procedures be introduced to ensure that the budget process works effectively. In practice, the procedures should be tailor-made to the requirements of the organization, but as a general rule a firm should ensure that procedures are established for approving the budgets and that the appropriate staff support is available for assisting managers in preparing their budgets.

THE BUDGET COMMITTEE

The budget committee should consist of high-level executives who represent the major segments of the business. Its major task is to ensure that budgets are realistically established and that they are coordinated satisfactorily. The normal procedure is for the functional heads to present their budget to the committee for approval. If the budget does not reflect a reasonable level of performance, it will not be approved and the functional head will be required to adjust the budget and re-submit it for approval. It is important that the person whose performance is being measured should agree that the revised budget can be achieved; otherwise, if it is considered to be impossible to achieve, it will not act as a motivational device. If budget revisions are made, the budgetees should at least feel that they were given a fair hearing by the committee. We shall discuss budget negotiation in more detail later in this chapter.

The budget committee should appoint a budget officer, who will normally be the accountant. The role of the budget officer is to coordinate the individual budgets into a

budget for the whole organization, so that the budget committee and the budgetee can see the impact of an individual budget on the organization as a whole.

ACCOUNTING STAFF

The accounting staff will normally assist managers in the preparation of their budgets; they will, for example, circulate and advise on the instructions about budget preparation, provide past information that may be useful for preparing the present budget, and ensure that managers submit their budgets on time. The accounting staff do not determine the content of the various budgets, but they do provide a valuable advisory and clerical service for the line managers.

BUDGET MANUAL

A budget manual should be prepared by the accountant. It will describe the objectives and procedures involved in the budgeting process and will provide a useful reference source for managers responsible for budget preparation. In addition, the manual may include a timetable specifying the order in which the budgets should be prepared and the dates when they should be presented to the budget committee. The manual should be circulated to all individuals who are responsible for preparing budgets.

Stages in the budgeting process

The important stages are as follows:

1. communicating details of budget policy and guidelines to those people responsible for the preparation of budgets;
2. determining the factor that restricts output;
3. preparation of the sales budget;
4. initial preparation of various budgets;
5. negotiation of budgets with superiors;
6. coordination and review of budgets;
7. final acceptance of budgets;
8. ongoing review of budgets.

Let us now consider each of these stages in more detail.

COMMUNICATING DETAILS OF THE BUDGET POLICY

Many decisions affecting the budget year will have been taken previously as part of the long-term planning process. The long-range plan is therefore the starting point for the preparation of the annual budget. Thus top management must communicate the policy effects of the long-term plan to those responsible for preparing the current year's budgets. Policy effects might include planned changes in sales mix, or the expansion or contraction of certain activities. In addition, other important guidelines that are to govern the preparation of the budget should be specified – for example the allowances that are to be made for price and wage increases, and the expected changes in productivity. Also, any expected changes in industry demand and output should be communicated by top

management to the managers responsible for budget preparation. It is essential that all managers be made aware of the policy of top management for implementing the long-term plan in the current year's budget so that common guidelines can be established. The process also indicates to the managers responsible for preparing the budgets how they should respond to any expected environmental changes.

DETERMINING THE FACTOR THAT RESTRICTS PERFORMANCE

In every organization there is some factor that restricts performance for a given period. In the majority of organizations this factor is sales demand. However, it is possible for production capacity to restrict performance when sales demand is in excess of available capacity. Prior to the preparation of the budgets, it is necessary for top management to determine the factor that restricts performance, since this factor determines the point at which the annual budgeting process should begin.

PREPARATION OF THE SALES BUDGET

The volume of sales and the sales mix determine the level of a company's operations, when sales demand is the factor that restricts output. For this reason, the sales budget is the most important plan in the annual budgeting process. This budget is also the most difficult plan to produce, because total sales revenue depends on the actions of customers. In addition, sales demand may be influenced by the state of the economy or the actions of competitors.

INITIAL PREPARATION OF BUDGETS

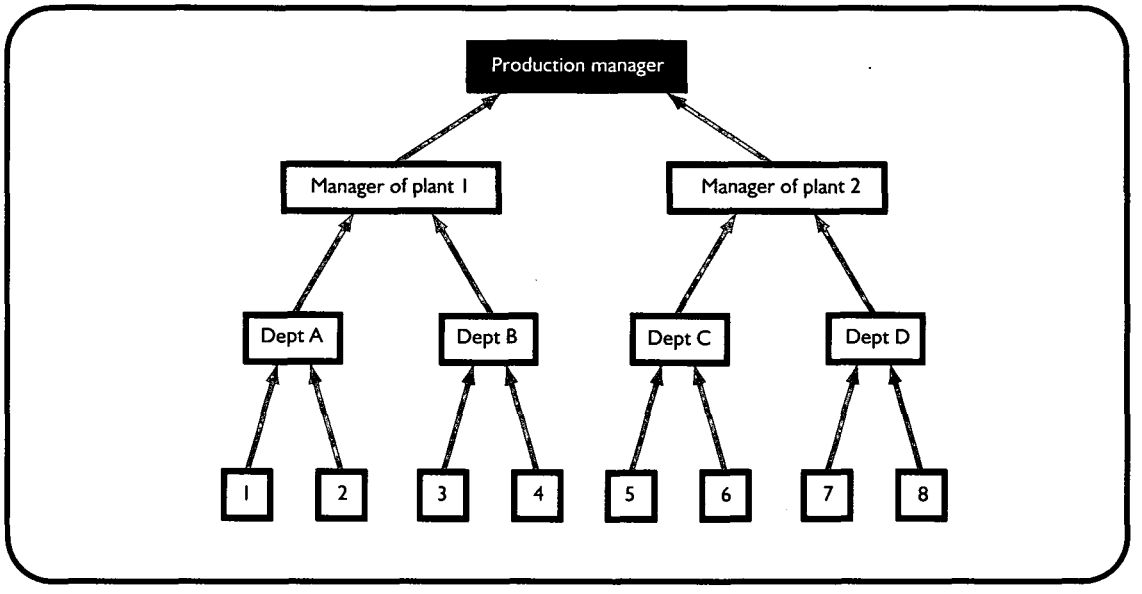
The managers who are responsible for meeting the budgeted performance should prepare the budget for those areas for which they are responsible. The preparation of the budget should be a 'bottom-up' process. This means that the budget should originate at the lowest levels of management and be refined and coordinated at higher levels. The justification for this approach is that it enables managers to participate in the preparation of their budgets and increases the probability that they will accept the budget and strive to achieve the budget targets.

There is no single way in which the appropriate quantity for a particular budget item is determined. Past data may be used as the starting point for producing the budgets, but this does not mean that budgeting is based on the assumption that what has happened in the past will occur in the future. Changes in future conditions must be taken into account, but past information may provide useful guidance for the future. In addition, managers may look to the guidelines provided by top management for determining the content of their budgets. For example, the guidelines may provide specific instructions as to the content of their budgets and the permitted changes that can be made in the prices of purchases of materials and services. For production activities standard costs may be used as the basis for costing activity volumes which are planned in the budget.

NEGOTIATION OF BUDGETS

To implement a participative approach to budgeting, the budget should be originated at the lowest level of management. The managers at this level should submit their budget to their superiors for approval. The superior should then incorporate this budget with other budgets for which he or she is responsible and then submit this budget for approval to his or her superior. The manager who is the superior then becomes the budgetee at the next higher

FIGURE 10.2 *An illustration of budgets moving up the organization hierarchy.*



level. The process is illustrated in Figure 10.2. Sizer (1989) describes this approach as a two-way process of a top-down statement of objectives and strategies, bottom-up budget preparation and top-down approval by senior management.

The lower-level managers are represented by boxes 1–8. Managers 1 and 2 will prepare their budgets in accordance with the budget policy and the guidelines laid down by top management. The managers will submit their budget to their supervisor, who is in charge of the whole department (department A). Once these budgets have been agreed by the manager of department A, they will be combined by the departmental manager, who will then present this budget to his or her superior (manager of plant 1) for approval. The manager of plant 1 is also responsible for department B, and will combine the agreed budgets for departments A and B before presenting the combined budget to his or her supervisor (the production manager). The production manager will merge the budget for plants 1 and 2, and this final budget will represent the production budget that will be presented to the budget committee for approval.

At each of these stages the budgets will be negotiated between the budgetees and their superiors, and eventually they will be agreed by both parties. Hence the figures that are included in the budget are the result of a bargaining process between a manager and his or her superior. It is important that the budgetees should participate in arriving at the final budget and that the superior does not revise the budget without giving full consideration to the subordinates' arguments for including any of the budgeted items. Otherwise, real participation will not be taking place, and it is unlikely that the subordinate will be motivated to achieve a budget that he or she did not accept.

It is also necessary to be watchful that budgetees do not deliberately attempt to obtain approval for easily attainable budgets, or attempt to deliberately understate budgets in the hope that the budget that is finally agreed will represent an easily attainable target. It is equally unsatisfactory for a superior to impose difficult targets in the hope that an authoritarian approach will produce the desired results. The desired results may be achieved in the short term, but only at the cost of a loss of morale and increased labour turnover in the future.

The negotiation process is of vital importance in the budgeting process, and can determine whether the budget becomes a really effective management tool or just a clerical device. If managers are successful in establishing a position of trust and confidence with their subordinates, the negotiation process will produce a meaningful improvement in the budgetary process and outcomes for the period.

COORDINATION AND REVIEW OF BUDGETS

As the individual budgets move up the organizational hierarchy in the negotiation process, they must be examined in relation to each other. This examination may indicate that some budgets are out of balance with other budgets and need modifying so that they will be compatible with other conditions, constraints and plans that are beyond a manager's knowledge or control. For example, a plant manager may include equipment replacement in his or her budget when funds are simply not available. The accountant must identify such inconsistencies and bring them to the attention of the appropriate manager. Any changes in the budgets should be made by the responsible managers, and this may require that the budgets be recycled from the bottom to the top for a second or even a third time until all the budgets are coordinated and are acceptable to all the parties involved. During the coordination process, a budgeted profit and loss account, a balance sheet and a cash flow statement should be prepared to ensure that all the parts combine to produce an acceptable whole. Otherwise, further adjustments and budget recycling will be necessary until the budgeted profit and loss account, the balance sheet and the cash flow statement prove to be acceptable.

FINAL ACCEPTANCE OF THE BUDGETS

When all the budgets are in harmony with each other, they are summarized into a **master budget** consisting of a budgeted profit and loss account, a balance sheet and a cash flow statement. After the master budget has been approved, the budgets are then passed down through the organization to the appropriate responsibility centres. The approval of the master budget is the authority for the manager of each responsibility centre to carry out the plans contained in each budget.

BUDGET REVIEW

The budget process should not stop when the budgets have been agreed. Periodically, the actual results should be compared with the budgeted results. These comparisons should normally be made on a monthly basis and a report sent to the appropriate budgetees in the first week of the following month, so that it has the maximum motivational impact. This will enable management to identify the items that are not proceeding according to plan and to investigate the reasons for the differences. If these differences are within the control of management, corrective action can be taken to avoid similar inefficiencies occurring again in the future. However, the differences may be due to the fact that the budget was unrealistic to begin with, or that the actual conditions during the budget year were different from those anticipated; the budget for the remainder of the year would than be invalid.

During the budget year, the budget committee should periodically evaluate the actual performance and reappraise the company's future plans. If there are any changes in the actual conditions from those originally expected, this will normally mean that the budget plans should be adjusted. This revised budget then represents a revised statement of formal

operating plans for the remaining portion of the budget period. The important point to note is that the budgetary process does not end for the current year once the budget has begun; budgeting should be seen as a continuous and dynamic process.

A detailed illustration

Let us now look at an illustration of the procedure for constructing budgets in a manufacturing company, using the information contained in Example 10.1. Note that the level of detail included here is much less than that which would be presented in practice. A truly realistic illustration would fill many pages, with detailed budgets being analysed in various ways. We shall consider an annual budget, whereas a realistic illustration would analyse the annual budget into twelve monthly periods. Monthly analysis would considerably increase the size of the illustration, but would not give any further insight into the basic concepts or procedures. In addition, we shall assume in this example that the budgets are prepared for only two responsibility centres (namely departments 1 and 2). In practice, many responsibility centres are likely to exist.

Sales budget

The sales budget shows the quantities of each product that the company plans to sell and the intended selling price. It provides the predictions of total revenue from which cash receipts from customers will be estimated, and it also supplies the basic data for constructing budgets for production costs, and for selling, distribution and administrative expenses. The sales budget is therefore the foundation of all other budgets, since all expenditure is ultimately dependent on the volume of sales. If the sales budget is not accurate, the other budget estimates will be unreliable. We will assume that the Enterprise Company has completed a marketing analysis and that the following annual sales budget is based on the result:

Schedule 1 – Sales budget for year ending 200X

Product	Units sold	Selling price (£)	Total revenue (£)
Alpha	8500	400	3 400 000
Sigma	1600	560	896 000
			4 296 000

Schedule 1 represents the *total* sales budget for the year. In practice, the *total* sales budget will be supported by detailed *subsidiary* sales budgets where sales are analysed by areas of responsibility, such as sales territories, and into monthly periods analysed by products. The detailed *subsidiary* sales budget could be set out as shown on page 294.

EXAMPLE 10.1

The Enterprise Company manufactures two products, known as alpha and sigma. Alpha is produced in department 1 and sigma in department 2. The following information is available for 200X.

Standard material and labour costs:

	(£)
Material X	7.20 per unit
Material Y	16.00 per unit
Direct labour	12.00 per hour

Overhead is recovered on a direct labour hour basis.

The standard material and labour usage for each product is as follows:

	Model alpha	Model sigma
Material X	10 units	8 units
Material Y	5 units	9 units
Direct labour	10 hours	15 hours

The balance sheet for the previous year end 200X was as follows:

	(£)	(£)	(£)
Fixed assets:			
Land		170 000	
Buildings and equipment	1 292 000		
Less depreciation	255 000	1 037 000	1 207 000
Current assets:			
Stocks, finished goods	99 076		
raw materials	189 200		
Debtors	289 000		
Cash	34 000		
	611 276		
Less current liabilities			
Creditors	248 800		362 476
Net assets			1 569 476
Represented by shareholder's interest:			
120 000 ordinary shares of £1 each		1 200 000	
Reserves		369 476	
			1 569 476

Other relevant data is as follows for the year 200X:

	Finished product	
	Model alpha	Model sigma
Forecast sales (units)	8500	1600
Selling price per unit	£400	£560
Ending inventory required (units)	1870	90
Beginning inventory (units)	170	85

	Direct material	
	Material X	**Material Y**
Beginning inventory (units)	8500	8000
Ending inventory required (units)	10200	1700

	Department 1 (£)	**Department 2 (£)**
Budgeted variable overhead rates (per direct labour hour):		
Indirect materials	1.20	0.80
Indirect labour	1.20	1.20
Power (variable portion)	0.60	0.40
Maintenance (variable portion)	0.20	0.40
Budgeted fixed overheads		
Depreciation	100000	80000
Supervision	100000	40000
Power (fixed portion)	40000	2000
Maintenance (fixed portion)	45600	3196

	(£)
Estimated non-manufacturing overheads:	
Stationery etc. (Administration)	4000
Salaries	
Sales	74000
Office	28000
Commissions	60000
Car expenses (Sales)	22000
Advertising	80000
Miscellaneous (Office)	8000
	276000

Budgeted cash flows are as follows:

	Quarter 1 (£)	**Quarter 2 (£)**	**Quarter 3 (£)**	**Quarter 4 (£)**
Receipts from customers	1000000	1200000	1120000	985000
Payments:				
Materials	400000	480000	440000	547984
Payments for wages	400000	440000	480000	646188
Other costs and expenses	120000	100000	72016	13642

You are required to prepare a master budget for the year 200X and the following budgets:

1. sales budget
2. production budget
3. direct materials usage budget

4. direct materials purchase budget
5. direct labour budget
6. factory overhead budget
7. selling and administration budget
8. cash budget

Note that with the detailed subsidiary monthly budgets the total budgeted sales of £4 296 000 is analysed by each sales territory for each month of the budget period. The detailed analysis assumes that sales are divided among the four sales territories as follows:

	Alpha	Sigma
North	3000 units	500 units
South	2500 units	600 units
East	1000 units	200 units
West	2000 units	300 units
	8500 units	1600 units

Detailed monthly budgets for North, South, East and West sales territories

		North		South		East		West		Total	
		Units	Value (£)	Units	Value (£)	Units	Value (£)	Units	Value (£)	Units	Value (£)
Month 1	Alpha										
	Sigma										
	Total										
Month 2											
Month 3											
Month 4											
Month 5											
Month 6											
Month 7											
Month 8											
Month 9											
Month 10											
Month 11											
Month 12											
Total months 1–12											
	Alpha	3000	1 200 000	2500	1 000 000	1000	400 000	2000	800 000	8500	3 400 000
	Sigma	500	280 000	600	336 000	200	112 000	300	168 000	1600	896 000
			1 480 000		1 336 000		512 000		968 000		4 296 000

Production budget and budgeted stock levels

When the sales budget has been completed, the next stage is to prepare the production budget. This budget is expressed in *quantities only* and is the responsibility of the

production manager. The objective is to ensure that production is sufficient to meet sales demand and that economic stock levels are maintained. The production budget (schedule 2) for the year will be as follows:

Schedule 2 – Annual production budget

	Department 1 (alpha)	Department 2 (sigma)
Units to be sold	8 500	1600
Planned closing stock	1 870	90
Total units required for sales and stocks	10 370	1690
Less planned opening stocks	170	85
Units to be produced	10 200	1605

The total production for each department should also be analysed on a monthly basis.

Direct materials usage budget

The supervisors of departments 1 and 2 will prepare estimates of the materials which are required to meet the production budget. The materials usage budget for the year will be as follows:

Schedule 3 – Annual direct material usage budget

	Department 1			Department 2					
	Units	Unit price (£)	Total (£)	Units	Unit price (£)	Total (£)	Total units	Total unit price (£)	Total (£)
Material X	102 000[a]	7.20	734 400	12 840[c]	7.20	92 448	114 840	7.20	826 848
Material Y	51 000[b]	16.00	816 000	14 445[d]	16.00	231 120	65 445	16.00	1 047 120
			1 550 400			323 568			1 873 968

[a] 10 200 units production at 10 units per unit of production.
[b] 10 200 units production at 5 units per unit of production.
[c] 1605 units production at 8 units per unit of production.
[d] 1605 units production at 9 units per unit of production.

Direct materials purchase budget

The direct materials purchase budget is the responsibility of the purchasing manager, since it will be he or she who is responsible for obtaining the planned quantities of raw materials to meet the production requirements. The objective is to purchase these materials at the right time at the planned purchase price. In addition, it is necessary to take into account the planned raw material stock levels. The annual materials purchase budget for the year will be as follows:

Schedule 4 – Direct materials purchase budget

	Material X (units)	Material Y (units)
Quantity necessary to meet production requirements as per material usage budget	114 840	65 445
Planned closing stock	10 200	1 700
	125 040	67 145
Less planned opening stock	8 500	8 000
Total units to be purchased	116 540	59 145
Planned unit purchase price	£7.20	£16
Total purchases	£839 088	£946 320

Note that this budget is a summary budget for the year, but for detailed planning and control it will be necessary to analyse the annual budget on a monthly basis.

Direct labour budget

The direct labour budget is the responsibility of the respective managers of departments 1 and 2. They will prepare estimates of the departments' labour hours required to meet the planned production. Where different grades of labour exist, these should be specified separately in the budget. The budget rate per hour should be determined by the industrial relations department. The direct labour budget will be as follows:

Schedule 5 – Annual direct labour budget

	Department 1	Department 2	Total
Budgeted production (units)	10 200	1 605	
Hours per unit	10	15	
Total budgeted hours	102 000	24 075	126 075
Budgeted wage rate per hour	£12	£12	
Total wages	£1 224 000	£288 900	£1 512 900

Factory overhead budget

The factory overhead budget is also the responsibility of the respective production department managers. The total of the overhead budget will depend on the behaviour of the costs of the individual overhead items in relation to the anticipated level of production. The overheads must also be analysed according to whether they are controllable or non-controllable for the purpose of cost control. The factory overhead budget will be as follows:

Schedule 6 – Annual factory overhead budget
Anticipated activity – 102 000 direct labour hours (department 1)
24 075 direct labour hours (department 2)

	Variable overhead rate per direct labour hour		Overheads		
	Department 1 (£)	Department 2 (£)	Department 1 (£)	Department 2 (£)	Total (£)
Controllable overheads:					
Indirect material	1.20	0.80	122 400	19 260	
Indirect labour	1.20	1.20	122 400	28 890	
Power (variable portion)	0.60	0.40	61 200	9 630	
Maintenance (variable portion)	0.20	0.40	20 400	9 630	
			326 400	67 410	393 810
Non-controllable overheads:					
Depreciation			100 000	80 000	
Supervision			100 000	40 000	
Power (fixed portion)			40 000	2 000	
Maintenance (fixed portion)			45 600	3 196	
			285 600	125 196	410 796
Total overhead			612 000	192 606	804 606
Budgeted departmental overhead rate			£6.00[a]	8.00[b]	

[a] £612 000 total overheads divided by 102 000 direct labour hours.
[b] £192 606 total overheads divided by 24 075 direct labour hours.

The budgeted expenditure for the variable overhead items is determined by multiplying the budgeted direct labour hours for each department by the budgeted variable overhead rate per hour. It is assumed that all variable overheads vary in relation to direct labour hours.

Selling and administration budget

The selling and administration budgets have been combined here to simplify the presentation. In practice, separate budgets should be prepared: the sales manager will be responsible for the selling budget, the distribution manager will be responsible for the distribution expenses and the chief administrative officer will be responsible for the administration budget.

Schedule 7 – Annual selling and administration budget

	(£)	(£)
Selling:		
Salaries	74 000	
Commission	60 000	
Car expenses	22 000	
Advertising	80 000	236 000

Administration:		
Stationery	4 000	
Salaries	28 000	
Miscellaneous	8 000	40 000
		276 000

Departmental budgets

For cost control the direct labour budget, materials usage budget and factory overhead budget are combined into separate departmental budgets. These budgets are normally broken down into twelve separate monthly budgets, and the actual monthly expenditure is compared with the budgeted amounts for each of the items concerned. This comparison is used for judging how effective managers are in controlling the expenditure for which they are responsible. The departmental budget for department 1 will be as follows:

Department 1 – Annual departmental operating budget

	(£)	Budget (£)	Actual (£)
Direct labour (from schedule 5):			
102 000 hours at £12		1 224 000	
Direct materials (from schedule 3):			
102 000 units of material X at £7.20 per unit	734 400		
51 000 units of material Y at £16 per unit	816 000	1 550 400	
Controllable overheads (from schedule 6):			
Indirect materials	122 400		
Indirect labour	122 400		
Power (variable portion)	61 200		
Maintenance (variable portion)	20 400	326 400	
Uncontrollable overheads (from schedule 6):			
Depreciation	100 000		
Supervision	100 000		
Power (fixed portion)	40 000		
Maintenance (fixed portion)	45 600	285 600	
		3 386 400	

Master budget

When all the budgets have been prepared, the budgeted profit and loss account and balance sheet provide the overall picture of the planned performance for the budget period.

Budgeted profit and loss account for the year ending 200X

	(£)	(£)
Sales (schedule 1)		4 296 000
Opening stock of raw materials (from opening balance sheet)	189 200	
Purchases (schedule 4)	1 785 408[a]	
	1 974 608	

Less closing stock of raw materials (schedule 4)		100 640[b]	
Cost of raw materials consumed		1 873 968	
Direct labour (schedule 5)		1 512 900	
Factory overheads (schedule 6)		804 606	
Total manufacturing cost		4 191 474	
Add opening stock of finished goods (from opening balance sheet)	99 076		
Less closing stock of finished goods	665 984[c]		
		(566 908)	
Cost of sales			3 624 566
Gross profit			671 434
Selling and administration expenses (schedule 7)			276 000
Budgeted operating profit for the year			395 434

[a]£839 088 (X) + £946 320 (Y) from schedule 4.
[b]10 200 units at £7.20 plus 1700 units at £16 from schedule 4.
[c]1870 units of alpha valued at £332 per unit, 90 units of sigma valued at £501.60 per unit. The product unit costs are calculated as follows:

	Alpha		Sigma	
	Units	**(£)**	**Units**	**(£)**
Direct materials				
X	10	72.00	8	57.60
Y	5	80.00	9	144.00
Direct labour	10	120.00	15	180.00
Factory overheads:				
Department 1	10	60.00	—	—
Department 2	—	—	15	120.00
		332.00		501.60

Budgeted balance sheet as at 31 December

	(£)	(£)
Fixed assets:		
Land		170 000
Building and equipment	1 292 000	
Less depreciation[a]	435 000	857 000
		1 027 000
Current assets:		
Raw material stock	100 640	
Finished good stock	665 984	
Debtors[b]	280 000	
Cash[c]	199 170	
	1 245 794	
Current liabilities:		
Creditors[d]	307 884	937 910
		1 964 910

Represented by shareholders' interest:		
300 000 ordinary shares of £1 each	1 200 000	
Reserves	369 476	
Profit and loss account	395 434	1 964 910

[a]£255 000 + £180 000 (schedule 6) = £435 000.
[b]£289 000 opening balance + £4 296 000 sales – £4 305 000 cash.
[c]Closing balance as per cash budget.
[d]£248 800 opening balance + £1 785 408 purchases + £141 660 indirect materials – £1 867 984 cash.

Cash budgets

The objective of the **cash budget** is to ensure that sufficient cash is available at all times to meet the level of operations that are outlined in the various budgets. The cash budget for Example 10.1 is presented below and is analysed by quarters, but in practice monthly or weekly budgets will be necessary. Because cash budgeting is subject to uncertainty, it is necessary to provide for more than the minimum amount required, to allow for some margin of error in planning. Cash budgets can help a firm to avoid cash balances that are surplus to its requirements by enabling management to take steps in advance to invest the surplus cash in short-term investments. Alternatively, cash deficiencies can be identified in advance, and steps can be taken to ensure that bank loans will be available to meet any temporary cash deficiencies. For example, by looking at the cash budget for the Enterprise Company, management may consider that the cash balances are higher than necessary in the second and third quarters of the year, and they may invest part of the cash balance in short-term investments.

The overall aim should be to manage the cash of the firm to attain maximum cash availability and maximum interest income on any idle funds.

Cash budget for year ending 200X

	Quarter 1 (£)	Quarter 2 (£)	Quarter 3 (£)	Quarter 4 (£)	Total (£)
Opening balance	34 000	114 000	294 000	421 984	34 000
Receipts from debtors	1 000 000	1 200 000	1 120 000	985 000	4 305 000
	1 034 000	1 314 000	1 414 000	1 406 984	4 339 000
Payments:					
Purchase of materials	400 000	480 000	440 000	547 984	1 867 984
Payment of wages	400 000	440 000	480 000	646 188	1 966 188
Other costs and expenses	120 000	100 000	72 016	13 642	305 658
	920 000	1 020 000	992 016	1 207 814	4 139 830
Closing balance	114 000	294 000	421 984	199 170	199 170

Final review

The budgeted profit and loss account, the balance sheet and the cash budget will be submitted by the accountant to the budget committee, together with a number of budgeted financial ratios such as the return on capital employed, working capital, liquidity and gearing ratios. If these ratios prove to be acceptable, the budgets will be approved. In Example 10.1 the return on capital employed is approximately 20%, but the working capital ratio (current assets : current liabilities) is over 4:1, so management should consider

alternative ways of reducing investment in working capital before finally approving the budgets.

Computerized budgeting

In the past, budgeting was a task dreaded by many management accountants. You will have noted from Example 10.1 that many numerical manipulations are necessary to prepare the budget. In the real world the process is far more complex, and, as the budget is being formulated, it is altered many times since some budgets are found to be out of balance with each other or the master budget proves to be unacceptable.

In today's world, the budgeting process is computerized instead of being primarily concerned with numerical manipulations, the accounting staff can now become more involved in the real planning process. Computer-based financial models normally consist of mathematical statements of inputs and outputs. By simply altering the mathematical statements budgets can be quickly revised with little effort. However, the major advantage of computerized budgeting is that management can evaluate many different options before the budget is finally agreed. Establishing a model enables 'What-if?' analysis to be employed. For example, answers to the following questions can be displayed in the form of a master budget: What if sales increase or decrease by 10%? What if unit costs increase or decrease by 5%? What if the credit terms for sales were reduced from 30 to 20 days?

In addition, computerized models can incorporate actual results, period by period, and carry out the necessary calculations to produce budgetary *control* reports. It is also possible to adjust the budgets for the remainder of the year when it is clear that the circumstances on which the budget was originally set have changed.

Activity-based budgeting

AR The conventional approach to budgeting works fine for unit level activity costs where the consumption of resources varies proportionately with the volume of the final output of products or services. However, for those indirect costs and support activities where there are no clearly defined input–output relationships, and the consumption of resources does not vary with the final output of products or services, conventional budgets merely serve as authorization levels for certain levels of spending for each budgeted item of expense. Budgets that are not based on well-understood relationships between activities and costs are poor indicators of performance and performance reporting normally implies little more than checking whether the budget has been exceeded. Conventional budgets therefore provide little relevant information for managing the costs of support activities.

With conventional budgeting indirect costs and support activities are prepared on an incremental basis. This means that existing operations and the current budgeted allowance for existing activities are taken as the starting point for preparing the next annual budget. The base is then adjusted for changes (such as changes in product mix, volumes and prices) which are expected to occur during the new budget period. This approach is called **incremental budgeting**, since the budget process is concerned mainly with the increment in operations or expenditure that will occur during the forthcoming budget period. For example, the allowance for budgeted expenses may be based on the previous budgeted allowance plus an increase to cover higher prices caused by inflation. The major disadvantage of the incremental approach is that the

majority of expenditure, which is associated with the 'base level' of activity, remains unchanged. Thus, the cost of non-unit level activities become fixed and past inefficiencies and waste inherent in the current way of doing things is perpetuated.

To manage costs more effectively organizations that have implemented activity-based costing (ABC) have also adopted activity-based **budgeting (ABB)**. The aim of ABB is to authorize the supply of only those resources that are needed to perform activities required to meet the budgeted production and sales volume. Whereas ABC assigns resource expenses to activities and then uses activity cost drivers to assign activity costs to cost objects (such as products, services or customers), ABB is the reverse of this process. Cost objects are the starting point. Their budgeted output determines the necessary activities which are then used to estimate the resources that are required for the budget period. ABB involves the following stages:

1. estimate the production and sales volume by individual products and customers;
2. estimate the demand for organizational activities;
3. determine the resources that are required to perform organizational activities;
4. estimate for each resource the quantity that must be supplied to meet the demand;
5. take action to adjust the capacity of resources to match the projected supply.

The first stage is identical to conventional budgeting. Details of budgeted production and sales volumes for individual products and customer types will be contained in the sales and production budgets. Next, ABC extends conventional budgeting to support activities such as ordering, receiving, scheduling production and processing customers' orders. To implement ABB a knowledge of the activities that are necessary to produce and sell the products and services and service customers is essential. Estimates of the quantity of activity cost drivers must be derived for each activity. For example, the number of purchase orders, the number of receipts, the number of set-ups and the number of customer orders processed are estimated using the same approach as that used by conventional budgeting to determine the quantity of direct labour and materials that are incorporated into the direct labour and materials purchase budgets. Standard cost data incorporating a bill of activities is maintained for each product indicating the different activities, and the quantity of activity drivers that are required, to produce a specified number of products. Such documentation provides the basic information for building up the activity-based budgets.

The third stage is to estimate the resources that are required for performing the quantity of activity drivers demanded. In particular, estimates are required of each type of resource, and their quantities required, to meet the demanded quantity of activities. For example, if the number of customer orders to be processed is estimated to be 5000 and each order takes 30 minutes processing time then 2500 labour hours of the customer processing activity must be supplied.

Next, the resources demanded (derived from the third stage) are converted into an estimate of the total resources that must be supplied for each type of resource used by an activity. The quantity of resources supplied depends on the cost behaviour of the resource. For flexible resources where the supply can be matched exactly to meet demand, such as direct materials and energy costs, the quantity of resources supplied will be identical to the quantity demanded. For example, if customer processing were a flexible resource exactly 2500 hours would be purchased. However, a more likely assumption is that customer processing labour will be a step cost function in relation to the volume of the activity (see Chapter 2 for a description of step cost functions). Assuming that each person employed is contracted to work 1500 hours per year then 1.67 persons (2500/1500) represents the quantity of resources required, but because

resources must be acquired in uneven amounts, two persons must be employed. For other resources, such as equipment, resources will tend to be fixed and committed over a very wide range of volume for the activity. As long as demand is less than the capacity supplied by the committed resource no additional spending will be required.

The final stage is to compare the estimates of the quantity of resources to be supplied for each resource with the quantity of resources that are currently committed. If the estimated supply of a resource exceeds the current capacity additional spending must be authorized within the budgeting process to acquire additional resources. Alternatively, if the demand for resources is less than the projected supply, the budgeting process should result in management taking action to either redeploy or reduce those resources that are no longer required.

Exhibit 10.1 illustrates an activity-based budget for an order receiving process or department. You will see that the budget is presented in a matrix format with the major activities being shown for each of the columns and the resource inputs are listed by rows. The cost driver activity levels are also highlighted. A major feature of ABB is the enhanced visibility arising from showing the outcomes, in terms of cost drivers, from the budgeted expenditure. This information is particularly useful for planning and estimating future expenditure.

Let us now look at how ABB can be applied using the information presented in Exhibit 10.1. Assume that ABB stages one and two as outlined above result in an estimated annual demand of 2800 orders for the processing of the receipt of the standard customers' order activity. For the staff salaries (that is, the processing of customers' orders labour resource) assume that each member of staff can process on average 50 orders per month, or 600 per year. Therefore 4.67 (2800 orders/600 orders) persons are required for the supply of this resource (that is, stage three as outlined above). The fourth stage converts the 4.67 staff resources into the amount that must be supplied, that is 5 members of staff. Let us assume that the current capacity or supply of resources committed to the activity is 6 members of staff at £25 000 per annum, giving a total annual cost of £150 000. Management is therefore made aware that staff resources can be reduced by £25 000 per annum by transferring one member of staff to other activities where staff resources need to be expanded or, more drastically, making them redundant.

Some of the other resource expenses (such as office supplies and telephone expenses) listed in Exhibit 10.1 for the processing of customers' order activity represent flexible resources which are likely to vary in the short-term with the number of orders processed. Assuming that the budget for the forthcoming period represents 80% of the number of orders processed during the previous budget period then the budget for those resource expenses that vary in the short-term with the number of orders processed should be reduced by 20%.

With conventional budgeting the budgeted expenses for the forthcoming budget for support activities are normally based on the previous year's budget plus an adjustment for inflation. Support costs are therefore considered to be fixed in relation to activity volume. In contrast, ABB provides a framework for understanding the amount of resources that are required to achieve the budgeted level of activity. By comparing the amount of resources that are required with the amount of resources that are in place, upwards or downwards adjustments can be made during the budget setting phase.

Periodically actual results should be compared with a budget adjusted (flexed) to the actual output for the activities (in terms of cost drivers) to highlight both in financial and non-financial terms those activities with major discrepancies from budget. Assume that practical capacity for salaries for the processing of customers' standard orders activity was set at 3000 orders (5 staff at 600 orders per member of staff), even though budgeted activity was only 2800 orders, and the actual number of orders processed

EXHIBIT 10.1

Activity-based budget for an order receiving process

during the period was 2500 orders. Also assume that the actual resources committed to the activity in respect of salaries was £125 000 (all fixed in the short term). The following information should be presented in the performance report:

Activities ⟶	Handle import goods	Execute express orders	Special deliveries	Distribution administration	Order receiving (standard products)	Order receiving (non-standard products)	Execute rush orders	Total cost
Resource expense accounts:								
Office supplies								
Telephone expenses								
Salaries								
Travel								
Training								
Total cost								
Activity cost driver measures ⟶	Number of customs documents	Number of customer bills	Number of letters of credit	Number of consignment notes	Number of standard orders	Number of non-standard orders	Number of rush orders	

Flexed budget based on the number of orders processed (2500 orders at £41.67)	104 175
Budgeted unused capacity (3000 − 2800) × £41.67	8 334
Actual unplanned unused capacity (2800 − 2500) × £41.67	12 491
	125 000

The cost driver rate of £41.67 per order processed is calculated by dividing the £125 000 budgeted cost of supplying the resources by the capacity supplied (3000 orders). The above activity performance information highlights for management attention the potential reduction in the supply of resources of £20 825 (£8334 expected and £12 491 unexpected) or, alternatively, the additional business that can be accommodated with the existing supply of resources.

A survey of UK organizations by Innes and Mitchell (1995a) found that 20% of the respondents used the activity-based approach for budgeting and 76% of these users rated the ability to set more realistic budgets as the most important benefit from ABB. Other benefits identified by the survey respondents included the better identification of resource needs and the identification of budget slack. In a later survey of organizations in the financial services sector Innes and Mitchell (1997) found that these organizations also derived similar benefits from ABB. ●●●

Zero-based budgeting

Zero-based budgeting (also known as **priority-based budgeting**) emerged in the late 1960s as an attempt to overcome the limitations of **incremental budgets**. This approach requires that all activities are justified and prioritized before decisions are taken relating to the amount of resources allocated to each activity. Besides adopting a 'zero-based' approach zero-base budgeting (ZBB) also focuses on programmes or activities instead of functional departments based on line-items which is a feature of traditional budgeting. **Programmes** normally relate to various activities undertaken by municipal or government organizations. Examples include extending childcare facilities, improvement of health care for senior citizens and the extension of nursery facilities.

ZBB works from the premise that projected expenditure for existing programmes should start from base zero, with each year's budgets being compiled as if the programmes were being launched for the first time. The budgetees should present their requirements for appropriations in such a fashion that all funds can be allocated on the basis of cost–benefit or some similar kind of evaluative analysis. The cost–benefit approach is an attempt to ensure 'value for money'; it questions long-standing assumptions and serves as a tool for systematically examining and perhaps abandoning any unproductive projects.

ZBB is best suited to discretionary costs and support activities. With **discretionary costs** management has some discretion as to the amount it will budget for the particular activity in question. Examples of discretionary costs include advertising, research and development and training costs. There is no optimum relationship between inputs (as measured by the costs) and outputs (measured by revenues or some other objective function) for these costs. Furthermore, they are not predetermined by some previous commitment. In effect, management can determine what quantity of service it wishes to purchase and there is no established method for determining the appropriate amount to be spent in particular periods. ZBB has mostly been applied in local and government organizations where the predominant costs are of a discretionary nature. In contrast, direct production and service costs, where input–output relationships exist, are more suited to traditional budgeting using standard costs.

ZBB involves the following three stages:

- a description of each organizational activity in a decision package;
- the evaluation and ranking of decision packages in order of priority;
- allocation of resources based on order of priority up to the spending cut-off level.

Decision packages are identified for each decision unit. Decision units represent separate programmes or groups of activities that an organization undertakes. A decision package represents the operation of a particular programme with incremental packages reflecting different levels of effort that may be expended on a specific function. One package is usually prepared at the 'base' level for each programme. This package represents the minimum level of service or support consistent with the organization's objectives. Service or support higher than the base level is described in one or more incremental packages. For example, managers might be asked to specify the base package in terms of level of service that can be provided at 70% of the current cost level and incremental packages identify higher activity or cost levels.

Once the decision packages have been completed, management is ready to start to review the process. To determine how much to spend and where to spend it, management will rank all packages in order of decreasing benefits to the organization. Theoretically, once management has set the budgeted level of spending, the packages should be accepted down to the spending level based on cost–benefit principles.

The benefits of ZBB over traditional methods of budgeting are claimed to be as follows:

1. Traditional budgeting tends to extrapolate the past by adding a percentage increase to the current year. ZBB avoids the deficiencies of incremental budgeting and represents a move towards the allocation of resources by need or benefit. Thus, unlike traditional budgeting the level of funding is not taken for granted.
2. ZBB creates a questioning attitude rather than one that assumes that current practice represents value for money.
3. ZBB focuses attention on outputs in relation to value for money.

ZBB was first applied in Texas Instruments in 1969. It quickly became one of the fashionable management tools of the 1970s and, according to Phyrr (1976), there were 100 users in the USA in the early 1970s, including the State of Georgia whose governor was ex-president Jimmy Carter. When he became the US President, he directed that all federal agencies adopt ZBB.

During the 1970s many articles on ZBB were published but they declined rapidly towards the end of the decade, and by the 1980s they had become a rarity. ZBB has never achieved the widespread adoption that its proponents envisaged. The major reason for its lack of success would appear to be that it is too costly and time-consuming. The process of identifying decision packages and determining their purpose, cost and benefits is extremely time-consuming. Furthermore, there are often too many decision packages to evaluate and there is frequently insufficient information to enable them to be ranked.

Research suggests that many organizations tend to approximate the principles of ZBB rather than applying the full-scale approach outlined in the literature. For example, it does not have to be applied throughout the organization. It can be applied selectively to those areas about which management is most concerned and used as a one-off cost reduction programme. Some of the benefits of ZBB can be captured by using **priority-based incremental budgets**. Priority incremental budgets require managers to specify what incremental activities or changes would occur if their budgets were increased or decreased by a specified percentage (say 10%). Budget allocations are made by comparing the change in costs with the change in benefits. Priority incremental budgets thus represent an economical compromise between ZBB and incremental budgeting.

Summary

Every organization needs to plan and consider how to confront future potential risks and opportunities. In most organizations this process is formalized by preparing annual budgets and monitoring performance against the budgets. Budgets are merely a collection of plans and forecasts. They reflect the financial implications of business plans, identifying the amount, quantity and timing of resources needed.

The annual budget should be set within the context of longer-term plans, which are likely to exist even if they have not been made explicit. Long-term planning involves strategic planning over several years and the identification of the basic strategy of the firm (i.e. the future direction the organization will take) and the gaps which exist between the future needs and present capabilities. A long-term plan is a statement of the preliminary targets and activities required by an organization to achieve its strategic plans together with a broad estimate for each year of the resources required. Because long-term planning involves 'looking into the future' for several years ahead, the plans tend to be uncertain, general in nature, imprecise and subject to change.

Annual budgeting is concerned with the implementation of the long-term plan for the year ahead. Before the annual budgeting process is begun, top management must communicate the policy effects of the long-term plan to those responsible for preparing the current year's budgets. Normally, the sales budget is the first to be prepared, and this supplies the basic data for producing the remaining budgets. The managers responsible for meeting budgeted performance should prepare the budgets for those areas for which they are responsible and submit them to their superiors for approval. As the budgets move up the organizational hierarchy, they must be examined in relation to each other to ensure that all the parts combine to produce an acceptable whole. When all the budgets are in mutual harmony, they will be summarized into a master budget consisting of a budgeted profit and loss account, a balance sheet and a cash flow statement. The approval of the master budget will constitute authority for the managers of each responsibility centre to carry out the plans contained in each budget. The process should not stop when all the budgets have been agreed; periodically, the actual results should be compared with the budget and remedial action taken to ensure that the results conform to plan. Budgeting is a continuous and dynamic process, and should not end once the annual budget has been prepared.

With conventional budgeting the budgeted expenses for the forthcoming budget for support activities are normally based on the previous year's budget plus an adjustment for inflation. Support costs are therefore considered to be fixed in relation to activity volume. In contrast, activity-based budgeting provides a framework for understanding the amount of resources that are required to achieve the budgeted level of activity. By comparing the amount of resources that are required with the amount of resources that are in place, upwards or downwards adjustments can be made during the budget setting phase.

Incremental budgeting is a system of preparing annual budgets that takes the current level of operating activity as the starting point for preparing the next annual budget. This base is then adjusted for the changes expected to occur during the new budget period. An alternative approach is that of zero-base budgeting where the projected expenditure for preparing the next annual budget for existing programmes starts from base zero.

Note

1 The criteria specified are derived from Johnson and Scholes (1999), ch 9.

Key Terms and Concepts

activity-based budgeting (p. 302)
aims (p. 280)
budgeting (p. 283)
budgets (p. 279)
cash budget (p. 300)
continuous budgeting (p. 286)
corporate objectives (p. 280)
corporate planning (p. 279)
decision package (p. 305)
discretionary costs (p. 305)
generic strategy (p. 281)
goals (p. 280)
incremental budgeting (p. 301)
long-range planning (p. 279)
long-term plan (p. 283)
management by exception (p. 285)
master budget (p. 290)
mission (p. 280)
objectives (p. 280)
priority based budgets (p. 305)
priority based incremental budgets (p. 306)
programmes (p. 305)
rolling budgeting (p. 286)
strategic planning (p. 279)
strategies (p. 281)
strategic analysis (p. 281)
unit objectives (p. 280)
zero-based budgeting (p. 305)

Recommended Reading

In this chapter we have provided a very brief summary of the process for selecting alternative strategies. A detailed explanation of strategy formulation can be found in the corporate strategy literature. Predominant texts on this area include Johnson and Scholes (1999) and Thompson (1997). For a more detailed discussion of budgeting in the public sector see Pendlebury (1996).

Review Problem

R Limited manufactures three products A, B and C.

You are required:

(a) Using the information given below, to prepare budgets for the month of January for
  (i) sales in quantity and value, including total value;
  (ii) production quantities;
  (iii) material usage in quantities;
  (iv) material purchases in quantity and value, including total value;
  (Note that particular attention should be paid to your layout of the budgets.)

(b) To explain the term 'principal budget factor' and state what it was assumed to be in (a).

	Product	Quantity (units)	Price each (£)
Sales:	A	1000	100
	B	2000	120
	C	1500	140
Materials used in the company's products:			
Material	M1	M2	M3
Unit cost	£4	£6	£9
Quantities used in:	M1 (units)	M2 (units)	M3 (units)

Product A	4	2	–
Product B	3	3	2
Product C	2	1	1

Finished stocks:	Product A (units)	Product B (units)	Product C (units)
Quantities			
1st January	1000	1500	500
31st January	1100	1650	550

Material stocks:	M1 (units)	M2 (units)	M3 (units)
1st January	26 000	20 000	12 000
31st January	31 200	24 000	14 400

(20 marks)
CIMA

Solution to Review Problem

(a) (i)

Sales quantity and value budget

	Products			
	A	**B**	**C**	**Total**
Sales quantities	1 000	2 000	1 500	
Selling prices	£100	£120	£140	
Sales value	£100 000	£250 000	£210 000	£550 000

(ii)

Production quantities budget

	Products		
Sales quantities	1000	2000	1500
Add closing stock	1100	1650	550
	2100	3650	2050
Deduct opening stock	1000	1500	500
Units to be produced	1100	2150	1550

(iii)

Material usage budget (quantities)

Production quantities	**Materials**					
	M1		**M2**		**M3**	
	Units per product	**Total**	**Units per product**	**Total**	**Units per product**	**Total**
A 1100	4	4400	2	2200	—	—
B 2150	3	6450	3	6450	2	4300
C 1550	2	3 100	1	1 550	1	1 550
Usage in quantities		13 950		10 200		5 850

(iv)

Material purchases budget (quantities and value)

	M1	M2	M3	Total
Materials usage budget	13 950	10 200	5 850	
Add closing stock	31 200	24 000	14 400	
	45 150	34 200	20 250	
Deduct opening stock	26 000	20 000	12 000	
Purchases in quantities	19 150	14 200	8 250	
Price per unit	£4	£6	£9	
Value of purchases	£76 600	£85 200	£74 250	£236 050

(b) The principal budget factor is also known as the limiting factor or key factor. The CIMA Terminology describes the principal budget factor as follows: 'The factor which, at a particular time, or over a period, will limit the activities of an undertaking. The limiting factor is usually the level of demand for the products or services of the undertaking but it could be a shortage of one of the productive resources, e.g. skilled labour, raw material, or machine capacity. In order to ensure that the functional budgets are reasonably capable of fulfillment, the extent of the influence of this factor must first be assessed.'

In the absence of any information to the contrary in the question, it is assumed that the principal budget factor is sales demand. See 'Determining factor that restricts performance' in Chapter 10 for a discussion of the importance of the principal budget factor in the budgeting process.

Questions

10.1

Outline:

(a) the objectives of budgetary planning and control systems; (7 marks)

(b) the organization required for the preparation of a master budget. (10 marks)

(Total 17 marks)

ACCA

10.2

The preparation of budgets is a lengthy process which requires great care if the ultimate master budget is to be useful for the purposes of management control within an organization.

You are required:

(a) to identify and to explain briefly the stages involved in the preparation of budgets identifying separately the roles of managers and the budget committee; (8 marks)

(b) to explain how the use of spreadsheets may improve the efficiency of the budget preparation process. (7 marks)

(Total 15 marks)

CIMA

10.3

What is zero-base budgeting and how does it differ from other more traditional forms of budgeting? Discuss the applicability of zero-base budgeting to profit-orientated organizations.

ACCA

10.4

You are the management accountant of a group of companies and your managing director has asked you to explore the possibilities of introducing a zero-base budgeting system experimentally in one of the operating companies in place of its existing orthodox system. You are required to prepare notes for a paper for submission to the board that sets out:

(a) how zero-base budgeting would work within the company chosen; (6 marks)

(b) what advantages it might offer over the existing system; (5 marks)

(c) what problems might be faced in introducing a zero-base budgeting scheme; (5 marks)

(d) the features you would look for in selecting the operating company for the introduction in

order to obtain the most beneficial results from the experiment. (4 marks)
(Total 20 marks)
CIMA

10.5
The chief executive of your organization has recently seen a reference to zero-base budgeting. He has asked for more details of the technique.

You are required to prepare a report for him explaining:

(a) what zero-base budgeting is and to which areas it can best be applied;
(b) what advantages the technique has over traditional type budgeting systems; and
(c) how the organization might introduce such a technique. (20 marks)
CIMA

10.6

(a) '... corporate planning and budgeting are complementary, rather than the former superseding the latter.'

Compare the aims and main features of 'corporate planning' and 'budgeting' systems. (12 marks)

(b) The aims of zero-base budgeting have been described recently in the following terms: 'Zero-base budgeting is a general management tool that can provide a systematic way to evaluate all operations and programmes; a means of establishing a working structure to recognise priorities and performance measures for current and future plans; in essence, a methodology for the continual redirection of resources into the highest priority programmes, and to explicitly identify tradeoffs among long-term growth, current operations, and profit needs.'

Explain how a system of zero-base budgeting works, and to assess its likely success in attaining the aims set out above. (13 marks)
ICAEW

10.7
A budgetary planning and control system may include many individual budgets which are integrated into a 'master budget'.

You are required to outline and briefly explain with reasons the steps which should normally be taken in the preparation of master budgets in a manufacturing company, indicating the main budgets which you think should normally be prepared. (12 marks)
ICAEW

10.8
Explain the specific roles of planning, motivation and evaluation in a system of budgetary control. (7 marks)
ACCA

10.9
Traditional budgeting systems are incremental in nature and tend to focus on cost centres. Activity based budgeting links strategic planning to overall performance measurement aiming at continuous improvement.

(a) Explain the weaknesses of an incremental budgeting system. (5 marks)
(b) Describe the main features of an activity based budgeting system and comment on the advantages claimed for its use. (10 marks)
(Total 15 marks)
ACCA

10.10 Preparation of functional budgets
D Limited is preparing its annual budgets for the year to 31 December 2001. It manufactures and sells one product, which has a selling price of £150. The marketing director believes that the price can be increased to £160 with effect from 1 July 2001 and that at this price the sales volume for each quarter of 2001 will be as follows:

	Sales volume
Quarter 1	40 000
Quarter 2	50 000
Quarter 3	30 000
Quarter 4	45 000

Sales for each quarter of 2002 are expected to be 40 000 units.

Each unit of the finished product which is manufactured requires four units of component R and three units of component T, together with a body shell S. These items are purchased from an outside supplier. Currently prices are:

Component R	£8.00 each
Component T	£5.00 each
Shell S	£30.00 each

The components are expected to increase in price by 10% with effect from 1 April 2001; no change is expected in the price of the shell.

Assembly of the shell and components into the finished product requires 6 labour hours: labour is currently paid £5.00 per hour. A 4% increase in wage costs is anticipated to take effect from 1 October 2001.

Variable overhead costs are expected to be £10 per unit for the whole of 2001; fixed production overhead costs are expected to be £240 000 for the year, and are absorbed on a per unit basis. Stocks on 31 December 2000 are expected to be as follows:

Finished units	9000 units
Component R	3000 units
Component T	5500 units
Shell S	500 units

Closing stocks at the end of each quarter are to be as follows:

Finished units	10% of next quarter's sales
Component R	20% of next quarter's production requirements
Component T	15% of next quarter's production requirements
Shell S	10% of next quarter's production requirements

Requirement:

(a) Prepare the following budgets of D Limited for the year ending 31 December 2001, showing values for each quarter and the year in total:
   (i) sales budget (in £s and units)
   (ii) production budget (in units)
   (iii) material usage budget (in units)
   (iv) production cost budget (in £s).
   (15 marks)

(b) Sales are often considered to be the principal budget factor of an organisation.

   Requirement:
   Explain the meaning of the 'principal budget factor' and, assuming that it is sales, explain how sales may be forecast making appropriate reference to the use of statistical techniques and the use of microcomputers. (10 marks)
   (Total 25 marks)
   CIMA

10.11 Preparation of functional budgets

Data

Wilmslow Ltd makes two products, the Alpha and the Beta. Both products use the same material and labour but in different amounts. The company divides its year into four quarters, each of twelve weeks. Each week consists of five days and each day comprises 7 hours.

You are employed as the management accountant to Wilmslow Ltd and you originally prepared a budget for quarter 3, the twelve weeks to 17 September. The basic data for that budget is reproduced below.

Original budgetary data: quarter 3
12 weeks to 17 September

Product	Alpha	Beta
Estimated demand	1800 units	2100 units
Material per unit	8 kilograms	12 kilograms
Labour per unit	3 hours	6 hours

Since the budget was prepared, three developments have taken place.

1. The company has begun to use linear regression and seasonal variations to forecast sales demand. Because of this, the estimated demand for quarter 3 has been revised to 2000 Alphas and 2400 Betas.
2. As a result of the revised sales forecasting, you have developed more precise estimates of sales and closing stock levels.
   - The sales volume of both the Alpha and Beta in quarter 4 (the twelve weeks ending 10 December) will be 20% more than in the revised budget for quarter 3 as a result of seasonal variations.
   - The closing stock of finished Alphas at the end of quarter 3 should represent 5 days sales for quarter 4.
   - The closing stock of finished Betas at the end of quarter 3 should represent 10 days sales for quarter 4.
   - Production in quarter 4 of both Alpha and Beta is planned to be 20% more than in the revised budget for quarter 3. The closing stock of materials at the end of quarter 3 should be sufficient for 20 days production in quarter 4.
3. New equipment has been installed. The workforce is not familiar with the equipment. Because of this, for quarter 3, they will only be working at 80% of the efficiency assumed in the original budgetary data.

   Other data from your original budget which has not changed is reproduced below:

   - 50 production employees work a 35 hour week and are each paid £210 per week;
   - overtime is paid for at £9 per hour;

- the cost of material is £10 per kilogram;
- opening stocks at the beginning of quarter 3 are as follows:
  - finished Alphas 500 units
  - finished Betas 600 units
  - material 12 000 kilograms
- there will not be any work in progress at any time.

Task 1

The production director of Wilmslow Ltd wants to schedule production for quarter 3 (the twelve weeks ending 17 September) and asks you to use the revised information to prepare the following:

(a) the revised production budget for Alphas and Betas;
(b) the material purchases budget in kilograms;
(c) a statement showing the cost of the material purchases;
(d) the labour budget in hours;
(e) a statement showing the cost of labour.

Data

Margaret Brown is the financial director of Wilmslow Ltd. She is not convinced that the use of linear regression, even when adjusted for seasonal variations, is the best way of forecasting sales volumes for Wilmslow Ltd.

The quality of sales forecasting is an agenda item for the next meeting of the Board of Directors and she asks for your advice.

Task 2

Write a *brief* memo to Margaret Brown. Your memo should:

(a) identify *two* limitations of the use of linear regression as a forecasting technique;
(b) suggest *two* other ways of sales forecasting.

AAT

10.12 Budget preparation and comments on sales forecasting methods

You have recently been appointed as the management accountant to Alderley Ltd, a small company manufacturing two products, the Elgar and the Holst. Both products use the same type of material and labour but in different proportions. In the past, the company has had poor control over its working capital. To remedy this, you have recommended to the directors that a budgetary control system be introduced. This proposal has, now, been agreed.

Because Alderley Ltd's production and sales are spread evenly over the year, it was agreed that the annual budget should be broken down into four periods, each of 13 weeks, and commencing with the 13 weeks ending 4 April. To help you in this task, the sales and production directors have provided you with the following information:

1. Marketing and production data

	Elgar	Holst
Budgeted sales for 13 weeks (units)	845	1235
Material content per unit (kilograms)	7	8
Labour per unit (standard hours)	8	5

2. Production labour
   The 24 production employees work a 37-hour, five-day week and are paid £8 per hour. Any hours in excess of this involve Alderley in paying an overtime premium of 25%. Because of technical problems, which will continue over the next 13 weeks, employees are only able to work at 95% efficiency compared to standard.
3. Purchasing and opening stocks
   The production director believes that raw material will cost £12 per kilogram over the budget period. He also plans to revise the amount of stock being kept. He estimates that the stock levels at the commencement of the budget period will be as follows:

Raw materials	Elgar	Holst
2328 kilograms	163 units	361 units

4. Closing stocks
   At the end of the 13-week period closing stocks are planned to change. On the assumption that production and sales volumes for the second budget period will be similar to those in the first period:
   - raw material stocks should be sufficient for 13 days' production;
   - finished stocks of the Elgar should be equivalent to 6 days' sales volume;
   - finished stocks of the Holst should be equivalent to 14 days sales volume.

Task 1

Prepare in the form of a statement the following information for the 13-week period to 4 April:

(a) the production budget in units for the Elgar and Holst;
(b) the purchasing budget for Alderley Ltd in units;
(c) the cost of purchases for the period;
(d) the production labour budget for Alderley Ltd in hours;
(e) the cost of production labour for the period.

Note: Assume a five-day week for both sales and production.

The managing director of Alderley Ltd, Alan Dunn, has also only recently been appointed. He is keen to develop the company and has already agreed to two new products being developed. These will be launched in eighteen months' time. While talking to you about the budget, he mentions that the quality of sales forecasting will need to improve if the company is to grow rapidly. Currently, the budgeted sales figure is found by initially adding 5% to the previous year's sales volume and then revising the figure following discussions with the marketing director. He believes this approach is increasingly inadequate and now requires a more systematic approach.

A few days later, Alan Dunn sends you a memo. In that memo, he identifies three possible strategies for increasing sales volume. They are:

- more sales to existing customers;
- the development of new markets;
- the development of new products.

He asks for your help in forecasting likely sales volumes from these sources.

Task 2

Write a brief memo to Alan Dunn. Your memo should:

(a) identify *four* ways of forecasting future sales volume;
(b) show how each of your four ways of forecasting can be applied to *one* of the sales strategies identified by Alan Dunn and justify your choice;
(c) give *two* reasons why forecasting methods might not prove to be accurate.

AAT

10.13 Preparation of cash budgets

The following data and estimates are available for ABC Limited for June, July and August.

	June (£)	July (£)	August (£)
Sales	45 000	50 000	60 000
Wages	12 000	13 000	14 500
Overheads	8 500	9 500	9 000

The following information is available regarding direct materials:

	June (£)	July (£)	August (£)	September (£)
Opening stock	5000	3500	6 000	4000
Material usage	8000	9000	10 000	

Notes:

1. 10% of sales are for cash, the balance is received the following month. The amount received in June for May's sales is £29 500.
2. Wages are paid in the month they are incurred.
3. Overheads include £1500 per month for depreciation. Overheads are settled the month following. £6500 is to be paid in June for May's overheads.
4. Purchases of direct materials are paid for in the month purchased.
5. The opening cash balance in June is £11 750.
6. A tax bill of £25 000 is to be paid in July.

Required:

(a) Calculate the amount of direct material purchases in *each* of the months of June, July and August. (3 marks)
(b) Prepare cash budgets for June, July and August. (9 marks)
(c) Describe briefly the advantages of preparing cash budgets. (3 marks)

(Total marks 15)

CIMA

10.14 Preparation of cash budgets

The management of Beck plc have been informed that the union representing the direct production workers at one of their factories, where a standard product is produced, intends to call a strike. The accountant has been asked to advise the management of the effect the strike will have on cash flow.

The following data has been made available:

	Week 1	Week 2	Week 3
Budgeted sales	400 units	500 units	400 units
Budgeted production	600 units	400 units	Nil

The strike will commence at the beginning of week 3 and it should be assumed that it will continue for at least four weeks. Sales at 400 units per week will continue to be made during the period of the strike until stocks of finished goods are exhausted. Production will stop at the end of week 2. The current stock level of finished goods is 600 units. Stocks of work in progress are not carried.

The selling price of the product is £60 and the budgeted manufacturing cost is made up as follows:

	(£)
Direct materials	15
Direct wages	7
Variable overheads	8
Fixed overheads	18
Total	£48

Direct wages are regarded as a variable cost. The company operates a full absorption costing system and the fixed overhead absorption rate is based upon a budgeted fixed overhead of £9000 per week. Included in the total fixed overheads is £700 per week for depreciation of equipment. During the period of the strike direct wages and variable overheads would not be incurred and the cash expended on fixed overheads would be reduced by £1500 per week.

The current stock of raw materials are worth £7500; it is intended that these stocks should increase to £11 000 by the end of week 1 and then remain at this level during the period of the strike. *All direct materials are paid for one week after they have been received. Direct wages are paid one week in arrears. It should be assumed that all relevant overheads are paid for immediately the expense is incurred.* All sales are on credit, 70% of the sales value is received in cash from the debtors at the end of the first week after the sales have been made and the balance at the end of the second week.

The current amount outstanding to material suppliers is £8000 and direct wage accruals amount to £3200. Both of these will be paid in week 1. The current balance owing from debtors is £31 200, of which £24 000 will be received during week 1 and the remainder during week 2. The current balance of cash at bank and in hand is £1000.

Required:

(a) (i) Prepare a cash budget for weeks 1 to 6 showing the balance of cash at the end of each week together with a suitable analysis of the receipts and payments during each week. (13 marks)

(ii) Comment upon any matters arising from the cash budget which you consider should be brought to management's attention. (4 marks)

(b) Explain why the reported profit figure for a period does not normally represent the amount of cash generated in that period. (5 marks)

(Total 22 marks)

ACCA

11

Management control systems

Control is the process of ensuring that a firm's activities conform to its plan and that its objectives are achieved. There can be no control without objectives and plans, since these predetermine and specify the desirable behaviour and set out the procedures that should be followed by members of the organization to ensure that a firm is operated in a desired manner.

Drucker (1964) distinguishes between 'controls' and 'control'. Controls are measurement and information, whereas control means direction. In other words, 'controls' are purely a means to an end; the end is control. 'Control' is the function that makes sure that actual work is done to fulfil the original intention, and 'controls' are used to provide information to assist in determining the control action to be taken. For example, material costs may be greater than budget. 'Controls' will indicate that costs exceed budget and that this may be because the purchase of inferior quality materials causes excessive wastage. 'Control' is the action that is taken to purchase the correct quality materials in the future to reduce excessive wastage.

'Controls' encompasses all the methods and procedures that direct employees towards achieving the organization objectives. Many different control mechanisms are used in organizations and the management accounting control system represents only one aspect of the various control mechanisms that companies use to control their managers and employees. To fully understand the role that management accounting control systems play in the control process, it is necessary to be aware of how they relate to the entire array of control mechanisms used by organizations.

This chapter begins by describing the different types of controls that are used by companies. The elements of management accounting control systems will then be described within the context of the overall control process.

Learning objectives

After studying this chapter you should be able to:

- describe the three different types of controls used in organizations;
- describe a cybernetic control system;
- distinguish between feedback and feed-forward controls;
- explain the potential harmful side-effects of the different types of controls;
- define the four different types of responsibility centres;
- explain the different elements of management accounting control systems;
- describe the controllability principle and the methods of implementing it;
- describe the different types of financial performance targets and the effects of their level of difficulty on motivation and performance;
- describe the influence of participation in the budgeting process;
- distinguish between the three different styles of evaluating performance and identify the circumstances when a particular style is most appropriate.

Control at different organizational levels

Control is applied at different levels within an organization. Merchant (1998) distinguishes between strategic control and management control. **Strategic control** has an external focus. The emphasis is on how a firm, given its strengths and weaknesses and limitations can compete with other firms in the same industry. We shall explore some of these issues in Chapter 16 within the context of strategic management accounting. In this, and the next four chapters, our emphasis will be on **management control systems** which consist of a collection of control mechanisms that primarily have an internal focus. The aim of management control systems is to influence employee behaviours in desirable ways in order to increase the probability that an organization's objectives will be achieved.

Different types of controls

Companies use many different control mechanisms to cope with the problem of organizational control. To make sense of the vast number of controls that are used we shall classify them into three categories using approaches that have been adopted by Ouchi (1979) and Merchant (1998). They are:

1. action (or behavioural) controls;
2. personnel and cultural (or clan and social) controls;
3. results (or output) controls.

The terms in parentheses refer to the classification used by Ouchi whereas the other terms refer to the categories specified by Merchant. Because the classifications used by both authors are compatible we shall use the terms interchangeably.

ACTION OR BEHAVIOURAL CONTROLS

Behavioural controls involve observing the actions of individuals as they go about their work. They are appropriate where cause and effect relationships are well understood, so that if the correct means are followed, the desired outcomes will occur. Under these circumstances effective control can be achieved by having superiors watch and guide the actions of subordinates. For example, if the foreman watches the workers on the assembly line and ensures that the work is done exactly as prescribed then the expected quality and quantity of work should ensue.

Instead of using the term behavioural controls Merchant uses the term action controls. He defines **action controls** as applying to those situations where the actions themselves are the focus of controls. They are usable and effective only when managers know what actions are desirable (or undesirable) and have the ability to make sure that the desirable actions occur (or that the undesirable actions do not occur). Forms of action controls described by Merchant include behavioural constraints, preaction reviews and action accountability.

The aim of *behavioural constraints* is to prevent people from doing things that should not be done. They include physical constraints, such as computer passwords that restrict accessing or updating information sources to authorized personnel, and administrative constraints. Imposing ceilings on the amount of capital expenditure that managers may authorize is an example of an administrative constraint. For example, managers at lower

levels may be able to authorize capital expenditure below £10 000 within a total annual budget of, say, £100 000. The aim is to ensure that only those personnel with the necessary expertise and authority can authorize major expenditure and that such expenditure remains under their control.

Preaction reviews involve the scrutiny and approval of action plans of the individuals being controlled before they can undertake a course of action. Examples include the approval by municipal authorities of plans for the construction of properties prior to building commencing or the approval by a tutor of a dissertation plan prior to the student being authorized to embark on the dissertation.

Action accountability involves defining actions that are acceptable or unacceptable, observing the actions and rewarding acceptable or punishing unacceptable actions. Examples of action accountability include establishing work rules and procedures and company codes of conduct that employees must follow. Line item budgets that were described in the previous chapter are another form of action accountability whereby an upper limit on an expense category is given for the budget period. If managers exceed these limits they are held accountable and are required to justify their actions. The purpose of action accountability is to set limits on employee behaviour. Direct observation of employees' actions by superiors to ensure that they are following prescribed rules represents the main form of ensuring action accountability. Other forms include internal audits which involve checks on transaction records and compliance with pre-set action standards.

Action/behavioural controls can only be used effectively when managers know what actions are desirable (or undesirable). In other words, they are appropriate only when cause-and-effect work relationships are well understood such as when a supervisor can observe the actions of workers on a production line to ensure that work is done exactly as prescribed. In contrast, the application of action controls is limited where the work of employees is complex and uncertain and cause-and-effect relationships cannot be precisely described. For action controls to be effective a second requirement must also be met. Managers must also be able to ensure that desired actions are taken. There must be some means of action tracking so that managers can distinguish between good and bad actions. If both of the above conditions do not apply then action controls are inappropriate.

Action controls that focus on *preventing* undesirable behaviour are the ideal form of control because their aim is to prevent the behaviour from occurring. They are preferable to *detection* controls that are applied after the occurrence of the actions because they avoid the costs of undesirable behaviour. Nevertheless, detection controls can still be useful if they are applied in a timely manner so that they can lead to the early cessation of undesirable actions. Their existence also discourages individuals from engaging in such actions.

PERSONNEL, CULTURAL AND SOCIAL CONTROLS

Clan and social controls are the second types of controls described by Ouchi. Clan controls are based on the belief that by fostering a strong sense of solidarity and commitment towards organizational goals people can become immersed in the interests of the organization. Macintosh (1985) illustrates an extreme example of clan controls by describing the exploits of the Japanese *kamikaze* pilots during World War II. He describes how each pilot fervently believed his individual interests were served best by complete personal immersion in the needs of Japan and the Emperor. It was understood that each pilot would sacrifice himself and his plane by crashing into an enemy warship. National ruin without resistance represented public disgrace. These beliefs were shared by each pilot.

The main feature of clan controls is the high degree of employee discipline attained through the dedication of each individual to the interests of the whole. At a less extreme level clan controls can be viewed as corporate cultures or a special form of **social control** such as the selection of people who have already been socialized into adopting particular norms and patterns of behaviour to perform particular tasks. For example, if the only staff promoted to managerial level are those who display a high commitment to the firm's objectives then the need for other forms of controls can be reduced, provided that the managers are committed to achieving the 'right' objectives.

Merchant adopts a similar approach to Ouchi and classifies personnel and cultural controls as a second form of control. He defines **personnel controls** as helping employees do a good job by building on employees' natural tendencies to control themselves. In particular, they ensure that the employees have the capabilities (in terms of intelligence, qualifications and experience) and the resources needed to do a good job. Merchant identifies three major methods of implementing personnel controls. They are selection and placement, training and job design and the provision of the necessary resources. Selection and placement involves finding the right people to do a specified job. Training can be used to ensure that employees know how to perform the assigned tasks and to make them fully aware of the results and actions that is expected from them. Job design entails designing jobs in such a way that enable employees to undertake their tasks with a high degree of success. This requires that jobs are not made too complex, onerous or badly defined so that employees do not know what is expected of them.

Cultural controls represent a set of values, social norms and beliefs that are shared by members of the organization and that influence their actions. Cultural controls are exercised by individuals over one another – for example, procedures used by groups within an organization to regulate performance of their own members and to bring them into line when they deviate from group norms. It is apparent from the above description that cultural controls are virtually the same as social controls.

Merchant suggest that a number of methods can be employed to shape culture and thus effect cultural controls. They include codes of conduct, group based rewards, and interorganizational transfers. Codes of conduct are formal written documents that incorporate general statements of corporate values and commitments to stakeholders and ways in which top management would like the organization to function. They are designed to indicate to employees what behaviours are expected in the absence of clearly defined rules or controls. Group based rewards consist of rewards based on collective achievements such as group bonuses and profit sharing schemes. They encourage mutual-monitoring by members of the group and reduce measurement costs because individual performance does not have to be measured. Interorganizational transfers involve moving managers between different functions and divisions in order to give them a better understanding of the organization as a whole. This practice is frequently used by Japanese firms to improve their sense of belonging to an organization rather than to the sub-units and also to ensure that managers are aware of the problems experienced by different parts of the organization.

In recent years working practices have begun to change and managers are now relying on people closest to the operating processes and customers to take actions without authorization from superiors. This approach is known as employee empowerment and places greater emphasis on shared organizational values for ensuring that everyone is acting in the organization's best interests. A strong internal firm culture can decrease the need for other control mechanisms since employee beliefs and norms are more likely to coincide with firm goals. They can also be used to some extent in many different organizational settings and are less costly to operate than other types of controls. They also tend to have less harmful side-effects than other control mechanisms.

RESULTS OR OUTPUT CONTROLS

Output or results controls involve collecting and reporting information about the outcomes of work effort. The major advantage of results controls is that senior managers do not have to be knowledgeable about the means required to achieve the desired results or be involved in directly observing the actions of subordinates. They merely rely on output reports to ascertain whether or not the desired outcomes have been achieved. Accounting control systems can be described as a form of output controls. They are mostly defined in monetary terms such as revenues, costs, profits and ratios such as return on investment. Results measures also include non-accounting measures such as the number of units of defective production, the number of loan applications processed or ratio measures such as the number of customer deliveries on time as a percentage of total deliveries.

Results controls involve the following stages:

1. establishing results (i.e. performance) measures that minimize undesirable behaviour;
2. establishing performance targets;
3. measuring performance;
4. providing rewards or punishment.

Ideally *desirable behaviour should improve the performance measure and undesirable behaviour should have a detrimental effect* on the measure. A performance measure that is not a good indicator of what is desirable to achieve the organization's objectives might actually encourage employees to take actions that are detrimental to the organization. The term 'What you measure is what you get' can apply whereby employees concentrate on improving the performance measures even when they are aware that their actions are not in the firm's best interests. For example, a divisional manager whose current return on investment (ROI) is 30% might reject a project which yields an ROI of 25% because it will lower the division's average ROI, even though the project has a positive NPV, and acceptance is in the best interests of the organization.

Without a *pre-set performance target* individuals do not know what to aim for. Various research studies suggest that the existence of a clearly defined quantitative target is likely to motivate higher performance than vague statements such as 'do your best'. It is also difficult for employees or their superiors to interpret performance unless actual performance can be compared against predetermined standards.

Ability to measure some outputs effectively constrains the use of results measures. For example, *measuring the performance* of support departments can sometimes be difficult. Consider a personnel department. The accomplishments of the department can be difficult to measure and other forms of control might be preferable.

For results measures to work effectively the individuals whose behaviours are being controlled must be able to control and influence the results. Where factors outside the control of the individuals affect the results measures it is difficult to determine whether the results are the outcome of actions taken or from the impact of uncontrollable factors. If uncontrollable factors cannot be separated from controllable factors results controls measures are unlikely to provide useful information for evaluating the actions taken. Note also that if the outcomes of desirable behaviours are offset by the impact of uncontrollable factors results measures will lose their motivational impact and create the impression that the results measures are unjust. The term **controllability principle** is used to refer to the extent that individuals whose behaviours are being controlled can influence the results controls measures. We shall examine the controllability principle in more detail later in this chapter.

Employees are encouraged to achieve organizational goals by having *rewards (or punishments)* linked to their success (or failure) in achieving the results measures. Organizational rewards include salary increases, bonuses, promotions and recognition. Employees can also derive intrinsic rewards through a sense of accomplishment and achievement. Punishments include demotions, failure to obtain the rewards and possibly the loss of one's job.

Cybernetic control systems

The traditional approach in the management control literature has been to view results controls as a simple **cybernetic system**. In describing this process authors often use a mechanical model such as a thermostat that controls a central heating system as a resemblance. This process is illustrated in Figure 11.1. You will see that the control system consists of the following elements:

1. The process (the room's temperature) is continually monitored by an automatic regulator (the thermostat).
2. Deviations from a predetermined level (the desired temperature) are identified by the automatic regulator.
3. Corrective actions are started if the output is not equal to the predetermined level. The automatic regulator causes the input to be adjusted by turning the heater on if the temperature falls below a predetermined level. The heater is turned off when the output (temperature) corresponds with the predetermined level.

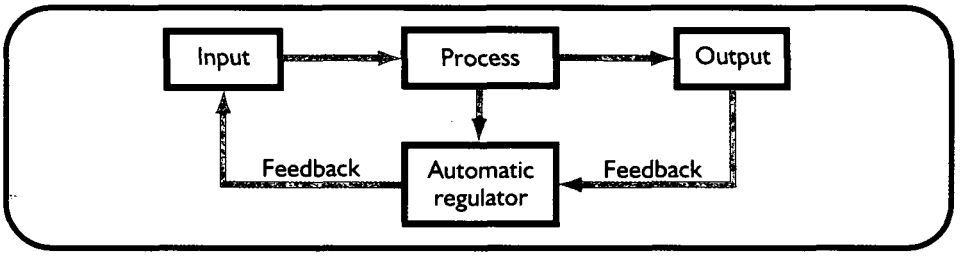
The output of the process is monitored, and whenever it varies from the predetermined level, the input is automatically adjusted. Emmanuel *et al.* (1990) state that four conditions must be satisfied before any process can be said to be controlled. First, objectives for the process being controlled must exist. Without an aim or purpose control has no meaning. Secondly, the output of the process must be measurable in terms of the dimensions defined by the objectives. In other words, there must be some mechanism for ascertaining whether the process is attaining its objectives. Thirdly, a predictive model of the process being controlled is required so that causes for the non-attainment can be identified and proposed corrective actions evaluated. Finally, there must be a capability for taking action so that deviations from objectives can be reduced. Emmanuel *et al.* stress that if any of these conditions are not met the process cannot be considered to be 'in control'.

Result controls resemble the thermostat control model. Standards of performance are determined, measurement systems monitor performance, comparisons are made between the standard and actual performance and feedback provides information on the variances. Note that the term **variance** is used to describe the difference the standard and actual performance of the actions that are being measured.

Feedback and feed-forward controls

The cybernetic system of control described in Figure 11.1 is that of feedback control. **Feedback control** involves monitoring outputs achieved against desired outputs and taking whatever corrective action is necessary if a deviation exists. In **feed-forward**

FIGURE 11.1 *A cybernetic control system.*



control instead of actual outputs being compared against desired outputs, predictions are made of what outputs are expected to be at some future time. If these expectations differ from what is desired, control actions are taken that will minimize these differences. The objective is for control to be achieved before any deviations from desired outputs actually occur. In other words, with feed-forward controls likely errors can be anticipated and steps taken to avoid them, whereas with feedback controls actual errors are identified after the event and corrective action is taken to implement future actions to achieve the desired outputs.

Feed-forward control requires the use of a predictive model that is sufficiently accurate to ensure that control action will improve the situation and not cause it to deteriorate further. A major limitation of feedback control is that errors are allowed to occur. This is not a significant problem when there is a short time lag between the occurrence of an error and the identification and implementation of corrective action. Feed-forward control is therefore preferable when a significant time lag occurs. The budgeting process is a feed-forward control system. To the extent that outcomes fall short of what is desired, alternatives are considered until a budget is produced that is expected to achieve what is desired. The comparison of actual results with budget, in identifying variances and taking remedial action to ensure that future outcomes will conform with budgeted outcomes is an illustration of a feedback control system. Thus accounting control systems consist of both feedback and feed-forward controls.

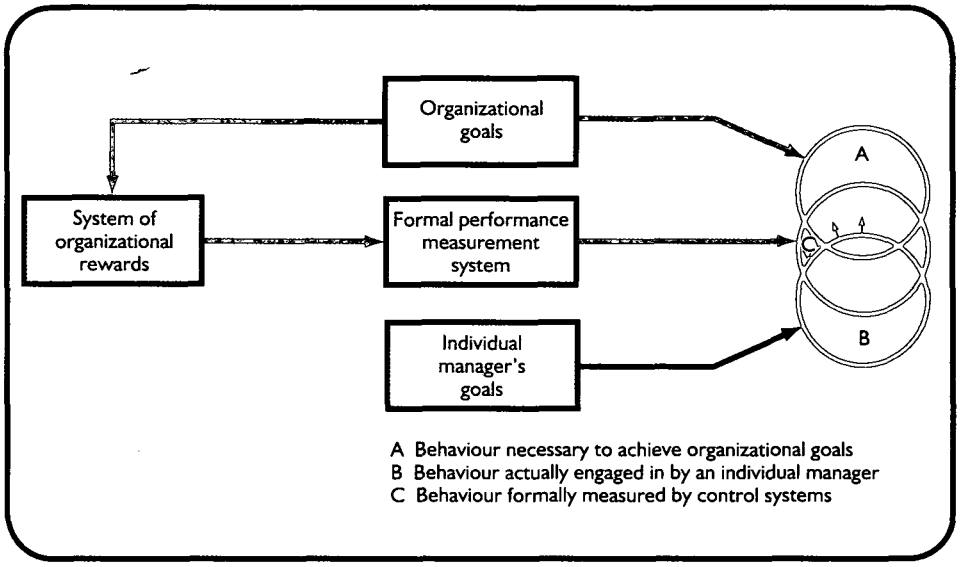
Harmful side-effects of controls

Harmful side-effects occur when the controls motivate employees to engage in behaviour that is not organizationally desirable. In this situation the control system leads to a lack of goal congruence. Alternatively, when controls motivate behaviour that is organizationally desirable they are described as encouraging goal congruence.

Results controls can lead to a lack of goal congruence if the results that are required can only be partially specified. Here there is a danger that employees will concentrate only on what is monitored by the control system, regardless of whether or not it is organizationally desirable. In other words, they will seek to maximize their individual performance according to the rules of the control system irrespective of whether their actions contribute to the organization's objectives. In addition, they may ignore other important areas, if they are not monitored by the control system. The term 'What you measure is what you get' applies in these circumstances.

Figure 11.2, derived from Otley (1987) illustrates the problems that can arise when the required results can only be partially specified. You will see that those aspects of behaviour on which subordinates are likely to concentrate to achieve their personal goals (circle B) do not necessarily correspond with those necessary for achieving the wider organizational goals (circle A). In an ideal system the measured behaviour (represented by circle C)

FIGURE 11.2 *The measurement and reward process with imperfect measures.*



should completely cover the area of desired behaviour (represented by circle A). Therefore if a manager maximizes the performance measure, he or she will also maximize his or her contribution to the goals of the organization. In other words, the performance measures encourage goal congruence. In practice, it is unlikely that perfect performance measures can be constructed that measure all desirable organizational behaviour, and so it is unlikely that all of circle C will cover circle A. Assuming that managers desire the rewards offered by circle C, their actual behaviour (represented by circle B) will be altered to include more of circle C and, to the extent that C coincides with A, more of circle A.

However, organizational performance will be improved only to the extent that the performance measure is a good indicator of what is desirable to achieve the firm's goals. Unfortunately, performance measures are not perfect and, as an ideal measure of overall performance, is unlikely to exist. Some measures may encourage goal congruence or organizationally desirable behaviour (the part of circle C that coincides with A), but other measures will not encourage goal congruence (the part of circle C that does not coincide with A). Consequently, there is a danger that subordinates will concentrate only on what is measured, regardless of whether or not it is organizationally desirable. Furthermore, actual behaviour may be modified so that desired results appear to be obtained, although they may have been achieved in an undesirable manner which is detrimental to the firm.

The evidence suggests that data manipulation is common with results controls (Merchant, 1990). Data manipulation occurs where individuals try and distort the data in order to improve the performance measure. For example, where individuals have some influence in the setting of performance targets there is a danger that they will seek to obtain easier targets by deliberately underperforming so that their targets will not be increased in the forthcoming period. Merchant (1990) also reported the widespread use of shifting funds between different budget items in order to avoid adverse budget variances.

Another harmful side effect of controls is that they can cause negative attitudes towards the control system. If controls are applied too rigorously they can result in job-related tensions, conflict and a deterioration in relationships with managers. To a certain extent

people do not like being subject to controls so that negative attitudes may be unavoidable. Nevertheless, they can be minimized if care is taken in designing control systems. Results controls can cause negative attitudes when targets are set which are considered to be too difficult and unachievable. Negative attitudes can also be exacerbated by a failure to apply the controllability principle. Performance evaluations are likely to be considered unfair where managers are held accountable for outcomes over which they have little control. Another potential cause of negative attitudes is the way in which results controls are applied. If they are applied in an insensitive and rigid manner and used mainly as punitive devices they are likely to provoke negative reactions. The way that a control system is applied can be just as important as the design issues in determining the success of a control system. Negative attitudes are likely to be the cause of many of the harmful side-effects that have been described above. Thus, if the negative attitudes can be minimized the harmful side-effects are likely to be minimized.

Advantages and disadvantages of different types of controls

Merchant (1998) suggests that when deciding on the control alternatives managers should start by considering whether *personnel* or *cultural controls* will be sufficient. He suggests that they are worthy of first consideration because they have relatively few harmful side-effects. Also in small organizations they may be completely effective without the need to supplement them with other forms of controls. Merchant concludes that considering personnel/cultural controls first allows managers to consider how reliable these controls are and the extent to which it is necessary to supplement them with other forms of control. However, he points out that these controls are appropriate only if the people in their particular roles understand what is required, are capable of performing well, and are motivated to perform well without additional rewards or punishments provided by the organization.

Action controls are the most effective form of control because there is a direct link between the control mechanism and the action and also a high probability that desirable outcomes will occur. They dispense with the need to measure the results and measurement problems do not therefore apply. The major limitation of action controls is that because they are dependent on cause-and-effect work relationships that are well understood they are not feasible in many situations. These requirements are likely to be applicable only with highly routinized jobs. A second limitation is that they tend to be best suited to stable situations. They can discourage creativity and the ability to adapt to changing circumstances and are therefore likely to be unsuitable in a changing environment.

The major attraction of *results controls* is that they can be applied where knowledge of what actions are desirable is lacking. This situation applies in most organizations. A second attraction of results controls is that their application does not restrict individual autonomy. The focus is on the outcomes thus giving individuals the freedom to determine how they can best achieve the outcomes. Individuals are not burdened with having to follow prescribed rules and procedures.

The major disadvantages of results controls have already been discussed. In many cases the results required can only be partially specified, there can be difficulties in separating controllable and uncontrollable factors and measurement problems may inhibit their ability to satisfactorily measure performance.

Management accounting control systems

To enable you to understand the role that management accounting control systems play within the overall control process this chapter has initially adopted a broad approach to describing management control systems. We shall now concentrate on management accounting control systems which represent the predominant controls in most organizations.

Why are accounting controls the predominant controls? There are several reasons. First, all organizations need to express and aggregate the results of a wide range of dissimilar activities using a common measure. The monetary measure meets this requirement. Second, profitability and liquidity are essential to the success of all organizations and financial measures relating to these and other areas are closely monitored by stakeholders. It is therefore natural that managers will wish to monitor performance in monetary terms. Third, financial measures also enable a common decision rule to be applied by all managers when considering alternative courses of action. That is, a course of action will normally benefit a firm only if it results in an improvement in its financial performance. Fourth, measuring results in financial terms enables managers to be given more autonomy. Focusing on the outcomes of managerial actions, summarized in financial terms, gives managers the freedom to take whatever actions they consider to be appropriate to achieve the desired results. Finally, outputs expressed in financial terms continue to be effective in uncertain environments even when it is unclear what course of action should be taken. Financial results provide a mechanism to indicate whether the actions benefited the organization.

Responsibility centres

The complex environment in which most businesses operate today makes it virtually impossible for most firms to be controlled centrally. This is because it is not possible for central management to have all the relevant information and time to determine the detailed plans for all the organization. Some degree of decentralization is essential for all but the smallest firms. Organizations decentralize by creating responsibility centres. A **responsibility centre** may be defined as a unit of a firm where an individual manager is held responsible for the unit's performance. There are four types of responsibility centres. They are:

1. cost or expense centres;
2. revenue centres;
3. profit centres;
4. investment centres.

The creation of responsibility centres is a fundamental part of management accounting control systems. It is therefore important that you can distinguish between the various forms of responsibility centres.

COST OR EXPENSE CENTRES

Cost or expense centres are responsibility centres whose managers are normally accountable for only those costs that are under their control. We can distinguish between

two types of cost centres – standard cost centres and discretionary cost centres. The main features of **standard cost centres** are that output can be measured and the input required to produce each unit of output can be specified. Control is exercised by comparing the standard cost (that is, the cost of the inputs that *should* have been consumed in producing the output) with the cost that was *actually* incurred. The difference between the actual cost and the standard cost is described as the **variance**. Standard cost centres and variance analysis will be discussed extensively in the next chapter.

Discretionary expense centres are those responsibility cost centres where output cannot be measured in financial terms and there are no clearly observable relationships between inputs (the resources consumed) and the outputs (the results achieved). Control normally takes the form of ensuring that actual expenditure adheres to budgeted expenditure for each expense category and also ensuring that the tasks assigned to each centre have been successfully accomplished. Examples of discretionary centres include advertising and publicity and research and development departments. You should note that in discretionary centres underspending against budget may not necessarily be a good thing since this may result in a lower level of service than that originally planned by management. For example, underspending on research and development may indicate that the amount to be spent on research and development has not been followed. One of the major problems arising in discretionary expense centres is measuring the effectiveness of expenditures. For example, the marketing support department may not have exceeded an advertising budget but this does not mean that the advertising expenditure has been effective. The advertising may have been incorrectly timed, it may have been directed to the wrong audience, or it may have contained the wrong message. Determining the effectiveness and efficiency of discretionary expense centres is one of the most difficult areas of management control.

REVENUE CENTRES

Revenue centres are responsibility centres where managers are accountable only for financial outputs in the form of generating sales revenues. Typical examples of revenue centres are where regional sales managers are accountable for sales within their regions. In some organizations revenue centres acquire finished goods from a manufacturing division and are responsible for selling and distributing these goods. Where managers are evaluated solely on the basis of sales revenues there is a danger that they may concentrate on maximizing sales revenues at the expense of profitability. This can occur when all sales are not equally profitable and managers can achieve higher sales revenues by promoting low-profit products.

Revenue centre managers may also be held accountable for selling expenses, such as salesperson salaries, commissions and order-getting costs. They are not, however, made accountable for the cost of the goods and services that they sell. Revenue centres can be distinguished from profit centres by the fact that revenue centres are accountable for only a small proportion of the total costs of manufacturing and selling products and services, namely selling costs, whereas profit centre managers are responsible for the majority of the costs including both manufacturing and selling costs.

PROFIT CENTRES

Both cost and revenue centre managers have limited decision-making authority. Cost centre managers are accountable only for managing inputs of their centres and decisions relating to outputs are made by other units within the firm. Revenue centres are

accountable for selling the products or services but they have no control over their manufacture. A significant increase in managerial autonomy occurs when unit managers are given responsibility for both production and sales. In this situation managers are normally free to set selling prices, choose which markets to sell in, make product-mix and output decisions and select suppliers. Units within an organization whose managers are accountable for both revenues and costs are called **profit centres**.

INVESTMENT CENTRES

Investment centres are responsibility centres whose managers are responsible for both sales revenues and costs and, in addition, have responsibility and authority to make working capital and capital investment decisions. Typical investment centre performance measures include return on investment and economic value added. These measures are influenced by revenues, costs and assets employed and thus reflect the responsibility that managers have for both generating profits and managing the investment base.

Investment centres represent the highest level of managerial autonomy. They include the company as a whole, operating subsidiaries, operating groups and divisions. You will find that many firms are not precise in their terminology and call their investment centres profit centres. Profit and investment centres will be discussed extensively in Chapter 13.

The nature of management accounting control systems

Management accounting control systems have two core elements. The first is the formal planning processes such as budgeting and long-term planning that were described in the previous chapter. These processes are used for establishing performance expectations for evaluating performance. The second is responsibility accounting which involves the creation of responsibility centres. Responsibility centres enable accountability for financial results and outcomes to be allocated to individuals throughout the organization. The objective of **responsibility accounting** is to measure the results of each responsibility centre. It involves accumulating costs and revenues for each individual responsibility centre so that the deviations from a performance target (typically the budget) can be attributed to the individual who is accountable for the responsibility centre. For each responsibility centre the process involves setting a performance target, measuring performance, comparing performance against the target, analysing the variances and taking action where significant variances exist between actual and target performance. Financial performance targets for profit or investment centres are typically in terms of profits, return on investment or economic value added whereas performance targets for cost centres are defined in terms of costs.

Responsibility accounting is implemented by issuing performance reports at frequent intervals (normally monthly) that inform responsibility centre managers of the deviations from budgets for which they are accountable and are required to take action. An example of a performance report issued to a cost centre manager is presented in the lower section of Exhibit 11.1. You should note that at successively higher levels of management less detailed information is reported. You can see from the upper sections of Exhibit 11.1 that the information is condensed and summarized as the results relating to the responsibility centre are reported at higher levels. Exhibit 11.1 only includes financial information. In

EXHIBIT 11.1

Responsibility accounting - monthly performance reports

addition non-financial measures such as those relating to quality and timeliness may be reported. We shall look at non-financial measures in more detail in Chapter 16.

Responsibility accounting involves:

- distinguishing between those items which managers can

Performance report to managing director

		Budget		Variance[a] F (A)	
		Current month (£)	Year to date (£)	This month (£)	Year to date (£)
Managing director	→ Factory A	453 900	6 386 640	80 000(A)	98 000(A)
	Factory B	X	X	X	X
	Factory C	X	X	X	X
	Administration costs	X	X	X	X
	Selling costs	X	X	X	X
	Distribution costs	X	X	X	X
		2 500 000	30 000 000	400 000(A)	600 000(A)

Performance report to production manager of factory A

Production manager	Works manager's office	X	X	X	X
	→ Machining department 1	165 600	717 600	32 760(A)	89 180(A)
	Machining department 2	X	X	X	X
	Assembly department	X	X	X	X
	Finishing department	X	X	X	X
		453 900	6 386 640	80 000(A)	98 000(A)

Performance report to head of responsibility centre

Head of responsibility centre	Direct materials	X	X	X	X
	Direct labour	X	X	X	X
	Indirect labour	X	X	X	X
	Indirect materials	X	X	X	X
	Power	X	X	X	X
	Maintenance	X	X	X	X
	Idle time	X	X	X	X
	Other	X	X	X	X
		165 600	717 600	32 760(A)	89 180(A)

[a]F indicates a favourable variance (actual cost less than budgeted cost) and (A) indicates an adverse budget (actual cost greater than budget cost). Note that, at the lowest level of reporting, the responsibility centre head's performance report contains detailed information on operating costs. At successively higher levels of management less detail is reported. For example, the managing director's information on the control of activities consists of examining those variances that represent significant departures from the budget for each factory and functional area of the business and requesting explanations from the appropriate managers.

control and for which they should be held accountable and those items over which they have no control and for which they are not held accountable;

- determining how challenging the financial targets should be;
- determining how much influence managers should have in the setting of financial targets.

We shall now examine each of these items in detail.

The controllability principle

Responsibility accounting is based on the application of the **controllability principle** which means that it is appropriate to charge to an area of responsibility only those costs that are significantly influenced by the manager of that responsibility centre. The controllability principle can be implemented by either eliminating the uncontrollable items from the areas for which managers are held accountable or calculating their effects so that the reports distinguish between controllable and uncontrollable items.

Applying the controllability principle is difficult in practice because many areas do not fit neatly into either controllable and uncontrollable categories. Instead, they are partially controllable. For example, even when outcomes may be affected by occurrences outside a manager's control; such as competitors' actions, price changes and supply shortages, managers can take action to reduce their adverse effects. They can substitute alternative materials where the prices of raw materials change or they can monitor and respond to competitors' actions. If these factors are categorized as uncontrollables managers will be motivated not to try and influence them. A further problem is that even when a factor is clearly uncontrollable, it is difficult to measure in order to highlight its impact on the reported outcomes.

TYPES OF UNCONTROLLABLE FACTORS

Merchant (1998) identifies three types of uncontrollable factors. They are:

1. economic and competitive factors;
2. acts of nature;
3. interdependencies.

Both revenues and costs are affected by *economic and competitive factors*. Changes in customers' tastes, competitors' actions, business cycles and changing government regulations and foreign exchange rates affect sales revenues. Costs are affected by items such as changes in input prices, interest and foreign exchange rates, government regulations and taxes. Although these items appear to be uncontrollable managers can respond to these changes to relieve their negative impacts. For example, they can respond to changes in customers' tastes by developing new products or redesigning existing products. They can respond to changes in exchange rates by changing their sources of supply and selling in different countries. Responding to such changes is an important part of a manager's job. Therefore most management accounting control systems do not shield managers completely from economic and competitive factors although they may not be required to bear all of the risk.

Acts of nature are usually large, one-time events with effects on performance that are beyond the ability of managers to anticipate. Examples are disasters such as fires, floods, riots, tornadoes, accidents and machine breakdowns. Most organizations protect managers

from the adverse consequences of acts of nature by not making them accountable for them provided that the events are considered to be clearly uncontrollable.

The third type of uncontrollable relates to *interdependence* whereby a responsibility centre is not completely self-contained so that the outcomes are affected by other units within the organization. For example, responsibility centres use common/pooled firm resources such as shared administrative activities. Interdependence is low when responsibility centres are relatively self-contained so that use of pooled resources has little impact on a unit's performance. The users of pooled resources should not have to bear any higher costs arising from the bad performance of the shared resource pools. Managers can be protected from inefficiencies of the shared resource pools to a certain extent by negotiations during the annual budgeting process whereby the quantities and amounts of services are agreed. Responsibility centre managers are charged with their usage of pooled resources at the budgeted rate and do not bear the cost of any inefficiencies incurred by the pooled resource centres during the current budget period.

DEALING WITH THE DISTORTING EFFECTS OF UNCONTROLLABLE FACTORS BEFORE THE MEASUREMENT PERIOD

Management can attempt to deal with the distorting effects of uncontrollables by making adjustments either before or after the measurement period. Uncontrollable and controllable factors can be determined prior to the measurement period by specifying which budget line items are to be regarded as controllable and uncontrollable. Uncontrollable items can either be excluded from performance reports or shown in a separate section within the performance report so that they are clearly distinguishable from controllable items. The latter approach has the advantage of drawing managerial attention to those costs that a company incurs to support their activities. Managers may be able to indirectly influence these costs if they are made aware of the sums involved.

How do we distinguish between controllable and uncontrollable items? Merchant suggests that the following general rule should be applied to all employees – 'Hold employees accountable for the performance areas you want them to pay attention to.' Applying this rule explains why some organizations assign the costs of shared resource pools, such as administrative costs relating to personnel and data processing departments, to responsibility centres. Assigning these costs authorizes managers of the user responsibility centres to question the amount of the costs and the quantity and quality of services supplied. In addition, responsibility centres are discouraged from making unnecessary requests for the use of these services when they are aware that increases in costs will be assigned to the users of the services.

Care must be taken, however, in making responsibility heads accountable for many areas for which they do not have a significant influence. The additional costs arising from the harmful side-effects described earlier will be incurred and these must be offset against the benefits discussed above.

DEALING WITH THE DISTORTING EFFECTS OF UNCONTROLLABLE FACTORS AFTER THE MEASUREMENT PERIOD

Merchant identifies four methods of removing the effects of uncontrollable factors from the results measures after the measurement period and before the rewards are assigned. They are:

1. variance analysis;
2. flexible performance standards;
3. relative performance evaluations;
4. subjective performance evaluations.

Variance analysis seeks to analyse the factors that cause the actual results to differ from pre-determined budgeted targets. In particular, variance analysis helps to distinguish between controllable and uncontrollable items and identify those individuals who are accountable for the variances. For example, variances analysed by each type of cost, and by their price and quantity effects, enables variances to be traced to accountable individuals and also to isolate those variances that are due to uncontrollable factors. Variance analysis will be discussed extensively in the next chapter.

Flexible performance standards apply when targets are adjusted to reflect variations in uncontrollable factors arising from the circumstances not envisaged when the targets were set. The most widely used flexible performance standard is to use **flexible budgets** whereby the uncontrollable volume effects on cost behaviour are removed from the manager's performance reports. Because some costs vary with changes in the level of activity, it is essential when applying the controllability principle to take into account the variability of costs. For example, if the actual level of activity is greater than the budgeted level of activity then those costs that vary with activity will be greater than the budgeted costs purely because of changes in activity. Let us consider the simplified situation presented in Example 11.1.

EXAMPLE 11.1

An item of expense that is included in the budget for a responsibility centre varies directly in relation to activity at an estimated cost of £5 per unit of output. The budgeted monthly level of activity was 20 000 units and the actual level of activity was 24 000 units at a cost of £105 000.

Assuming that the increase in activity was due to an increase in sales volume greater than that anticipated when the budget was set then the increases in costs arising from the volume change are beyond the control of the responsibility centre manager. It is clearly inappropriate to compare actual *variable* costs of £105 000 from an activity level of 24 000 units with budgeted *variable* costs of £100 000 from an activity level of 20 000 units. This would incorrectly suggest an overspending of £5000. If managers are to be made responsible for their costs, it is essential that they are responsible for performance under the conditions in which they worked, and not for a performance based on conditions when the budget was drawn up. In other words, it is misleading to compare actual costs at one level of activity with budgeted costs at another level of activity. At the end of the period the original budget must be adjusted to the actual level of activity to take into account the impact of the uncontrollable volume change on costs. This procedure is called flexible budgeting. In Example 11.1 the performance report should be as follows:

Budgeted expenditure	**Actual expenditure**
(flexed to 24 000 units)	(24 000 units)
£120 000	£105 000

The budget is adjusted to reflect what the costs should have been for an actual activity of 24 000 units. This indicates that the manager has incurred £15 000 less expenditure than

would have been expected for the actual level of activity, and a favourable variance of £15 000 should be recorded on the performance report, not an adverse variance of £5000, which would have been recorded if the original budget had not been adjusted.

In Example 11.1 it was assumed that there was only one variable item of expense, but in practice the budget will include many different expenses including fixed, semi-variable and variable expenses. You should note that fixed expenses do not vary in the short-term with activity and therefore the budget should remain unchanged for these expenses. The budget should be flexed only for variable and semi-variable expenses.

Budgets may also be adjusted to reflect other uncontrollable factors besides volume changes. Budgets are normally set based on the environment that is anticipated during the budget setting process. If the budget targets are then used throughout the duration of the annual budget period for performance evaluation the managers will be held accountable for uncontrollable factors arising from forecasting errors. To remove the managerial exposure to uncontrollable risks arising from forecasting errors *ex post* **budget adjustments** can be made whereby the budget is adjusted to the environmental and economic conditions that the manager's actually faced during the period.

Relative performance evaluation relates to the situations where the performance of a responsibility centre is evaluated relative to the performance of similar centres within the same company or to similar units outside the organization. To be effective responsibility centres must perform similar tasks and face similar environmental and business conditions with the units that they are being benchmarked against. Such relative comparisons with units facing similar environmental conditions neutralizes the uncontrollable factors because they are in effect held constant when making the relative comparisons. The major difficulty relating to relative performance evaluations is finding benchmark units that face similar conditions and uncertainties.

Instead of making the formal and quantitative adjustments that are a feature of the methods that have been described so far **subjective judgements** are made in the evaluation process based on the knowledge of the outcome measures and the circumstances faced by the responsibility centre heads. The major advantage of subjective evaluations is that they can alleviate some of the defects of the measures used by accounting control systems. The disadvantages of subjective evaluations are that they are not objective, they tend not to provide the person being evaluated with a clear indication of how performance has been evaluated, they can create conflict with superiors resulting in a loss of morale and a decline in motivation and they are expensive in terms of management time.

GUIDELINES FOR APPLYING THE CONTROLLABILITY PRINCIPLE

Dealing with uncontrollables represents one of the most difficult areas for the design and operation of management accounting control systems. The following guidelines published by the Report of the Committee of Cost Concepts and Standards in the United States in 1956 still continues to provide useful guidance:

1. If a manager *can control the quantity and price paid* for a service then the manager is responsible for all the expenditure incurred for the service.
2. If the manager *can control the quantity of the service but not the price paid* for the service then only that amount of difference between actual and budgeted expenditure that is due to usage should be identified with the manager.
3. If the manager *cannot control either the quantity or the price paid* for the service then the expenditure is uncontrollable and should not be identified with the manager.

An example of the latter situation is when the costs of an industrial relations department are apportioned to a department on some arbitrary basis; such arbitrary apportionments are likely to result in an allocation of expenses that the managers of responsibility centres may not be able to influence. In addition to the above guidelines Merchants's general rule should also be used as a guide – 'Hold employees accountable for the performance areas you want them to pay attention to.'

Setting financial performance targets

There is substantial evidence from a large number of studies that the existence of a defined, quantitative goal or target is likely to motivate higher levels of performance than when no such target is stated. People perform better when they have a clearly defined goal to aim for and are aware of the standards that will be used to interpret their performance. There are three approaches that can be used to set financial targets. They are targets derived from engineering studies of input–output relationships, targets derived from historical data and targets derived from negotiations between superiors and subordinates.

Engineered targets can be used when there are clearly defined and stable input–output relationships such that the inputs required can be estimated directly from product specifications. For example, in a fast-food restaurant for a given output of hamburgers it is possible to estimate the inputs required because there is a physical relationship between the ingredients such as meats, buns, condiments and packaging and the number of hamburgers made. Input–output relationships can also be established for labour by closely observing the processes to determine the quantity of labour that will be required for a given output.

Where clearly defined input–output relationships do not exist other approaches must be used to set financial targets. One approach is to use **historical targets** derived directly from the results of previous periods. Previous results plus an increase for expected price changes may form the basis for setting the targets or an improvement factor may be incorporated into the estimate, such as previous period costs less a reduction of 10%. The disadvantage of using historical targets is that they may include past inefficiencies or may encourage employees to underperform if the outcome of efficient performance in a previous period is used as a basis for setting a more demanding target in the next period.

Negotiated targets are set based on negotiations between superiors and subordinates. The major advantage of negotiated targets is that they address the information asymmetry gap that can exist between superior and subordinate. This gap arises because subordinates have more information than their superiors on the relationships between outputs and inputs and the constraints that exist at the operating level, whereas superiors have a broader view of the organization as a whole and the resource constraints that apply. Negotiated targets enable the information asymmetry gap to be reduced so that the targets set incorporate the constraints applying at both the operational level and the firm as a whole. You should refer back to the previous chapter for a more detailed discussion of the negotiation process.

Targets vary in their level of difficulty and the chosen level has a significant effect on motivation and performance. Targets are considered to be moderately difficult (or highly achievable) when they are set at the average level of performance for a given task. According to Merchant (1990) most companies set their annual profit budgets targets at levels that are highly achievable. Their budgets are set to be challenging but achievable 80–90 per cent of the time by an effective management team working at a consistently high level of effort. Targets set at levels above average are labelled as difficult, tight or high, and those set below average are classed as easy, loose or low (Chow, 1983).

THE EFFECT OF THE LEVEL OF BUDGET DIFFICULTY ON MOTIVATION AND PERFORMANCE

The fact that a financial target represents a specific quantitative goal gives it a strong motivational potential, but the targets set must be accepted if managers are to be motivated to achieve higher levels of performance. Unfortunately, it is not possible to specify exactly the optimal degree of difficulty for financial targets, since task uncertainty and cultural, organizational and personality factors all affect an individual manager's reaction to a financial target.

Figure 11.3 derived from Otley (1987) shows the theoretical relationship between budget difficulty, aspiration levels and performance. In Figure 11.3 it is assumed that performance and aspiration levels are identical. Note that the **aspiration level** relates to the personal goal of the budgetee (that is, the person who is responsible for the budget). In other words, it is the level of performance that they hope to attain. You will see from Figure 11.3 that as the level of budget difficulty is increased both the budgetees' aspiration level and performance increases. However, there becomes a point where the budget is perceived as impossible to achieve and the aspiration level and performance decline dramatically. It can be seen from Figure 11.3 that the budget level that motivates the best level of performance may not be achievable. In contrast, the budget that is expected to be achieved (that is, the expectations budget in Figure 11.3) motivates a lower level of performance.

Therefore if budgets are to be set at a level that will motivate individuals to achieve maximum performance, adverse budget variances are to be expected. In such a situation it is essential that adverse budget variances are not used by management as a punitive device, since this is likely to encourage budgetees to attempt to obtain looser budgets by either underperforming or deliberately negotiating easily attainable budgets. This may lead to fewer adverse variances, but also to poorer overall performance.

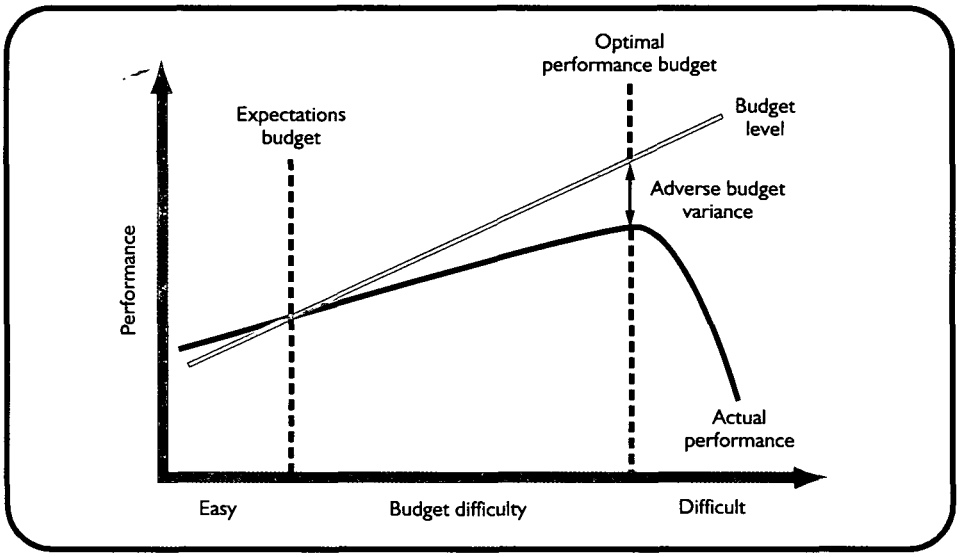
To motivate the best level of actual performance, demanding budgets should be set and small adverse variances should be regarded as a healthy sign and not as something to be avoided. If budgets are always achieved with no adverse variances, this indicates that the standards are too loose to motivate the best possible results.

ARGUMENTS IN FAVOUR OF SETTING HIGHLY ACHIEVABLE BUDGETS

It appears from our previous discussion that tight budgets should be established to motivate maximum performance, although this may mean that the budget has a high probability of not being achieved. Otley (1987) suggests that the optimum point may be at the point where individuals perceive there is significantly less than a 50% chance of target achievement. However, budgets are not used purely as a motivational device to maximize performance. They are also used for planning purposes and it is most unlikely that tight budgets will be suitable for planning purposes. Why? Tight budgets that have a high probability of not being achieved are most unsuitable for cash budgeting and for harmonizing the company plans in the form of a master budget. Because of this conflict, it has been suggested that separate budgets should be used for planning and for motivation purposes. The counter argument to this is that budgetees may react unfavourably to a situation where they believe that one budget is used to evaluate their performance and a second looser budget is used by top management.

Most companies use the same budgets for planning and motivational purposes (Umapathy, 1987). If only one set of budgets is used it is most unlikely that one set

FIGURE 11.3 *The effect of budget difficulty on performance. Source: Otley (1987).*



can, at the same time, perfectly meet both the planning and the motivational requirements. A compromise is required whereby the targets that can be used for planning purposes are not so easy that they have no motivational impact. Merchant (1990) suggests that highly achievable budgets that are achievable 80–90 per cent of the time require managers to be working consistently at a high level of effort to meet this requirement.

Highly achievable budgets also have a number of other advantages. The theoretical models such as the one illustrated in Figure 11.3 ignores the psychological impact of failure. For example, Merchant (1998) points out that when managers fail to achieve their budget targets they live with that failure for an entire year and that this can result in a prolonged period of discouragement and depression that can be quite costly to the organization. In contrast, highly achievable budgets provide managers with a sense of achievement and self-esteem which can be beneficial to the organization in terms of increased levels of commitment and aspirations. Highly achievable budgets also shield managers from unexpected adverse circumstances which were not anticipated when the budget was set. Hence, they are less likely to look for excuses for failure to achieve the budget. Instead, they promote an increase in commitment to achieving the budgets.

Rewards such as bonuses, promotions and job security are normally linked to budget achievement so that the costs of failing to meet budget targets can be high. The greater the probability of the failure to meet budget targets the greater is the probability that managers will be motivated to distort their performance by engaging in behaviour that will result in the harmful side-effects described earlier in this chapter. You should be able to recall that they include manipulation of data, negative attitudes and deliberately underperforming so that targets will not be increased in the forthcoming periods. Adopting targets that are highly achievable alleviates these harmful side-effects.

The disadvantage of adopting highly achievable budget targets is that aspiration levels and performance may not be maximized. To encourage managers to maximize performance when highly achievable standards are adopted, rewards can be given for achieving the budget, and additional rewards can also be given relating to the extent to which they exceed the budget. Managers therefore have incentives not to merely achieve the budget but to exceed it.

Participation in the budgeting and target setting process

Participation relates to the extent that subordinates or budgetees are able to influence the figures that are incorporated in their budgets or targets. Participation is sometimes referred to as **bottom-up budget setting** whereas a non-participatory approach whereby subordinates have little influence on the target setting process is sometimes called **top-down budget setting**.

Allowing individuals to participate in the setting of performance targets has several advantages. First, individuals are more likely to accept the targets and be committed to achieving them if they have been involved in the target setting process. Second, participation can reduce the information asymmetry gap that applies when standards are imposed from above. Earlier in this chapter it was pointed out that subordinates have more information than their superiors on the relationships between outputs and inputs and the constraints that exist at the operating level whereas the superiors have a broader view of the organization as a whole and the resource constraints that apply. This information sharing process enables more effective targets to be set that attempt to deal with both operational and organizational constraints. Finally, imposed standards can encourage negative attitudes and result in demotivation and alienation. This in turn can lead to a rejection of the targets and poor performance.

FACTORS INFLUENCING THE EFFECTIVENESS OF PARTICIPATION

Participation has been advocated by many writers as a means of making tasks more challenging and giving individuals a greater sense of responsibility. For many years participation in decision-making was thought to be a panacea for effective organizational effort but this school of thought was later challenged. The debate has never been resolved. The believers have never been able to demonstrate that participation really does have a positive effect on productivity and the sceptics have never been able to prove the opposite (Macintosh, 1985). The empirical studies have presented conflicting evidence on the usefulness of participation in the management process. For every study indicating that participation leads to better attitudes and improved performance, an alternative frequently exists suggesting the opposite.

Because of the conflicting findings relating to the effectiveness of participation research has tended to concentrate on studying how various factors influence the effectiveness of participation. In a classic study Vroom (1960) demonstrated that personality variables can have an important influence on the effectiveness of participation. He identified authoritarianism as an important factor conditioning the relationship between participation and performance. Vroom found that highly authoritarian people with a low need for independence were unaffected by participative approaches, and that high participation was effective only for individuals who were low on the authoritarianism measure.

Hopwood (1978) identified the importance of the work situation in determining the appropriateness of participation. He states:

> In highly programmed, environmentally and technologically constrained areas, where speed and detailed control are essential for efficiency, participative approaches may have much less to offer from the point of view of the more economic aspects of organizational effectiveness... In contrast, in areas where flexibility, innovation and the capacity to deal with unanticipated problems are important, participation in

decision-making may offer a more immediate and more narrowly economic payoff than more authoritarian styles.

Brownell (1981) examined the role of the personality variable, locus of control (i.e. the degree to which individuals feel they have control over their own destiny), and its effect on the participation–performance relationship. Budgetary participation was found to have a positive effect on those individuals who felt they had a large degree of control over their destiny, but a negative effect on those who felt that their destinies were controlled by luck, chance or fate. Brownell suggests that when an organization has discretion over the level of budgetary participation afforded to its members, role descriptions should be modified (specifically in regard to participation) to suit the individual characteristics of the role occupants. For example, participation appears to have a positive motivational effect only upon those managers who are confident in their ability to cope with the many factors influencing job performance. Conversely, managers who lack confidence are likely to find that participation only serves to increase their feelings of stress and tension due to uncertainty.

The evidence from the various studies suggests that participative styles of management will not necessarily be more effective than other styles, and that participative methods should be used with care. It is therefore necessary to identify those situations where there is evidence that participative methods are effective, rather than to introduce universal application into organizations. Participation must be used selectively; but if it is used in the right circumstances, it has an enormous potential for encouraging the commitment to organizational goals, improving attitudes towards the budgeting system, and increasing subsequent performance. Note, however, at this stage that there are some limitations on the positive effects of participation in standard setting and circumstances where top-down budget setting is preferable. They are:

1. Performance is measured by precisely the same standard that the budgetee has been involved in setting. This gives the budgetee the opportunity to negotiate lower targets that increase the probability of target achievement and the accompanying rewards. Therefore an improvement in performance – in terms of comparison with the budget – may result merely from a lowering of the standard. Ideally external reference points should be available, since this can provide an indication as to whether the participation process leads to low performance because of loose standards.
2. Personality traits of the participants may limit the benefits of participation. For example, the evidence appears to indicate that authoritarians and persons of weak independence needs may well perform better on standards set by a higher authority.
3. Participation by itself is not adequate in ensuring commitment to standards. The manager must also believe that he or she can significantly influence the results and be given the necessary feedback about them.
4. A top-down approach to budget setting is likely to be preferable where a process is highly programmable, and there are clear and stable input–output relationships, so that engineered studies can be used to set the targets. Here there is no need to negotiate targets using a bottom-up process.
5. Where a company has a large number of homogeneous units (such as many similar retailing outlets) operating in a stable environment, relative comparisons of the units can be made for performance evaluation. In these circumstances it is inappropriate for each unit to be involved in setting the targets. It is preferable for a top-down approach to be adopted so that a uniform policy can be established for setting the targets.

Side-effects arising from using accounting information for performance evaluation

Earlier in this chapter we discussed some of the harmful side-effects that can arise from the use of results controls. Some of these effects can be due to the ways in which the output measures are used. A number of studies have been undertaken that examine the side-effects arising from the ways that accounting information is used in performance evaluation.

A study on how budgets are used in performance evaluation was undertaken by Hopwood (1976), based on observations in a manufacturing division of a large US company. Three distinct styles of using budget and actual cost information in performance evaluation were observed and were described as follows:

1. **Budget-constrained style**: Despite the many problems in using accounting data as comprehensive measures of managerial performance, the evaluation is based primarily upon the cost centre head's ability continually to meet the budget on a short-term basis. This criterion of performance is stressed at the expense of other valued and important criteria, and a cost centre head will tend to receive an unfavourable evaluation if his or her actual costs exceed the budgeted costs, regardless of other considerations. Budget data are therefore used in a rigid manner in performance evaluation.
2. **Profit-conscious style**: The performance of the cost centre head is evaluated on the basis of his or her ability to increase the general effectiveness of his or her unit's operations in relation to the long-term goals of the organization. One important aspect of this at the cost centre level is the head's concern with the minimization of long-run costs. The accounting data must be used with some care and in a rather flexible manner, with the emphasis for performance evaluation in contributing to long-term profitability.
3. **Non-accounting style**: Accounting data plays a relatively unimportant part in the supervisor's evaluation of the cost centre head's performance.

Emmanuel *et al.* (1990) state that

> The three styles of evaluation are distinguished by the way in which extrinsic rewards are associated with budget achievement. In the rigid (budget constrained) style there is a clear-cut relationship; not achieving budget targets results in punishment, whereas achievement results in rewards. In the flexible (profit conscious) style, the relationship depends on other factors; given good reasons for over-spending, non-attainment of the budget can still result in rewards, whereas the attainment of the budget in undesirable ways may result in punishment. In the non-accounting style, the budget is relatively unimportant because rewards and punishment are not directly associated with its attainment. (Page 179.)

The evidence from Hopwood's study indicated that both the budget-constrained and the profit-conscious styles of evaluation led to a higher degree of involvement with costs than the non-accounting style. Only the profit-conscious style, however, succeeded in attaining this involvement without incurring either emotional costs for the managers in charge of the cost centres or defensive behaviour that was undesirable from the company's point of view.

The budget-constrained style gave rise to a belief that the evaluation was unjust, and caused widespread worry and tension on the job. Hopwood provides evidence of

manipulation and undesirable decision behaviour as methods of relieving tension when a budget-constrained style of evaluation is used. In addition, the manager's relationships with the budget-constrained supervisors were allowed to deteriorate, and the rigid emphasis on the short-term budget results also highlighted the interdependent nature of their tasks, so that the immediate instrumental concerns permeated the pattern of social relationships among colleagues. For example, managers went out to improve their own reports, regardless of the detrimental effects on the organization, and then tried to pass on the responsibility by blaming their colleagues. In contrast, Hopwood found that the profit-conscious style avoided these problems, while at the same time it ensured that there was an active involvement with the financial aspects of the operations. A summary of the effect of the three styles of evaluation is given in Exhibit 11.2.

Hopwood's study was based on cost centres having a high degree of interdependence. Rigid measures of performance become less appropriate as the degree of interdependence increases, and therefore the managers used the accounting information in a more flexible manner to ensure that the information remained effective. Otley (1978) replicated Hopwood's study in a British firm that consisted of profit centres with a high degree of independence and where accounting information represented a more adequate basis of performance evaluation. He found no significant differences in the levels of job tension and performance reported by managers evaluated on styles initially used by Hopwood. Three explanations were offered for the differences in results. First, Otley's managers were said to operate more independently of other units within the same organization than Hopwood's managers. Second, Otley's managers were profit centre managers whereas Hopwood's were cost centre managers. Finally, Hopwood's managers operated in a less predictable environment than Otley's.

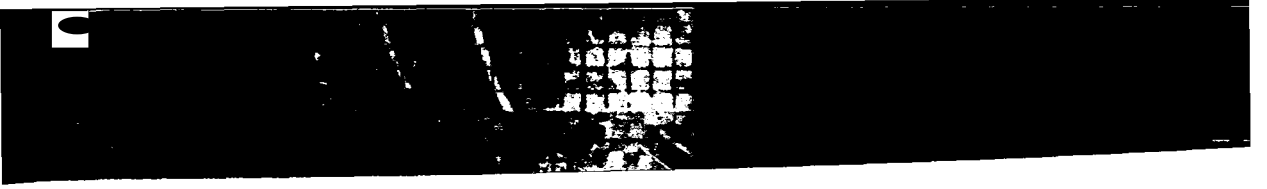
Otley suggested a style-context framework to reconcile the differences in results between his study and that of Hopwood. The style dimension consisted of a high and low emphasis on budget data in performance evaluation. The context dimension consisted of managerial interdependency[1] (high and low) and task uncertainty[2] (also high and low). Otley's framework suggested that when managers face high levels of interdependency or uncertainty, they may perceive themselves as having less than full control over performance outcomes. Using budget data in a rigid manner in such situations may be dysfunctional for performance, since a rigid use of budget data assumes that most of the factors that have an effect on task outcomes are within the control of the managers being evaluated (Ansari, 1979). On the other hand, Imoisili (1989) suggests that a rigid use of

EXHIBIT 11.2

Hopwood's findings on the effect of different styles of evaluating budget performance

	Style of evaluation		
	Budget-constrained	**Profit-conscious**	**Non-accounting**
Involvement with costs	High	High	Low
Job-related tension	High	Medium	Medium
Manipulation of accounting information	Extensive	Little	Little
Relations with superior	Poor	Good	Good
Relations with colleagues	Poor	Good	Good

budget data may be more acceptable to managers if they perceive they are able to exercise control over their performance outcomes. This would be the case with tasks characterized by low uncertainty or interdependency. In other words, it is not budget style *per se* that may lead to higher stress or lower performance. Rather, it is the mismatch of budget style and task contexts that may enhance stress or reduce managerial performance (Imoisili, 1989).



Summary

The aim of management control systems is to influence employee behaviours in desirable ways in order to increase the probability that an organization's objectives will be achieved. Companies use many different control mechanisms to cope with the problem of organizational control. To fully understand the role that management accounting control systems play in the control process, it is necessary to be aware of how they relate to the entire array of control mechanisms used by firms.

We therefore initially examined the different types of controls that are used by firms. Three different categories were identified – action/behavioural controls, personnel and cultural controls and results/output controls. With action controls the actions themselves are the focus of controls. They are usable and effective only when managers know what actions are desirable (or undesirable) and have the ability to make sure that the desirable actions occur (or that the undesirable actions do not occur). Personnel controls help employees do a good job by building on employees' natural tendencies to control themselves. They include selection and placement, training and job design. Cultural controls represent a set of values, social norms and beliefs that are shared by members of the organization and that influence their actions. Output or results controls involve collecting and reporting information about the outcomes of work effort. They involve the following stages – establishing results and performance targets, measuring performance and providing rewards or punishments based on an employee's ability to achieve the performance target.

Results controls can promote a number of harmful side effects. They can lead to a lack of goal congruence when employees seek to achieve the performance targets in a way that is not organizationally desirable. They can also lead to data manipulation and negative attitudes which can result in a decline in morale and a lack of motivation.

The creation of responsibility centres is a fundamental part of management accounting control systems. Four different types of responsibility centres were described. They were cost (or expense) centres, revenue centres, profit centres and investment centres. Management accounting control systems have two core elements. The first, is the formal planning processes such as budgeting and long-term planning. These processes are used for establishing performance expectations for evaluating performance. The second is responsibility accounting which involves the creation of responsibility centres. Responsibility centres enable accountability for financial results/outcomes to be allocated to individuals throughout the firm. The objective of responsibility accounting is to accumulate costs and revenues for each individual responsibility centre so that the deviations from a performance target can be attributed to the individual who is accountable. For each responsibility centre the process involves setting a performance target, measuring performance, comparing performance against the target, analysing the variances and taking action where significant variances exist between actual and target performance.

Responsibility accounting involves:

1. distinguishing between those items which managers can control and for which they should be held accountable and those items over which they have no control and for which they are not held accountable;
2. determining how challenging the financial targets should be;
3. determining how much influence managers should have in the setting of financial targets.

The controllability principle states that it is appropriate to charge to an area of responsibility only those costs that are significantly influenced by the manager of that responsibility centre. Different types of uncontrollables were explained and methods of dealing with them, either before or after the measurement period, were described. The general rule that should be applied is to hold employees accountable for the performance area you want them to pay attention to.

Different types of financial performance targets have been described and the impact of their level of difficulty on motivation and performance examined. Highly achievable targets were recommended because they could be used for planning purposes and they also had a motivational impact.

Participation or bottom-up budget setting was compared with top-down budget setting. The benefits arising from participation in the budget process were outlined and the empirical studies summarized. It was concluded that participation must be used selectively; but if it is used in the right circumstances, it has an enormous potential for encouraging commitment to organizational goals, improving attitudes towards the budgeting system, and increasing subsequent performance.

The side-effects arising from the ways that accounting information is used in performance evaluation was examined in the final section. Three different styles of performance evaluation were described (a budget-constrained, profit conscious and non-accounting style) and the circumstances where a specific style was recommended were identified.

Finally, you should note that there is no universally best management accounting control system which can be applied to all organizations. The contingency theory of management accounting advocates that it all depends upon the situational or contingent factors. A vast amount of literature has emerged on the impact of contingent factors on management accounting control systems. The contingency theory of management accounting is a complex topic that is beyond the scope of this book. For a discussion of this topic you should refer to Drury (2000, ch. 17).

Notes

1 Managerial interdependency is the extent to which each manager perceives his or her work-related activities to require the joint or cooperative effort of other managers within the organization.

2 Task uncertainty is the extent to which managers can predict confidently the factors that have effects on their work-related activities.

Key Terms and Concepts

action controls (p. 318)
aspiration level (p. 335)
behavioural controls (p. 318)
bottom-up budget setting (p. 337)
budget-constrained style (p. 339)
clan controls (p. 319)
contingency theory of management accounting (p. 344)
control (p. 317)
controllability principle (pp. 321, 330)
controls (p. 317)
cost centres (p. 326)
cultural controls (p. 320)
cybernetic system (p. 322)
discretionary expense centres (p. 327)
engineered targets (p. 334)
expense centres (p. 326)
ex post budget adjustments (p. 333)
feedback control (p. 322)
feed-forward control (p. 322)
flexible budgets (p. 332)
goal congruence (p. 323)
historical targets (p. 334)
investment centres (p. 328)
management control systems (p. 318)
negotiated targets (p. 334)
non-accounting style (p. 339)
output controls (p. 321)
participation (p. 337)
personnel controls (p. 320)
profit centres (p. 328)
profit-conscious style (p. 339)
relative performance evaluation (p. 333)
responsibility accounting (p. 328)
responsibility centre (p. 326)
results controls (p. 321)
revenue centres (p. 327)
social control (p. 320)
standard cost centres (p. 327)
strategic control (p. 318)
subjective judgements (p. 333)
top-down budget setting (p. 337)
variance (pp. 322, 327)
variance analysis (p. 332)

Recommended Reading

For a detailed study of the controllability principle you should refer to Merchant (1989). There are a number of important textbooks that specialize in management control. If you wish to study management control in more depth you are recommended to read Merchant (1998). For a discussion of performance measurement in the service industries you should refer to Fitzgerald and Moon (1996).

Review Problems

1. The Victoria Hospital is located in a holiday resort that attracts visitors to such an extent that the population of the area is trebled for the summer months of June, July and August. From past experience, this influx of visitors doubles the activity of the hospital during these months. The annual budget for the hospital's laundry department is broken down into four quarters, namely April–June, July–September, October–December and January–March, by dividing the annual budgeted figures by four. The budgeting work has been done for the current year by the secretary of the hospital using the previous year's figures and adding 3% for inflation. It is realized by the Hospital Authority that management information for control purposes needs to be improved, and you have been recruited to help to introduce a system of responsibility accounting.

   You are required, from the information given, to:

   (a) comment on the way in which the quarterly budgets have been prepared and to suggest improvements that could be introduced when preparing the budgets for 2001/2002;
   (b) state what information you would like to flow from the actual against budget comparison (note that calculated figures are *not* required);
   (c) state the amendments that would be needed to the current practice of budgeting and reporting to enable the report shown below to be used as a measure of the efficiency of the laundry manager.

Victoria Hospital – Laundry department
Report for quarter ended 30 September 2000

	Budget	Actual
Patients days	9000	12000
Weight processed (kgs)	180000	240000
	(£)	(£)
Costs:		
Wages	8800	12320
Overtime premium	1400	2100
Detergents and other supplies	1800	2700
Water, water softening and heating	2000	2500
Maintenance	1000	1500
Depreciation of plant	2000	2000
Manager's salary	1250	1500
Overhead, apportioned:		
for occupancy	4000	4250
for administration	5000	5750

(15 marks)
CIMA

2. The Viking Smelting Company established a division, called the reclamation division, two years ago, to extract silver from jewellers' waste materials. The waste materials are processed in a furnace, enabling silver to be recovered. The silver is then further processed into finished products by three other divisions within the company.

A performance report is prepared each month for the reclamation division which is then discussed by the management team. Sharon Houghton, the newly appointed financial controller of the reclamation division, has recently prepared her first report for the four weeks to 31 May. This is shown below:

Performance Report Reclamation Division
4 weeks to 31 May

	Actual	Budget	Variance		Comments
Production (tonnes)	200	250	50	(F)[a]	
	(£)	(£)	(£)		
Wages and social security costs	46 133	45 586	547	(A)	Overspend
Fuel	15 500	18 750	3250	(F)	
Consumables	2 100	2 500	400	(F)	
Power	1 590	1 750	160	(F)	
Divisional overheads	21 000	20 000	1 000	(A)	Overspend
Plant maintenance	6 900	5 950	950	(A)	Overspend
Central services	7 300	6 850	450	(A)	Overspend
Total	100 523	101 386	863	(F)	

[a] (A) = adverse, (F) = favourable

In preparing the budgeted figures, the following assumptions were made for May:

- the reclamation division was to employ four teams of six production employees;
- each employee was to work a basic 42-hour week and be paid £7.50 per hour for the four weeks of May;
- social security and other employment costs were estimated at 40% of basic wages;
- a bonus, shared amongst the production employees, was payable if production exceeded 150 tonnes. This varied depending on the output achieved;

1. if output was between 150 and 199 tonnes, the bonus was £3 per tonne produced;
2. if output was between 200 and 249 tonnes, the bonus was £8 per tonne produced;
3. if output exceeded 249 tonnes the bonus was £13 per tonne produced;

- the cost of fuel was £75 per tonne;
- consumables were £10 per tonne;
- power comprised a fixed charge of £500 per four weeks plus £5 per tonne for every tonne produced;
- overheads directly attributable to the division were £20 000;
- plant maintenance was to be apportioned to divisions on the basis of the capital values of each division;
- the cost of Viking's central services was to be shared equally by all four divisions.

You are the deputy financial controller of the reclamation division. After attending her first monthly meeting with the board of the reclamation division, Sharon Houghton arranges a meeting with you. She is concerned about a number of issues, one of them being that the current report does not clearly identify those expenses and variances which are the direct responsibility of the reclamation division.

Task 1

Sharon Houghton asks you to prepare a flexible budget report for the reclamation division for May in a form consistent with responsibility accounting.

On receiving your revised report. Sharon tells you about the other questions raised at the management meeting when the original report was presented. These are summarized below:

(i) Why are the budget figures based on 2-year-old data taken from the proposal recommending the establishment of the reclamation division?
(ii) Should the budget data be based on what we were proposing to do or what we actually did do?
(iii) Is it true that the less we produce the more favourable our variances will be?
(iv) Why is there so much maintenance in a new division with modern equipment and why should we be charged with the actual costs of the maintenance department even when they overspend?
(v) Could the comments, explaining the variances, be improved?
(vi) Should all the variances be investigated?
(vii) Does showing the cost of central services on the divisional performance report help control these costs and motivate the divisional managers?

Task 2

Prepare a memo for the management of the reclamation division. Your memo should:
(a) answer their queries and justify your comments;
(b) highlight the main objective of your revised performance report developed in Task 1 and give two advantages of it over the original report

AAT

Solutions to Review Problems

SOLUTION 1

(a) (i) Activity varies from month to month, but quarterly budgets are set by dividing total annual expenditure by 4.
(ii) The budget ought to be analysed by shorter intervals (e.g. monthly) and costs estimated in relation to monthly activity.
(iii) For control purposes monthly comparisons and cumulative monthly comparisons of planned and actual expenditure to date should be made.
(iv) The budget holder does not participate in the setting of budgets.
(v) An incremental budget approach is adopted. A zero-based approach would be more appropriate.
(vi) The budget should distinguish between controllable and uncontrollable expenditure.

(b) The information that should flow from a comparison of the actual and budgeted expenditure would consist of the variances for the month and year to date analysed into the following categories:
(i) controllable and uncontrollable items;
(ii) price and quantity variances with price variance analysed by inflationary and non-inflationary effects.

(c) (i) Flexible budgets should be prepared on a monthly basis. Possible measures of activity are number of patient days or expected laundry weight.
(ii) The laundry manager should participate in the budgetary process.
(iii) Costs should be classified into controllable and non-controllable items.
(iv) Variances should be reported and analysed by price and quantity on a monthly and cumulative basis.
(v) Comments should be added explaining possible reasons for the variances.

SOLUTION 2

Task 1

Reclamation Division Performance Report – 4 weeks to 31 May:

Original budget 250 tonnes
Actual output 200 tonnes

	Budget based on 200 tonnes	Actual	Variance	Comments
Controllable expenses:				
Wages and social security costs[a]	43 936	46 133	2197A	
Fuel[b]	15 000	15 500	500A	
Consumables[c]	2 000	2 100	100A	
Power[d]	1 500	1 590	90A	
Directly attributable overheads[e]	20 000	21 000	1000A	
	82 436	86 323	3887A	
Non-controllable expenses:				
Plant maintenance[e]	5 950	6 900	950A	
Central services[e]	6 850	7 300	450A	
	12 800	14 200	1400A	
Total	95 236	100 523	5287A	

Notes:

[a] 6 employees × 4 teams × 42 hours per week × £7.50 per hour × 4 weeks = £30 240.
[b] 200 tonnes × £75
[c] 200 tonnes × £10
[d] £500 + (£5 × 200) = £1500
[e] It is assumed that directly attributable expenses, plant maintenance and central services are non-variable expenses.

Task 2

(a) (i) Past knowledge can provide useful information on future outcomes but ideally budgets ought to be based on the most up-to-date information. Budgeting should be related to the current environment and the use of past information that is two years old can only be justified where the operating conditions and environment are expected to remain unchanged.

(ii) For motivation and planning purposes budgets should represent targets based on what we are proposing to do. For control purposes budgets should be flexed based on what was actually done so that actual costs for actual output can be compared with budgeted costs for the actual output. This ensures that valid comparisons will be made.

(iii) For variable expenses the original budget should be reduced in proportion to reduced output in order to reflect cost behaviour. Fixed costs are not adjusted since they are unaffected in the short-term by output changes. Flexible budgeting ensures that like is being compared with like so that reduced output does not increase the probability that favourable cost variances will be reported. However, if less was produced because of actual sales being less than budget this will result in an adverse sales variance and possibly an adverse profit variance.

(iv) Plant maintenance costs are apportioned on the basis of capital values and therefore newer equipment (with higher written-down values) will be charged with a higher maintenance cost. Such an approach does not provide a mean-

ingful estimate of maintenance resources consumed by departments since older equipment is likely to be more expensive to maintain. The method of recharging should be reviewed and ideally based on estimated usage according to maintenance records. The charging of the overspending by the maintenance department to user departments is questionable since this masks inefficiencies. Ideally, maintenance department costs should be recharged based on actual usage at budgeted cost and the maintennacnce department made accountable for the adverse spending (price) variance.

(v) The comments do not explain the causes of the variances and are presented in a negative tone. No comments are made, nor is any praise given, for the favourable variances.

(vi) Not all variances should be investigated. The decision to investigate should depend on both their absolute and relative size and the likely benefits arising from an investigation.

(vii) Central service costs are not controllable by divisional managers. However, even though the divisional manager cannot control these costs there is an argument for including them as non-controllable costs in the performance report. The justification for this is that divisional managers are made aware of central service costs and may put pressure on central service staff to control such costs more effectively. It should be made clear to divisional managers that they are not accountable for any non-controllable expenses that are included in their performance reports.

Questions

11.1

(a) Identify and explain the essential elements of an effective cost control system. (13 marks)

(b) Outline possible problems which may be encountered as a result of the introduction of a system of cost control into an organization. (4 marks)

(Total 17 marks)

11.2

You have applied for the position of assistant accountant in a company manufacturing a range of products with a sales turnover of £12 million per annum and employing approximately 300 employees. As part of the selection process you are asked to spend half an hour preparing a report, to be addressed to the managing director, on the topic of 'cost control'.

You are required to write the report which should deal with what is meant by 'cost control', its purpose and the techniques which you believe would be useful within this particular company. (20 marks)

CIMA 1

11.3

Outline the main features of a responsibility accounting system. (6 marks)

ACCA

11.4

(a) Budgetary controls have been likened to a system of thermostatic control.

(i) In what respects is the analogy inappropriate? (10 marks)

(ii) What are the matters raised in (a) (i) above that need to be considered when setting a structure for an effective budgetary control system? (8 marks)

(b) Describe the pre-conditions which should exist if budget variance analysis is to be of value to an organization. (7 marks)

(Total 25 marks)

CIMA

11.5

One common approach to organisational control theory is to look at the model of a cybernetic system. This is often illustrated by a diagram of a thermostat mechanism.

You are required:

(a) to explain the limitations of the simple feedback control this model illustrates, as an explanation of the working of organisational control systems;

Note: A diagram is *not* required. (7 marks)

(b) to explain

(i) the required conditions (pre-requisites) for the existence of control in an organisation, which are often derived from this approach to control theory; (5 marks)

(ii) the difficulties of applying control in a not-for-profit organisation (NPO). (8 marks)

(Total 20 marks)

CIMA

11.6

(a) In the context of budgeting, provide definitions for *four* of the following terms:

aspiration level;
budgetary slack;
feedback;
zero-base budgeting;
responsibility accounting. (8 marks)

(b) Discuss the motivational implications of the level of efficiency assumed in establishing a budget. (9 marks)

(Total 17 marks)

ACCA

11.7

You are required, within the context of budgetary control, to:

(a) explain the specific roles of planning, motivation and evaluation; (7 marks)

(b) describe how these roles may conflict with each other; (7 marks)

(c) give *three* examples of ways by which the management accountant may resolve the conflict described in (b). (6 marks)

CIMA

11.8

(a) Explain the ways in which the attitudes and behaviour of managers in a company are liable to pose more threat to the success of its budgetary control system than are minor technical inadequacies that may be in the system. (15 marks)

(b) Explain briefly what the management accountant can do to minimise the disruptive effects of such attitudes and behaviour. (5 marks)

CIMA

11.9

What are the behavioural aspects which should be borne in mind by those who are designing and operating standard costing and budgetary control systems? (20 marks)

CIMA 2

11.10

In his study of 'The Impact of Budgets on People', published in 1952, C. Argyris reported *inter alia* the following comment by a financial controller on the practice of participation in the setting of budgets in his company:

'We bring in the supervisors of budget areas, we tell them that we want their frank opinion, but most of them just sit there and nod their heads. We know they're not coming out with exactly how they feel. I guess budgets scare them.'

You are required to suggest reasons why managers may be reluctant to participate fully in setting budgets, and to suggest also unwanted side effects which may arise from the imposition of budgets by senior management. (13 marks)

ICAEW

11.11

You are required to:

(i) discuss the factors that are likely to cause managers to submit budget estimates of sales and costs that do not represent their best estimates or expectations of what will actually occur, (8 marks)

(ii) suggest, as a budget accountant, what procedures you would advise in order to minimize the likelihood of such biased estimates arising. (4 marks)

ICAEW

11.12

'Budgeting is too often looked upon from a purely mechanistic viewpoint. The human factors in budgeting are more important than the accounting techniques. The success of a budgetary system depends upon its acceptance by the company members who are affected by the budgets.'

Discuss the validity of the above statement from the viewpoint of both the planning and the control aspects of budgeting. In the course of your discus-

sion present at least one practical illustration to support your conclusions. (20 marks)
ACCA

11.13
'The major reason for introducing budgetary control and standard costing systems is to influence human behaviour and to motivate the managers to achieve the goals of the organization. However, the accounting literature provides many illustrations of accounting control systems that fail to give sufficient attention to influencing human behaviour towards the achievement of organization goals.'

You are required:
(a) To identify and discuss four situations where accounting control systems might not motivate desirable behaviour.
(b) To briefly discuss the improvements you would suggest in order to ensure that some of the dysfunctional behavioural consequences of accounting control systems are avoided.

11.14
'The final impact which any accounting system has on managerial and employee behaviour is dependent not only upon its design and technical characteristics but also in the precise manner in which the resulting information is used...' (A. Hopwood, *Accounting and Human Behaviour*).

Discuss this statement in relation to budgeting and standard costing.

11.15
The typical budgetary control system in practice does not encourage *goal congruence*, contains *budgetary slack*, ignores the *aspiration levels* of participants and attempts to control operations by *feedback*, when *feedforward* is likely to be more effective; in summary the typical budgetary control system is likely to have dysfunctional effects.

You are required to
(a) explain briefly *each* of the terms in italics; (6 marks)
(b) describe how the major dysfunctional effects of budgeting could be avoided. (11 marks)
(Total 17 marks)
CIMA

11.16 Flexible budgets and the motivational role of budgets
Club Atlantic is an all-weather holiday complex providing holidays throughout the year. The fee charged to guests is fully inclusive of accommodation and all meals. However, because the holiday industry is so competitive, Club Atlantic is only able to generate profits by maintaining strict financial control of all activities.

The club's restaurant is one area where there is a constant need to monitor costs. Susan Green is the manager of the restaurant. At the beginning of each year she is given an annual budget which is then broken down into months. Each month she receives a statement monitoring actual costs against the annual budget and highlighting any variances. The statement for the month ended 31 October is reproduced below along with a list of assumptions:

Club Atlantic Restaurant Performance Statement
Month to 31 October

	Actual	Budget	Variance (over)/ under
Number of guest days	11 160	9 600	(1560)
	(£)	(£)	(£)
Food	20 500	20 160	(340)
Cleaning materials	2 232	1 920	(312)
Heat, light and power	2 050	2 400	350
Catering wages	8 400	7 200	(1200)
Rent rates, insurance and depreciation	1 860	1 800	(60)
	35 042	33 480	(1562)

Assumptions:
(a) The budget has been calculated on the basis of a 30-day calendar month with the cost of rents, insurance and depreciation being an apportionment of the fixed annual charge.
(b) The budgeted catering wages assume that:
  (i) there is one member of the catering staff for every forty guests staying at the complex;
  (ii) the daily cost of a member of the catering staff is £30.
(c) All other budgeted costs are variable costs based on the number of guest days.

Task 1
Using the data above, prepare a revised performance statement using flexible budgeting. Your statement should show both the revised budget and the revised variances. Club Atlantic uses the existing budgets and performance statements to motivate its managers as well as for financial

control. If managers keep expenses below budget they receive a bonus in addition to their salaries. A colleague of Susan is Brian Hilton. Brian is in charge of the swimming pool and golf course, both of which have high levels of fixed costs. Each month he manages to keep expenses below budget and in return enjoys regular bonuses. Under the current reporting system, Susan Green only rarely receives a bonus.

At a recent meeting with Club Atlantic's directors Susan Green expressed concern that the performance statement was not a valid reflection of her management of the restaurant. You are currently employed by Hall and Co., the club's auditors, and the directors of Club Atlantic have asked you to advise them whether there is any justification for Susan Green's concern.

At the meeting with the Club's directors, you were asked the following questions:

(a) Do budgets motivate managers to achieve objectives?
(b) Does motivating managers lead to improved performance?
(c) Does the current method of reporting performance motivate Susan Green and Brian Hilton to be more efficient?

Task 2

Write a *brief* letter to the directors of Club Atlantic addressing their question and justifying your answers.

Note: You should make use of the data given in this task plus your findings in Task 1.

AAT

11.17 Criticism and redrafting of a performance report

(a) The following report has been prepared, relating to one product for March. This has been sent to the appropriate product manager as part of PDC Limited's monitoring procedures.

Monthly variance report – March 1

	Actual	Budget	Variance	%
Production volume (units)	9905	10000	95 A	0.95 A
Sales volume (units)	9500	10000	500 A	5.00 A
Sales revenue (£)	27700	30000	2300 A	7.67 A
Direct material (kg)	9800	10000	200 F	2.00 F
Direct material (£)	9600	10000	400 F	4.00 F
Direct labour (hours)	2500	2400	100 A	4.17 A
Direct labour (£)	8500	8400	100 A	1.19 A
Contribution (£)	9600	11600	2000 A	17.24 A

The product manager has complained that the report ignores the principle of flexible budgeting and is unfair.

Required:

Prepare a report addressed to the management team which comments critically on the monthly variance report. Include as an appendix to your report the layout of a revised monthly variance report which will be more useful to the product manager. Include row and column headings, but do *not* calculate the contents of the report. (15 marks)

(b) Explain the differences between budgetary control and standard costing/variance analysis. In what circumstances would an organization find it beneficial to operate both of these cost control systems? (5 marks)

(Total 20 marks)

CIMA

11.18 Preparation of flexible budgets

Data

Rivermede Ltd makes a single product called the Fasta. Last year, Steven Jones, the managing director of Rivermede Ltd, attended a course on budgetary control. As a result, he agreed to revise the way budgets were prepared in the company. Rather than imposing targets for managers, he encouraged participation by senior managers in the preparation of budgets.

An initial budget was prepared but Mike Fisher, the sales director, felt that the budgeted sales volume was set too high. He explained that setting too high a budgeted sales volume would mean his sales staff would be de-motivated because they would not be able to achieve that sales volume. Steven Jones agreed to use the revised sales volume suggested by Mike Fisher.

Both the initial and revised budgets are reproduced below complete with the actual results for the year ended 31 May.

Rivermede Ltd – budgeted and actual costs for the year ended 31 May

Fasta production and sales (units)	Original budget 24 000 (£)	Revised budget 20 000 (£)	Actual results 22 000 (£)	Variances from revised budget 2000 (£)	(F)
Variable costs					
Material	216 000	180 000	206 800	26 800	(A)
Labour	288 000	240 000	255 200	15 200	(A)
Semi-variable costs					
Heat, light and power	31 000	27 000	33 400	6400	(A)
Fixed costs					
Rent, rates and depreciation	40 000	40 000	38 000	2 000	(F)
	575 000	487 000	533 400	46 400	(A)

Assumptions in the two budgets
1. No change in input prices
2. No change in the quantity of variable inputs per Fasta

As the management accountant at Rivermede Ltd, one of your tasks is to check that invoices have been properly coded. On checking the actual invoices for heat, light and power for the year to 31 May, you find that one invoice for £7520 had been incorrectly coded. The invoice should have been coded to materials.

Task 1

(a) Using the information in the original and revised budgets, identify:
- the variable cost of material and labour per Fasta;
- the fixed and unit variable cost within heat, light and power.

(b) Prepare a flexible budget, including variances, for Rivermede Ltd after correcting for the miscoding of the invoice.

Data

On receiving your flexible budget statement, Steven Jones states that the total adverse variance is much less than the £46 400 shown in the original statement. He also draws your attention to the actual sales volume being greater than in the revised budget. He believes these results show that a participative approach to budgeting is better for the company and wants to discuss this belief at the next board meeting. Before doing so, Steven Jones asked for your comments.

Task 2

Write a memo to Steven Jones. Your memo should:

(a) *briefly* explain why the flexible budgeting variances differ from those in the original statement given in the data to task 1;

(b) give *two* reasons why a favourable cost variance may have arisen other than through the introduction of participative budgeting;

(c) give *two* reasons why the actual sales volume compared with the revised budget's sales volume may not be a measure of improved motivation following the introduction of participative budgeting.

AAT

11.19 Responsibility centre performance reports

Data

Jim Smith has recently been appointed as the Head Teacher of Mayfield School in Midshire. The age of the pupils ranges from 11 years to 18 years. For many years, Midshire County Council was responsible for preparing and reporting on the school budget. From June, however, these responsibilities passed to the Head Teacher of Mayfield School.

You have recently accepted a part-time appointment as the accountant to Mayfield School, although your previous accounting experience has been gained in commercial organisations. Jim Smith is hoping that you will be able to apply that experience to improving the financial reporting procedures at Mayfield School.

The last budget statement prepared by Midshire County Council is reproduced below. It covers the ten months to the end of May and all figures refer to cash *payments* made.

Midshire County Council Mayfield School
Statement of school expenditure against budget: 10 months ending May

	Expenditure to date	Budget to date	Under/ over spend	Total budget for year
Teachers – full-time	1 680 250	1 682 500	2250 Cr	2 019 000
Teachers – part-time	35 238	34 600	638	41 520
Other employee expenses	5 792	15 000	9 208 Cr	18 000
Administrative staff	69 137	68 450	687	82 140
Caretaker and cleaning	49 267	57 205	7 938 Cr	68 646
Resources (books, etc.)	120 673	100 000	20 673	120 000
Repairs and maintenance	458	0	458	0
Lighting and heating	59 720	66 720	7 000 Cr	80 064
Rates	23 826	19 855	3 971	23 826
Fixed assets: furniture and equipment	84 721	100 000	15 279 Cr	120 000
Stationery, postage and phone	1 945	0	1 945	0
Miscellaneous expenses	9 450	6 750	2 700	8 100
Total	2 140 477	2 151 080	10 603 Cr	2 581 296

Task 1

Write a memo to Jim Smith. Your memo should:

(a) identify *four* weaknesses of the existing statement as a management report;

(b) include an improved *outline* statement format showing revised column headings and a more meaningful classification of costs which will help Jim Smith to manage his school effectively (figures are not required);

(c) give *two* advantages of your proposed format over the existing format.

Data

The income of Mayfield School is based on the number of pupils at the school. Jim Smith provides you with the following breakdown of student numbers.

Mayfield School: Student numbers as at 31 May

School year	Age range	Current number of pupils
1	11–12	300
2	12–13	350
3	13–14	325
4	14–15	360
5	15–16	380
6	16–17	240
7	17–18	220
Total number of students		2175

Jim also provides you with the following information relating to existing pupils:

- pupils move up one school-year at the end of July;
- for those pupils entering year 6, there is an option to leave the school. As a result only 80% of the current school-year 5 pupils go on to enter school-year 6;
- of those currently in school-year 6 only 95% continue into school-year 7;
- pupils currently in school-year 7 leave to go on to higher education or employment;
- the annual income per pupil is £1200 in years 1 to 5 and £1500 in years 6 to 7.

The new year 1 pupils come from the final year at four junior schools. Not all pupils, however, elect to go to Mayfield School. Jim has investigated this matter and derived accurate estimates of the proportion of final year pupils at each of the four junior schools who go on to attend Mayfield School.

The number of pupils in the final year at each of the four junior schools is given below along with Jim's estimate of the proportion likely to choose Mayfield School.

Junior School	Number in final year at 31 May	Proportion choosing Mayfield School
Ranmoor	60	0.9
Hallamshire	120	0.8
Broomhill	140	0.9
Endcliffe	80	0.5

Task 2

(a) Forecast the number of pupils and the income of Mayfield School for the next year from August to July

(b) Assuming expenditure next year is 5% more than the current annual budgeted expenditure, calculate the budgeted surplus or deficit of Mayfield School for next year.

AAT

11.20 Recommendations for improvements to a performance report and a review of the management control system

Your firm has been consulted by the managing director of Inzone plc, which owns a chain of retail stores. Each store has departments selling furniture, tableware and kitchenware. Departmental managers are responsible to a store manager, who is in turn responsible to head office (HO).

All goods for sale are ordered centrally and stores sell at prices fixed by HO. Store managers (aided by departmental managers) order stocks from HO and stores are charged interest based on month-end stock levels. HO appoints all permanent staff and sets all pay levels. Store managers can engage or dismiss temporary workers, and are responsible for store running expenses.

The introduction to Inzone plc's management accounting manual states:

> 'Budgeting starts three months before the budget year, with product sales projections which are developed by HO buyers in consultation with each store's departmental managers. Expense budgets, adjusted for expected inflation, are then prepared by HO for each store. Inzone plc's accounting year is divided into 13 four-weekly control periods, and the budgeted sales and expenses are assigned to periods with

due regard to seasonal factors. The budgets are completed one month before the year begins on 1st January.

'All HO expenses are recharged to stores in order to give the clearest indication of the "bottom line" profit of each store. These HO costs are mainly buying expenses, which are recharged to stores according to their square footage.

'Store reports comparing actual results with budgets are on the desks of HO and store management one week after the end of each control period. Significant variations in performance are then investigated, and appropriate action taken.'

Ms Lewis is manager of an Inzone plc store. She is eligible for a bonus equal to 5% of the amount by which her store's 'bottom-line' profit exceeds the year's budget. However, Ms Lewis sees no chance of a bonus this year, because major roadworks near the store are disrupting trade. Her store report for the four weeks ending 21 June is as follows:

	Actual (£)	Budget (£)
Sales	98 850	110 000
Costs:		
Cost of goods (including stock losses)	63 100	70 200
Wages and salaries	5 300	5 500
Rent	11 000	11 000
Depreciation of store fittings	500	500
Distribution costs	4 220	4 500
Other store running expenses	1 970	2 000
Interest charge on stocks	3 410	3 500
Store's share of HO costs	2 050	2 000
Store profit	7 300	10 800
	98 850	110 000
Stocks held at end of period	341 000	350 000
Store fittings at written down value	58 000	58 000

Requirements:

(a) Make recommendations for the improvement of Inzone plc's store report, briefly justifying each recommendation. (11 marks)

(b) Prepare a report for the managing director of Inzone plc reviewing the company's responsibility delegation, identifying the major strengths and weaknesses of Inzone plc's management control system, and recommending any changes you consider appropriate. (14 marks)

(Total 25 marks)

ICAEW

11.21 Budget use and performance reporting

A new private hospital of 100 beds was opened to receive patients on 2 January though many senior staff members including the supervisor of the laundry department had been *in situ* for some time previously. The first three months were expected to be a settling-in period; the hospital facilities being used to full capacity only in the second and subsequent quarters.

In May the supervisor of the laundry department received her first quarterly performance report from the hospital administrator, together with an explanatory memorandum. Copies of both documents are set out below.

The supervisor had never seen the original budget, nor had she been informed that there would be a quarterly performance report. She knew she was responsible for her department and had made every endeavour to run it as efficiently as possible. It had been made clear to her that there would be a slow build up in the number of patients accepted by the hospital and so she would need only 3 members of staff, but she had had to take on a fourth during the quarter due to the extra work. This extra hiring had been anticipated for May, not late February.

Rockingham Private Patients Hospital Ltd
MEMORANDUM 30 April
To: All Department Heads/Supervisors
From: Hospital Administrator

Attached is the Quarterly Performance Report for your department. The hospital has adopted a responsibility accounting system so you will be receiving one of these reports quarterly. Responsibility accounting means that you are accountable for ensuring that the expenses of running your department are kept in line with the budget. Each report compares the actual expenses of running your department for the quarter with our budget for the same period. The difference between the actual and forecast will be highlighted so that you can identify the important variations from budget and take corrective action to get back on budget. Any variation in excess of 5% from budget should be investigated and an explanatory memo sent to me

giving reasons for the variations and the proposed corrective actions.

Performance report – laundry department
3 Months to 31 March

	Actual	Budget	Variation (Over)/ Under	% Variation
Patient days	8 000	6 500	(1 500)	(23)
Weight of laundry processed (kg)	101 170	81 250	(19 920)	(24.5)
	(£)	(£)	(£)	
Department expenses				
Wages	4 125	3 450	(675)	(19.5)
Supervisor salary	1 490	1 495	5	—
Washing materials	920	770	(150)	(19.5)
Heating and power	560	510	(50)	(10)
Equipment depreciation	250	250	—	–
Allocated administration costs	2 460	2 000	(460)	(23)
Equipment maintenance	10	45	35	78
	9 815	8 520	(1 295)	(15)

Comment: We need to have a discussion about the overexpenditure of the department.

You are required to:

(a) discuss in detail the various possible effects on the behaviour of the laundry supervisor of the way that her budget was prepared and the form and content of the performance report, having in mind the published research findings in this area, (15 marks)

(b) re-draft, giving explanations, the performance report and supporting memorandum in a way which, in your opinion, would make them more effective management tools. (10 marks)

(Total 25 marks)

ICAEW

12

Standard costing and variance analysis

In the previous chapter the major features of management accounting control systems were examined. The different types of controls used by companies were described so that the elements of management accounting control systems could be considered within the context of the overall control process. A broad approach to control was adopted and the detailed procedures of financial controls were not examined. In this chapter we shall focus on the detailed financial controls that are used by organizations.

We shall consider a financial control system that enables the deviations from budget to be analysed in detail, thus enabling costs to be controlled more effectively. This system of control is called standard costing. In particular, we shall examine how a standard costing system operates and how the variances are calculated. Standard costing systems are applied in standard cost centres which were described in the previous chapter. You will recall that the main features of standard cost centres are that output can be measured and the input required to produce each unit of output can be specified. In addition, the sales variances that are described in this chapter can also be applied in revenue centres. In the next chapter we shall look at financial controls that are appropriate for measuring profit and investment centre performance.

Standard costs are predetermined costs; they are target costs that should be incurred under efficient operating conditions. They are not the same as **budgeted costs**. A budget relates to an entire activity or operation; a standard presents the same information on a per unit basis. A standard therefore provides cost expectations per unit of activity and a budget provides the cost expectation for the total activity. If the budget output for a product is for 10 000 units and the standard cost is £3 per unit, budgeted cost will be £30 000. We shall see that establishing standard costs for each unit produced enables a detailed analysis to be made of the difference between the budgeted cost and the actual cost so that costs can be controlled more effectively.

Learning objectives

After studying this chapter, you should be able to:

- explain how standard costs are set;
- explain the meaning of standard hours produced;
- define basic, ideal and currently attainable standards;
- explain how a standard costing system operates;
- calculate labour, material, overhead and sales margin variances and reconcile actual profit with budgeted profit;
- identify the causes of labour, material, overhead and sales margin variances;
- construct a departmental performance report.

Operation of a standard costing system

Standard costing is most suited to an organization whose activities consist of a series of *common* or *repetitive* operations and the input required to produce each unit of output can be specified. It is therefore relevant in manufacturing companies, since the processes involved are often of a repetitive nature. Standard costing procedures can also be applied in service industries such as units within banks, where output can be measured in terms of the number of cheques or the number of loan applications processed, and there are also well-defined input–output relationships. Standard costing cannot, however, be applied to activities of a non-repetitive nature, since there is no basis for observing repetitive operations and consequently standards cannot be set.

A standard costing system can be applied to organizations that produce many different products, as long as production consists of a series of common operations. For example, if the output from a factory is the result of five common operations, it is possible to produce many different product variations from these operations. It is therefore possible that a large product range may result from a small number of common operations. Thus standard costs should be developed for repetitive operations and product standard costs are derived simply by combining the standard costs from the operations which are necessary to make the product. This process is illustrated in Exhibit 12.1.

It is assumed that the standard costs are £20, £30, £40 and £50 for each of the operations 1 to 4. The standard cost for *product* 100 is therefore £110, which consists of £20 for operation 1, plus £40 and £50 for operations 3 and 4. The standard costs for each of the other products are calculated in a similar manner. In addition, the total standard cost for the total output of each operation for the period has been calculated. For example, six items of operation number 1 have been completed, giving a total standard cost of £120 for this operation (six items at £20 each). Three items of operation 2 have been completed, giving a total standard cost of £90, and so on.

VARIANCES ALLOCATED TO RESPONSIBILITY CENTRES

You can see from Exhibit 12.1 that different responsibility centres are responsible for each operation. For example, responsibility centre A is responsible for operation 1, responsibility centre B for operation 2, and so on. Consequently, there is no point in comparing the actual cost of *product* 100 with the standard cost of £110 for the purposes of control, since responsibility centres A, C and D are responsible for the variance. None of the responsibility centres is solely answerable for the variance. Cost control requires that responsibility centres be identified with the standard cost for the output achieved. Therefore if the actual costs for responsibility centre A are compared with the standard cost of £120 for the production of the six items (see the first row in Exhibit 12.1), the manager of this responsibility centre will be answerable for the full amount of the variance. Only by comparing total actual costs with total standard costs *for each operation or responsibility centre* for a period can control be effectively achieved. A comparison of standard *product* costs (i.e. the columns in Exhibit 12.1) with actual costs that involves several different responsibility centres is clearly inappropriate.

Figure 12.1 provides an overview of the operation of a standard costing system. You will see that the standard costs for the actual output for a particular period are traced to the managers of responsibility centres who are responsible for the various operations. The actual costs for the same period are also charged to the responsibility centres. Standard and actual costs are compared and the variance is reported. For example, if the actual cost

EXHIBIT 12.1

Standard costs analysed by operations and products

for the output of the six items produced in responsibility centre A during the period is £220 and the standard cost is £120 (Exhibit 12.1), a variance of £100 will be reported.

Responsibility centre	Operation no. and standard cost		Products							Total standard cost	Actual cost
	No.	(£)	100	101	102	103	104	105	106	(£)	
A	1	20	√	√		√	√	√	√	120	
B	2	30		√		√		√		90	
C	3	40	√		√		√			120	
D	4	50	√	√	√				√	200	
Standard product cost			£110	£100	£90	£50	£60	£50	£70	530	

DETAILED ANALYSIS OF VARIANCES

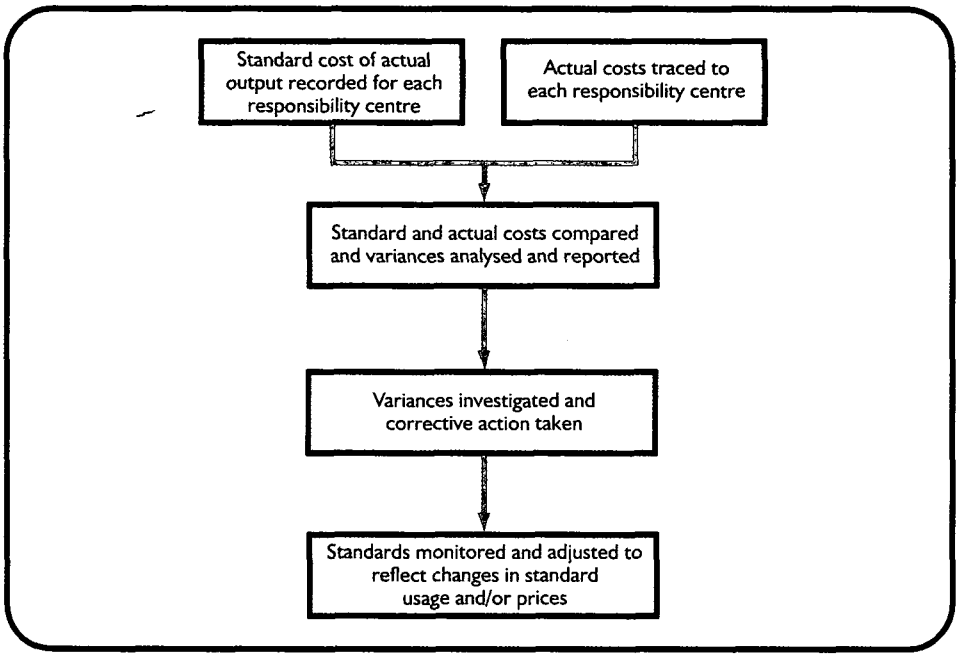
You can see from the box below the first arrow in Figure 12.1 that the operation of a standard costing system also enables a detailed analysis of the variances to be reported. For example, variances for each responsibility centre can be identified by each element of cost and analysed according to the price and quantity content. The accountant assists managers by pinpointing where the variances have arisen and the responsibility managers can undertake to carry out the appropriate investigations to identify the reasons for the variance. For example, the accountant might identify the reason for a direct materials variance as being excessive usage of a certain material in a particular process, but the responsibility centre manager must investigate this process and identify the reasons for the excessive usage. Such an investigation should result in appropriate remedial action being taken or, if it is found that the variance is due to a permanent change in the standard, the standard should be changed.

ACTUAL PRODUCT COSTS ARE NOT REQUIRED

It is questionable whether the allocation of actual costs to products serves any useful purpose. Because standard costs represent *future* target costs, they are preferable to actual *past* costs for decision-making. Also, the external financial accounting regulations in most countries specify that if standard product costs provide a reasonable approximation of actual product costs, they are acceptable for inventory valuation calculations for external reporting.

There are therefore strong arguments for not producing actual product costs when a standard costing system exists, since this will lead to large clerical savings. However, it

FIGURE 12.1 *An overview of a standard costing sytem.*



must be stressed that actual costs must be accumulated periodically for each operation or responsibility centre, so that comparisons can be made with standard costs. Nevertheless, there will be considerably fewer responsibility centres than products, and the accumulation of actual costs is therefore much less time consuming.

COMPARISONS AFTER THE EVENT

It may be argued that there is little point in comparing actual performance with standard performance, because such comparisons can only be made after the event. Nevertheless, if people know in advance that their performance is going to be judged, they are likely to act differently from the way they would have done if they were aware that their performance was not going to be measured. Furthermore, even though it is not possible for a manager to change his or her performance after the event, an analysis of how well a person has performed in the past may indicate – both to the person concerned and his or her superior – ways of obtaining better performance in the future.

Establishing cost standards

Control over costs is best effected through action at the point where the costs are incurred. Hence the standards should be set for the quantities of material, labour and services to be consumed in performing an *operation*, rather than the complete *product* cost standards. Variances from these standards should be reported to show causes and responsibilities for deviations from standard. Product cost standards are derived by listing and adding the standard costs of operations required to produce a particular product. For example, if you

refer to Exhibit 12.1 you will see that the standard cost of product 100 is £110 and is derived from the sum of the standard costs of operations 1, 3 and 4.

There are two approaches that can be used to set standard costs. First, past historical records can be used to estimate labour and material usage. Secondly, standards can be set based on **engineering studies**. With engineering studies a detailed study of each operation is undertaken based on careful specifications of materials, labour and equipment and on controlled observations of operations. If historical records are used to set standards, there is a danger that the latter will include past inefficiencies. With this approach, standards are set based on average past performance for the same or similar operations. Known excess usage of labour or materials should be eliminated or the standards may be tightened by an arbitrary percentage reduction in the quantity of resources required. The disadvantage of this method is that, unlike the engineering method, it does not focus attention on finding the best combination of resources, production methods and product quality. Nevertheless, standards derived from average historical usage do appear to be widely used in practice. (See Exhibit 12.3 on page 366.)

Let us now consider how standards are established for each operation for direct materials, direct labour and overheads using the engineering studies approach. Note that the standard cost for each operation is derived from multiplying the quantity of input that should be used per unit of output (i.e. the quantity standard) by the amount that should be paid for each unit of input (i.e. the price standard).

DIRECT MATERIAL STANDARDS

These are based on product specifications derived from an intensive study of the input *quantity* necessary for each operation. This study should establish the most suitable materials for each product, based on product design and quality policy, and also the optimal quantity that should be used after taking into account any wastage or loss that is considered inevitable in the production process. Material quantity standards are usually recorded on a **bill of materials**. This describes and states the required quantity of materials for each operation to complete the product. A separate bill of materials is maintained for each product. The standard material product cost is then found by multiplying the standard quantities by the appropriate standard prices.

The standard *prices* are obtained from the purchasing department. The standard material prices are based on the assumption that the purchasing department has carried out a suitable search of alternative suppliers and has selected suppliers who can provide the required quantity of sound quality materials at the most competitive price. Normally, price standards take into account the advantages to be obtained by determining the most economical order quantity and quantity discounts, best method of delivery and the most favourable credit terms. However, consideration should also be given to vendor reliability with respect to material quality and meeting scheduled delivery dates. Standard prices then provide a suitable base against which actual prices paid for materials can be evaluated.

DIRECT LABOUR STANDARDS

To set labour standards, activities should be analysed by the different operations. Each operation is studied and an allowed time computed, usually after carrying out a time and motion study. The normal procedure for such a study is to analyse each operation to eliminate any unnecessary elements and to determine the most efficient production

method. The most efficient methods of production, equipment and operating conditions are then standardized. This is followed by time measurements that are made to determine the number of standard hours required by an average worker to complete the job. Unavoidable delays such as machine breakdowns and routine maintenance are included in the standard time. Wage rate standards are normally either a matter of company policy or the result of negotiations between management and unions. The agreed wage rates are applied to the standard time allowed to determine the standard labour cost for each operation.

OVERHEAD STANDARDS

The procedure for establishing standard manufacturing overhead rates for a standard costing system is the same as that which is used for establishing predetermined overhead rates as described in Chapter 5. Separate rates for fixed and variable overheads are essential for planning and control. Normally the standard overhead rate will be based on a rate per direct labour hour or machine hour of input.

Fixed overheads are largely independent of changes in activity, and remain constant over wide ranges of activity in the short term. It is therefore inappropriate for short-term cost control purposes to unitize fixed overheads to derive a fixed overhead rate per unit of activity. However, in order to meet the external financial reporting stock valuation requirements, fixed manufacturing overheads must be traced to products. It is therefore necessary to unitize fixed overheads for stock valuation purposes.

The main difference with the treatment of overheads under a standard costing system as opposed to a non-standard costing system is that the product overhead cost is based on the hourly overhead rates multiplied by the *standard hours* (that is, hours which should have been used) rather than the *actual hours* used.

At this stage it is appropriate if we summarize the approach that should be used to establish cost standards. Control over costs is best effected through action at the point where they are incurred. Hence standards should be set for labour, materials and variable overheads consumed in performing an *operation*. For stock valuation purposes it is necessary to establish *product cost* standards. Standard manufacturing product costs consist of the total of the standard costs of operations required to produce the product plus the product's standard fixed overhead cost. A standard cost card should be maintained for each product and operation. It reveals the quantity of each input that should be used to produce one unit of output. A typical product standard cost card is illustrated in Exhibit 12.2. In most organizations standard cost cards are now stored on a computer. Standards should be continuously reviewed, and, where significant changes in production methods or input prices occur, they should be changed in order to ensure that standards reflect current targets.

STANDARD HOURS PRODUCED

It is not possible to measure *output* in terms of units produced for a department making several different products or operations. For example, if a department produces 100 units of product X, 200 units of product Y and 300 units of product Z, it is not possible to add the production of these items together, since they are not homogeneous. This problem can be overcome by ascertaining the amount of time, working under efficient conditions, it should take to make each product. This time calculation is called standard hours

EXHIBIT 12.2

An illustration of a standard cost card

produced. In other words, standard hours are an *output* measure that can act as a common denominator for adding together the production of unlike items.

Let us assume that the following standard times are established for the production of one unit of each product:

Date standard set ..... **Product: Sigma**

Direct materials

Operation no.	Item code	Quantity (kg)	Standard price (£)	Department A	B	C	D	Totals (£)
1	5.001	5	3		£15			
2	7.003	4	4			£16		
								31

Direct labour

Operation no.	Standard hours	Standard rate (£)				
1	7	9		£63		
2	8	9			£72	
						135

Factory overhead

Department	Standard hours	Standard rate (£)				
B	7	3		£21		
C	8	4			£32	
						53
Total manufacturing cost per unit (£)						219

Product X	5 standard hours
Product Y	2 standard hours
Product Z	3 standard hours

This means that it should take 5 hours to produce one unit of product X under efficient production conditions. Similar comments apply to products Y and Z. The production for the department will be calculated in standard hours as follows:

Product	Standard time per unit produced (hours)	Actual output (units)	Standard hours produced
X	5	100	500
Y	2	200	400
Z	3	300	900
			1800

Remember that standard hours produced is an output measure, and flexible budget allowances should be based on this. In the illustration we should expect the *output* of 1800 standard hours to take 1800 direct labour hours of *input* if the department works at the prescribed level of efficiency. The department will be inefficient if 1800 standard hours of output are produced using, say, 2000 direct labour hours of input. The flexible budget allowance should therefore be based on 1800 standard hours produced to ensure that no extra allowance is given for the 200 excess hours of input. Otherwise, a manager will obtain a higher budget allowance through being inefficient.

Types of cost standards

The determination of standard costs raises the problem of how demanding the standards should be. Should they represent ideal or faultless performance or should they represent easily attainable performance? Standards are normally classified into three broad categories:

1. basic cost standards;
2. ideal standards;
3. currently attainable standards.

BASIC COST STANDARDS

Basic cost standards represent constant standards that are left unchanged over long periods. The main advantage of basic standards is that a base is provided for a comparison with actual costs through a period of years with the same standard, and efficiency trends can be established over time. When changes occur in methods of production, price levels or other relevant factors, basic standards are not very useful, since they do not represent *current* target costs. For this reason basic cost standards are seldom used.

IDEAL STANDARDS

Ideal standards represent perfect performance. Ideal standard costs are the minimum costs that are possible under the most efficient operating conditions. Ideal standards are unlikely to be used in practice because they may have an adverse impact on employee motivation. Such standards constitute goals to be aimed for rather than performance that can currently be achieved.

CURRENTLY ATTAINABLE STANDARD COSTS

These standards represent those costs that should be incurred under efficient operating conditions. They are standards that are difficult, but not impossible, to achieve. **Attainable standards** are easier to achieve than ideal standards because allowances are made for normal spoilage, machine breakdowns and lost time. The fact that these standards represent a target that can be achieved under efficient conditions, but which is also viewed as being neither too easy to achieve nor impossible to achieve, provides the best norm to which actual costs should be compared. Attainable standards can vary in terms of the level of difficulty. For example, if tight attainable standards are set over a given time

period, there might only be a 70% probability that the standard will be attained. On the other hand, looser attainable standards might be set with a probability of 90% attainment. Attainable standards are equivalent to highly achievable standards described in Chapter 11.

Attainable standards that are likely to be achieved are preferable for planning and budgeting. It is preferable to prepare the master budget and cash budget using these standards. Clearly, it is inappropriate to use standards that may not be achieved for planning purposes. Hence attainable standards that are likely to be achieved lead to economies, since they can be used for both *planning* and *control*. However, easily attainable standards are unlikely to provide a challenging target that will motivate higher levels of efficiency.

For an indication of the types of cost standards that companies actually use you should refer to Exhibit 12.3.

PURPOSES OF STANDARD COSTING

Standard costing systems are widely used because they provide cost information for many different purposes such as the following.

- Providing a prediction of future costs that can be used for *decision-making purposes*. Standard costs can be derived from either traditional or activity-based costing systems. Because standard costs represent *future* target costs based on the elimination of avoidable inefficiencies they are preferable to estimates based on adjusted past costs which may incorporate inefficiencies. For example, in markets where competitive prices do not exist products may be priced on a bid basis. In these situations standard costs provide more appropriate information because efficient competitors will seek to eliminate avoidable costs. It is therefore unwise to assume that inefficiencies are recoverable within the bid price.
- Providing a *challenging target* which individuals are motivated to achieve. For example research evidence suggests that the existence of a defined quantitative goal or target is likely to motivate higher levels of performance than would be achieved if no such target was set.
- Assisting in *setting budgets* and evaluating managerial performance. Standard costs are particularly valuable for budgeting because a reliable and convenient source of data is provided for converting budgeted production into physical and monetary resource requirements. Budgetary preparation time is considerably reduced if standard costs are available because the standard costs of operations and products can be readily built up into total costs of any budgeted volume and product mix.
- Acting as a *control device* by highlighting those activities which do not conform to plan and thus alerting managers to those situations that may be 'out of control' and in need of corrective action. With a standard costing system variances are analysed in great detail such as by element of cost, price and quantity elements. Useful feedback is therefore provided in pinpointing the areas where variances have arisen.
- Simplifying the task of tracing costs to products for *profit measurement and inventory valuation* purposes. Besides preparing annual financial accounting profit statements most organizations also prepare monthly internal profit statements. If actual costs are used a considerable amount of time is required in tracking costs so that monthly costs can be allocated between cost of sales and inventories. A data processing system is required which can track monthly costs in a resource efficient manner. Standard costing systems meet this requirement You will see from Figure 12.2 that product costs are maintained at standard cost. Inventories and cost of goods sold are recorded

at standard cost and a conversion to actual cost is made by writing off all variances arising during the period as a period cost. Note that the variances from standard cost are extracted by comparing actual with standard costs at the responsibility centre level, and not at the product level, so that actual costs are not assigned to individual products.

EXHIBIT 12.3

Surveys of company practice

Since its introduction in the early 1900s standard costing has flourished and is now one of the most widely used management accounting techniques. Three independently conducted surveys of USA practice indicate highly consistent figures in terms of adopting standard costing systems. Cress and Pettijohn (1985) and Schwarzbach (1985) report an 85% adoption rate, while Cornick *et al.* (1988), found that 86% of the surveyed firms used a standard costing system. A Japanese survey by Scarborough *et al.* (1991) reported a 65% adoption rate. Surveys of UK companies by Drury *et al.* (1993) and New Zealand companies by Guilding *et al.* (1998) report adoption rates of 76% and 73% respectively.

In relation to the methods to set labour and material standards Drury *et al.* reported the following usage rates:

	Extent of use (%)				
	Never	**Rarely**	**Sometimes**	**Often**	**Always**
Standards based on design/ engineering studies	18	11	19	31	21
Observations based on trial runs	18	16	36	25	5
Work study techniques	21	18	19	21	21
Average of historic usage	22	11	23	35	9

In the USA Lauderman and Schaeberle (1983) reported that 43% of the respondents used average historic usage, 67% used engineering studies, 11% used trial runs under controlled conditions and 15% used other methods. The results add up to more than 100% because some companies used more than one method.

Drury *et al.* also reported that the following types of standards were employed:

Maximum efficiency standards	5%
Achievable but difficult to attain standards	44%
Average past performance standards	46%
Other	5%

Variance analysis

It is possible to compute variances simply by committing to memory a series of variance formulae. If you adopt this approach, however, it will not help you to understand what a

EXAMPLE 12.1

Alpha manufacturing company produces a single product, which is known as sigma. The product requires a single operation, and the standard cost for this operation is presented in the following standard cost card:

Standard cost card for product sigma	(£)
Direct materials:	
2 kg of A at £10 per kg	20.00
1 kg of B at £15 per kg	15.00
Direct labour (3 hours at £9 per hour)	27.00
Variable overhead (3 hours at £2 per direct labour hour)	6.00
Total standard variable cost	68.00
Standard contribution margin	20.00
Standard selling price	88.00

Alpha Ltd plan to produce 10 000 units of sigma in the month of April, and the budgeted costs based on the information contained in the standard cost card are as follows:

Budget based on the above standard costs and an output of 10 000 units

	(£)	(£)	(£)
Sales (10 000 units of sigma at £88 per unit)			880 000
Direct materials:			
A: 20 000 kg at £10 per kg	200 000		
B: 10 000 kg at £15 per kg	150 000	350 000	
Direct labour (30 000 hours at £9 per hour)		270 000	
Variable overheads (30 000 hours at £2 per direct labour hour)		60 000	680 000
Budgeted contribution			200 000
Fixed overheads			120 000
Budgeted profit			80 000

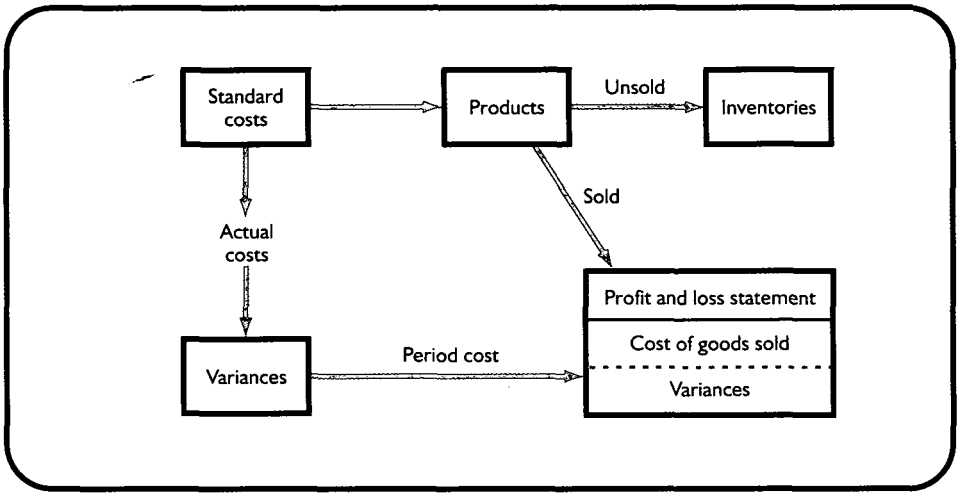
Annual budgeted fixed overheads are £1 440 000 and are assumed to be incurred evenly throughout the year. The company uses a variable costing system for internal profit measurement purposes.

The actual results for April are:

	(£)	(£)
Sales (9000 units at £90)		810 000
Direct materials:		
A: 19 000 kg at £11 per kg	209 000	
B: 10 100 kg at £14 per kg	141 400	
Direct labour (28 500 hours at £9.60 per hour)	273 600	
Variable overheads	52 000	676 000
Contribution		134 000
Fixed overheads		116 000
Profit		18 000

Manufacturing overheads are charged to production on the basis of direct labour hours. Actual production and sales for the period were 9000 units.

FIGURE 12.2 *Standard costs for inventory valuation and profit measurement.*



variance is intended to depict and what the relevant variables represent. In our discussion of each variance we shall therefore concentrate on the fundamental meaning of the variance, so that you can logically deduce the variance formulae as we go along.

All of the variances presented in this chapter are illustrated from the information contained in Example 12.1 on page 367. Note that the level of detail presented is highly simplified. A truly realistic situation would involve many products, operations and responsibility centres but would not give any further insights into the basic concepts or procedures.

Figure 12.3 shows the breakdown of the profit variance (the difference between budgeted and actual profit) into the component cost and revenue variances that can be calculated for a standard variable costing system. We shall now calculate the variances set out in Figure 12.3 using the data presented in Example 12.1.

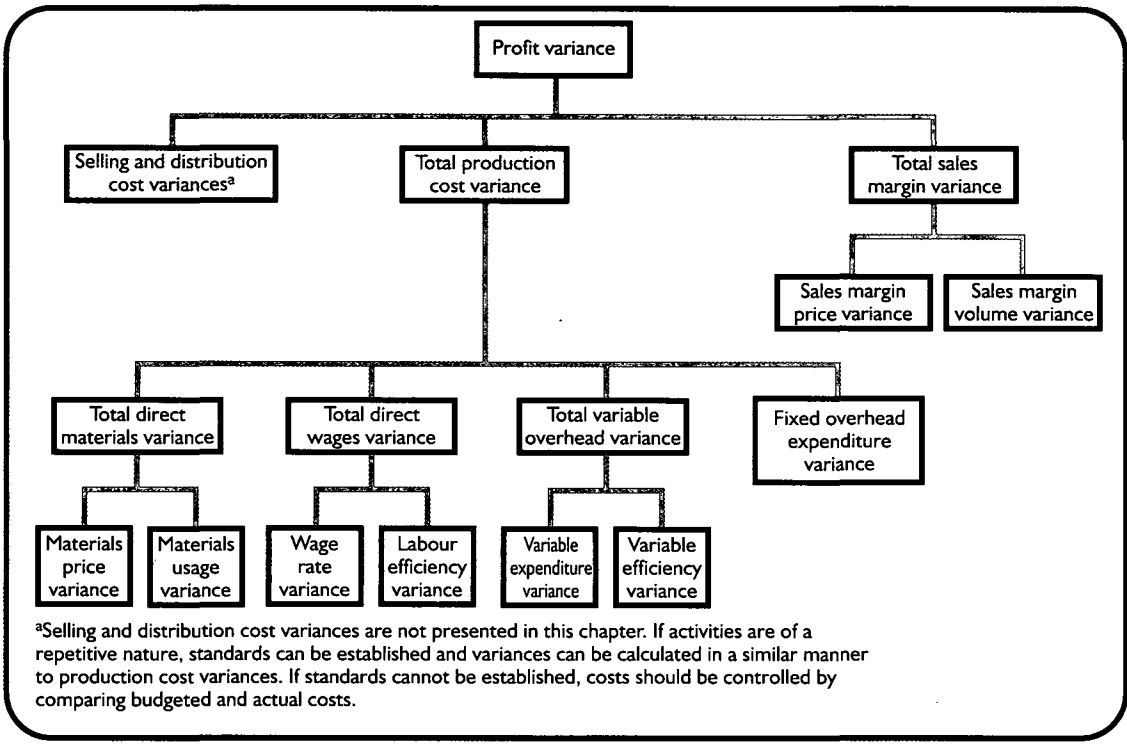
Material variances

The costs of the materials which are used in a manufactured product are determined by two basic factors: the price paid for the materials, and the quantity of materials used in production. This gives rise to the possibility that the actual cost will differ from the standard cost because the *actual quantity* of materials used will be different from the *standard quantity* and/or that the *actual price* paid will be different from the *standard price*. We can therefore calculate a material usage and a material price variance.

Material price variances

The starting point for calculating this variance is simply to compare the standard price per unit of materials with the actual price per unit. You should now refer to Example 12.1. You will see that the standard price for material A is £10 per kg, but the actual price paid is £11 per kg. The price variance is £1 per kg. This is of little consequence if the excess purchase price has been paid only for a small number of units or purchases. But the consequences

FIGURE 12.3 *Variance analysis for a variable costing system.*



[a]Selling and distribution cost variances are not presented in this chapter. If activities are of a repetitive nature, standards can be established and variances can be calculated in a similar manner to production cost variances. If standards cannot be established, costs should be controlled by comparing budgeted and actual costs.

are important if the excess purchase price has been paid for a large number of units, since the effect of the variance will be greater.

The difference between the standard material price and the actual price per unit should therefore be multiplied by the quantity of materials purchased. For material A the price variance is £1 per unit; but since 19 000 kg were purchased, the excess price was paid out 19 000 times. Hence the total material price variance is £19 000 adverse. The formula for the material price variance now follows logically:

the **material price variance** is equal to the difference between the standard price (SP) and the actual price (AP) per unit of materials multiplied by the quantity of materials purchased (QP):

$$(SP - AP) \times QP$$

Now refer to Material B in Example 12.1. The standard price is £15, compared with an actual price of £14 giving a £1 saving per kg. As 10 100 kg were purchased, the total price variance will be £10 100 (10 100 kg at £1). The variance for material B is favourable and that for material A is adverse. The normal procedure is to present the amount of the variances followed by symbols A or F to indicate either adverse or favourable variances.

POSSIBLE CAUSES

It is incorrect to assume that the material price variance will always indicate the efficiency of the purchasing department. Actual prices may exceed standard prices because of a

change in market conditions that causes a general price increase for the type of materials used. The price variance might therefore be beyond the control of the purchasing department. Alternatively, an adverse price variance may reflect a failure by the purchasing department to seek the most advantageous sources of supply. A favourable price variance might be due to the purchase of inferior quality materials, which may lead to inferior product quality or more wastage. For example, the price variance for material B is favourable, but we shall see in the next section that this is offset by excess usage. If the reason for this excess usage is the purchase of inferior quality materials then the material usage variance should be charged to the purchasing department.

It is also possible that another department may be responsible for all or part of the price variance. For example, a shortage of materials resulting from bad inventory control may necessitate an emergency purchase being made at short notice. The supplier may incur additional handling and freight charges on special rush orders, and may therefore charge a higher price for the materials. In this situation the price variance will be the responsibility of the stores department and not the purchasing department.

CALCULATION ON QUANTITY PURCHASED OR QUANTITY USED

We have noted that the price variance may be due to a variety of causes, some of which will be beyond a company's control, but others of which may be due to inefficiencies. It is therefore important that variances be reported as quickly as possible so that any inefficiencies can be identified and remedial action taken. A problem occurs, however, with material purchases in that the time of purchase and the time of usage may not be the same: materials may be purchased in one period and used in a subsequent period. For example, if 10 000 units of a material are purchased in period 1 at a price of £1 per unit over standard and 2000 units are used in each of periods 1 to 5, the following alternatives are available for calculating the price variance:

1. The full amount of the price variance of £10 000 is reported in *period 1* with quantity being defined as the *quantity purchased.*
2. The price variance is calculated with quantity being defined as the *quantity used.* The unit price variance of £1 is multiplied by the quantity used (i.e. 2000 units), which means that a price variance of £2000 will be reported for each of *periods 1 to 5.*

Method 1 is recommended, because the price variance can be reported in the period in which it is incurred, and reporting of the total variance is not delayed until months later when the materials are used. Also adopting this approach enables corrective action to be taken earlier. For the sake of simplicity we shall assume in Example 12.1 that the actual purchases are identical with the actual usage.

Material usage variance

The starting point for calculating this quantity variance is simply to compare the standard quantity that should have been used with the actual quantity which has been used. Refer again to Example 12.1. You will see that the standard usage for the production of one unit of sigma is 2 kg for material A. As 9000 units of sigma are produced, 18 000 kg of material A should have been used; however, 19 000 kg are actually used, which means there has been an excess usage of 1000 kg.

The importance of this excess usage depends on the price of the materials. For example, if the price is £0.01 per kg then an excess usage of 1000 kg will not be very significant, but if the price is £10 per unit then an excess usage of 1000 kg will be very significant. It follows that to assess the importance of the excess usage, the variance should be expressed in monetary terms.

CALCULATION BASED ON STANDARD PRICE OR ACTUAL PRICE

Should the standard material price per kg or the actual material price per kg be used to calculate the variance? The answer is the standard price. If the *actual* material price is used, the usage variance will be affected by the efficiency of the purchasing department, since any excess purchase price will be assigned to the excess usage. It is therefore necessary to remove the price effects from the usage variance calculation, and this is achieved by valuing the variance at the standard price. Hence the 1000 kg excess usage of material A is multiplied by the standard price of £10 per unit, which gives an adverse usage variance of £10 000. The formula for the variance is

the material usage variance is equal to the difference between the standard quantity (SQ) required for actual production and the actual quantity (AQ) used multiplied by the standard material price (SP):

$$(SQ - AQ) \times SP$$

For material B you will see from Example 12.1 that the standard quantity is 9000 kg (9000 units × 1 kg) but 10 100 kg have been used. The excess usage of 1100 kg is multiplied by the standard price of £15 per kg, which gives an adverse variance of £16 500. Note that the principles of flexible budgeting described in the previous chapter also apply here, with *standard quantity being based on actual production and not budgeted production*. This ensures that a manager is evaluated under the conditions in which he or she actually worked and not those envisaged at the time the budget was prepared.

POSSIBLE CAUSES

The material usage variance is normally controllable by the manager of the appropriate production responsibility centre. Common causes of material usage variances include the careless handling of materials by production personnel, the purchase of inferior quality materials, pilferage, changes in quality control requirements, or changes in methods of production. Separate material usage variances should be calculated for each type of material used and allocated to each responsibility centre.

Total material variance

From Figure 12.3 you will see that this variance is the total variance before it is analysed into the price and usage elements. The formula for the variance is

the total material variance is the difference between the standard material cost (SC) for the actual production and the actual cost (AC):

$$SC - AC$$

For material A the standard material cost is £20 per unit (see Example 12.1) giving a total standard material cost of £180 000 (9000 units × £20). The actual cost is £209 000, and therefore the variance is £29 000 adverse. The price variance of £19 000 plus the usage variance of £10 000 agrees with the total material variance. Similarly, the total material variance for material B is £6400, consisting of a favourable price variance of £10 100 and an adverse usage variance of £16 500.

Note that if the price variance is calculated on the actual quantity *purchased* instead of the actual quantity *used*, the price variance plus the usage variance will agree with the total variance only when the quantity purchased is equal to the quantity which is used in the particular accounting period. Reconciling the price and usage variance with the total variance is merely a reconciliation exercise, and you should not be concerned if reconciliation of the sub-variances with the total variance is not possible.

Labour variances

The cost of labour is determined by the price paid for labour and the quantity of labour used. Thus a price and quantity variance will also arise for labour. Unlike materials, labour cannot be stored, because the purchase and usage of labour normally takes place at the same time. Hence the actual quantity of hours *purchased* will be equal to the actual quantity of hours *used* for each period. For this reason the price variance plus the quantity variance should agree with the total labour variance.

Wage rate variance

This variance is calculated by comparing the standard price per hour with the actual price paid per hour. In Example 12.1 the standard wage rate per hour is £9 and the actual wage rate is £9.60 per hour, giving a wage rate variance of £0.60 per hour. To determine the importance of the variance, it is necessary to ascertain how many times the excess payment of £0.60 per hour is paid. As 28 500 labour hours are used (see Example 12.1) we multiply 28 500 hours by £0.60. This gives an adverse wage rate variance of £17 100. The formula for the wage rate variance is

the wage rate variance is equal to the difference between the standard wage rate per hour (SR) and the actual wage rate (AR) multiplied by the actual number of hours worked (AH):

$$(SR - AR) \times AH$$

Note the similarity between this variance and the material price variance. Both variances multiply the difference between the standard price and the actual price paid for a unit of a resource by the actual quantity of resources used.

POSSIBLE CAUSES

The wage rate variance may be due to a negotiated increase in wage rates not yet having been reflected in the standard wage rate. In a situation such as this the variance cannot be regarded as controllable. Unexpected overtime can also be the cause of the variance. Labour rate variances may also occur because a standard is used that represents a single average rate for a given operation performed by workers who are paid at several different

rates. In this situation part of all of the variance may be due to the assignment of skilled labour to work that is normally performed by unskilled labour. The variance may then be regarded as the responsibility of the foreman, because he should have matched the appropriate grade of labour to the task at hand. However, the wage rate variance is probably the one that is least subject to control by management. In most cases the variance is due to wage rate standards not being kept in line with changes in actual wage rates, and for this reason it is not normally controllable by departmental managers.

Labour efficiency variance

The labour efficiency variance represents the quantity variance for direct labour. The quantity of labour that should be used for the actual output is expressed in terms of *standard hours produced*. In Example 12.1 the standard time for the production of one unit of sigma is 3 hours. Thus a production level of 9000 units results in an output of 27 000 standard hours. In other words, working at the prescribed level of efficiency, it should take 27 000 hours to produce 9000 units. However, 28 500 direct labour hours are actually required to produce this output, which means that 1500 excess direct labour hours are used. We multiply the excess direct labour hours by the *standard* wage rate to calculate the variance. This gives an adverse variance of £13 500. The formula for calculating the labour efficiency variance is

the **labour efficiency variance** is equal to the difference between the standard labour hours for actual production (SH) and the actual labour hours worked (AH) during the period multiplied by the standard wage rate per hour (SR):

$$(SH - AH) \times SR$$

This variance is similar to the material usage variance. Both variances multiply the difference between the standard quantity and actual quantity of resources consumed by the standard price.

POSSIBLE CAUSES

The labour efficiency variance is normally controllable by the manager of the appropriate production responsibility centre and may be due to a variety of reasons. For example, the use of inferior quality materials, different grades of labour, failure to maintain machinery in proper condition, the introduction of new equipment or tools and changes in the production processes will all affect the efficiency of labour. An efficiency variance may not always be controllable by the production foreman; it may be due, for example, to poor production scheduling by the planning department, or to a change in quality control standards.

Total labour variance

From Figure 12.3 you will see that this variance represents the total variance before analysis into the price and quantity elements. The formula for the variance is the total

labour variance is the difference between the standard labour cost (SC) for the actual production and the actual labour cost (AC):

$$SC - AC$$

In Example 12.1 the actual production was 9000 units, and, with a standard labour cost of £27 per unit, the standard cost is £243 000. The actual cost is £273 600, which gives an adverse variance of £30 600. This consists of a wage rate variance of £17 100 and a labour efficiency variance of £13 500.

Variable overhead variances

A *total* variable overhead variance is calculated in the same way as the total direct labour and material variances. In Example 12.1 the output is 9000 units and the standard variable overhead cost is £6 *per unit* produced. The standard cost of production for variable overheads is thus £54 000. The actual variable overheads incurred are £52 000, giving a favourable variance of £2000. The formula for the variance is

total variable overhead variance is the difference between the standard variable overheads charged to production (SC) and the actual variable overheads incurred (AC):

$$SC - AC$$

Where variable overheads vary with direct labour or machine hours of *input* the total variable overhead variance will be due to one or both of the following:

1. A *price* variance arising from actual expenditure being different from budgeted expenditure.
2. A *quantity* variance arising from actual direct labour or machine hours of input being different from the hours of input, which *should* have been used.

These reasons give rise to the two sub-variances, which are shown in Figure 12.3: the variable overhead expenditure variance and the variable overhead efficiency variance.

Variable overhead expenditure variance

To compare the actual overhead expenditure with the budgeted expenditure, it is necessary to flex the budget. Because it is assumed in Example 12.1 that variable overheads will vary with direct labour hours of *input* the budget is flexed on this basis. Actual variable overhead expenditure is £52 000, resulting from 28 500 direct labour hours of input. For this level of activity variable overheads of £57 000, which consist of 28 500 input hours at £2 per hour, should have been spent. Spending was £5000 less than it should have been, and the result is a favourable variance.

If we compare the budgeted and the actual overhead costs for 28 500 direct labour hours of input, we shall ensure that any efficiency content is removed from the variance. This means that any difference must be due to actual variable overhead spending being different from the budgeted variable overhead spending. The formula for the variance is: the **variable overhead expenditure variance** is equal to the difference between the budgeted

flexed variable overheads (BFVO) for the actual direct labour hours of input and the actual variable overhead costs incurred (AVO):

$$\text{BFVO} - \text{AVO}$$

POSSIBLE CAUSES

Variable overhead represents the aggregation of a large number of individual items, such as indirect labour, indirect materials, electricity, maintenance and so on. The variable overhead variance can arise because the prices of individual items have changed. Alternatively, the variance can also be affected by how efficiently the individual variable overhead items are used. Waste or inefficiency, such as using more kilowatt-hours of power than should have been used will increase the cost of power and, thus, the total cost of variable overhead. The variable overhead expenditure on its own is therefore not very informative. Any meaningful analysis of this variance requires a comparison of the actual expenditure for each individual item of variable overhead expenditure against the budget. If you refer to the performance report presented in Exhibit 12.5 on page 381, you can see how the £5000 variable overhead expenditure variance can be analysed by individual items of expenditure. Control should be exercised by focusing on the individual line items of expenditure variances and not the total expenditure variance.

Variable overhead efficiency variance

In Example 12.1 it is assumed that variable overheads vary with the direct labour hours of input. The variable overhead efficiency variance arises because 28 500 direct labour hours of input were required to produce 9000 units. Working at the prescribed level of efficiency, it should take 27 000 hours to produce 9000 units of output. Therefore an extra 1500 direct labour hours of input were required. Because variable overheads are assumed to vary with direct labour hours of input, an additional £3000 (1500 hours at £2) variable overheads will be incurred. The formula for the variance is

the **variable overhead efficiency variance** is the difference between the standard hours of output (SH) and the actual hours of input (AH) for the period multiplied by the standard variable overhead rate (SR):

$$(\text{SH} - \text{AH}) \times \text{SR}$$

You should note that if it is assumed that variable overheads vary with direct labour hours of input, this variance is identical to the labour efficiency variance. Consequently, the reasons for the variance are the same as those described previously for the labour efficiency variance. If you refer again to Figure 12.3, you will see that the variable overhead expenditure variance (£5000 favourable) plus the variable efficiency variance (£3000 adverse) add up to the total variable overhead variance of £2000 favourable.

Similarities between materials, labour and overhead variances

So far, we have calculated price and quantity variances for direct material, direct labour and variable overheads. You will have noted the similarities between the computations of

EXAMPLE 12.2

The budgeted sales for a company are £110 000 consisting of 10 000 units at £11 per unit. The standard cost per unit is £7. Actual sales are £120 000 (12 000 units at £10 per unit) and the actual cost per unit is £7.

the **total sales margin variance** is the difference between the actual contribution (AC) and the budgeted contribution (BC) (both based on standard unit costs):

$$AC - BC$$

Using the standard cost to calculate both the budgeted and the actual contribution ensures that the production variances do not distort the calculation of the sales variances. The effect of using standard costs throughout the contribution margin calculations means that the sales variances arise because of changes in those variables controlled by the sales function (i.e. selling prices and sales quantity). Consequently, Figure 12.3 indicates that it is possible to analyse the total sales margin variance into two sub-variances – a sales margin price variance and a sales margin volume variance.

Sales margin price variance

In Example 12.1 the actual selling price is £90 but the budgeted selling price is £88. With a standard unit variable cost of £68, the change in selling price has led to an increase in the contribution margin from £20 per unit to £22 per unit. Because the actual sales volume is 9000 units, the increase in the selling price means that an increased contribution margin is obtained 9000 times, giving a favourable sales margin price variance of £18 000. The formula for calculating the variance is

the **sales margin price variance** is the difference between the actual contribution margin (AM) and the standard margin (SM) (both based on standard unit costs) multiplied by the actual sales volume (AV):

$$(AM - SM) \times AV$$

Sales margin volume variance

To ascertain the effect of changes in the sales volume on the difference between the budgeted and the actual contribution, we must compare the budgeted sales volume with the actual sales volume. You will see from Example 12.1 that the budgeted sales are 10 000 units but the actual sales are 9000 units, and to enable us to determine the impact of this reduction in sales volume on profit, we must multiply the 1000 units by the standard contribution margin of £20. This gives an adverse variance of £20 000.

The use of the standard margin (standard selling price less standard cost) ensures that the standard selling price is used in the calculation, and the volume variance will not be affected by any *changes* in the actual selling prices. The formula for calculating the variance is

the sales margin volume variance is the difference between the actual sales volume (AV) and the budgeted volume (BV) multiplied by the standard contribution margin (SM):

$$(AV - BV) \times SM$$

Difficulties in interpreting sales margin variances

The favourable sales margin price variance of £18 000 plus the adverse volume variance of £20 000 add up to the total adverse sales margin variance of £2000. It may be argued that it is not very meaningful to analyse the total sales margin variance into price and volume components, since changes in selling prices are likely to affect sales volume. Consequently, a favourable price variance will tend to be associated with an adverse volume variance, and vice versa. It may be unrealistic to sell more than the budgeted volume when selling prices have increased.

A further problem with sales variances is that the variances may arise from external factors and may not be controllable by management. For example, changes in selling prices may be the result of a response to changes in selling prices of competitors. Alternatively, a reduction in both selling prices and sales volume may be the result of an economic recession that was not foreseen when the budget was prepared. Manufacturing variances are not influenced as much by external factors, and for this reason management are likely to focus most of their attention on the control of the manufacturing variances. Nevertheless, sales margin variances provide useful information that enables the budgeted profit to be reconciled with the actual profit. However, for control and performance appraisal it is preferable to compare actual market share with target market share for each product. In addition, the trend in market shares should be monitored and selling prices should be compared with competitors' prices.

Reconciling budgeted profit and actual profit

Top management will be interested in the reason for the actual profit being different from the budgeted profit. By adding the favourable production and sales variances to the budgeted profit and deducting the adverse variances, the reconciliation of budgeted and actual profit shown in Exhibit 12.4 can be presented in respect of Example 12.1.

Example 12.1 assumes that Alpha Ltd produces a single product consisting of a single operation and that the activities are performed by one responsibility centre. In practice, most companies make many products, which require operations to be carried out in different responsibility centres. A reconciliation statement such as that presented in Exhibit 12.4 will therefore normally represent a summary of the variances for many responsibility centres. The reconciliation statement thus represents a broad picture to top management that explains the major reasons for any difference between the budgeted and actual profits.

Performance reports

The managers of responsibility centres will require a more detailed analysis of the variances to enable them to exercise control, and detailed performance reports should be prepared at monthly or weekly intervals to bring to their attention any significant variances. A typical performance report based on the information contained in Example

EXHIBIT 12.4

Reconciliation of budgeted and actual profits for a standard variable costing system

12.1 is presented in Exhibit 12.5. A departmental performance report should include only those items that the responsibility manager can control or influence. The material price variance is *not* presented, since it is not considered to be within the control of the manager of the responsibility centre. A comparison of current variances with those of previous periods and/or with those of the year to date is presented in the summary of the performance report. This information is often useful in establishing a framework within which current variances can be evaluated. In addition to weekly or monthly performance reports, the manager of a responsibility centre should

	(£)	(£)	(£)
Budgeted net profit			80 000
Sales variances:			
Sales margin price	18 000F		
Sales margin volume	20 000A	2 000A	
Direct cost variances:			
Material: Price	8 900A		
Usage	26 500A	35 400A	
Labour: Rate	17 100A		
Efficiency	13 500A	30 600A	
Manufacturing overhead variances:			
Fixed overhead expenditure	4 000F		
Variable overhead expenditure	5 000F		
Variable overhead efficiency	3 000A	6 000F	62 000A
Actual profit			18 000

receive daily reports on those variances that are controllable on a daily basis. This normally applies to material usage and labour efficiency. For these variances the weekly or monthly performance reports will provide a summary of the information that has previously been reported on a daily basis.

EXHIBIT 12.5

A typical departmental performance report

DEPARTMENTAL PERFORMANCE REPORT

Department..... Actual production 27 000 standard hours
Period..... April 20XX ..... Actual working hours 28 500 hours
Budgeted hours 30 000 hours

DIRECT MATERIALS

Type	Standard quantity	Actual quantity	Difference	Standard price	Usage variance	Reason
A	18 000 kg	19 000	1000	£10.00	£10 000A	
B	9 000 kg	10 100	1100	£15.00	£16 500A	

DIRECT LABOUR

Grade	Standard hours	Actual hours	Difference	Standard cost	Actual cost	Total variance	Analysis: Efficiency	Analysis: Rate	Reason
	27 000	28 500	1500	£243 000	£273 600	£30 600	£13 500A	£17 100A	

OVERHEADS

	Allowed cost	Actual cost	Expenditure variance	Reason		Variable overhead efficiency variance (hours)	Variable overhead efficiency variance (£)
Controllable costs (variable):							
Indirect labour Power Maintenance Indirect materials					Difference between standard hours and actual hours at £2 per hour	1500	3000A
Total	£57 000	£52 000	£5000F			1500	3000A
Uncontrollable costs (fixed):							
Lighting and heating Depreciation Supervision							
	£120 000	116 000	4000F				

SUMMARY

	Variances (£)		Variances as a % of a standard cost	
	This month (£)	**Cumulative (£)**	**This month (%)**	**Cumulative (%)**
Direct materials usage	26 500A			
Direct labour:				
Efficiency	13 500A			
Wage rate	17 100A			
Controllable overheads:				
Expenditure	5 000F			
Variable overhead	3 000A			
Total	55 100A			

Comments:

Summary

To enable you to review your understanding of variance calculations, the formulae for the variances that we have considered in this chapter are summarized below. In each case the formula is arranged so that a positive variance is favourable and a negative variance unfavourable. The following variances are reported for both variable and absorption standard costing systems.

Materials and labour

1. Material price variance = (standard price per unit of material – actual price) × quantity of materials purchased
2. Material usage variance = (standard quantity of materials for actual production – actual quantity used) × standard price per unit
3. Total materials cost variance = (actual production × standard material cost per unit of production) – actual materials cost
4. Wage rate variance = (standard wage rate per hour – actual wage rate) × actual labour hours worked
5. Labour efficiency variance = (standard quantity of labour hours for actual production – actual labour hours) × standard wage rate
6. Total labour cost variance = (actual production × standard labour cost per unit of production) – actual labour cost

Fixed production overhead

7. Fixed overhead expenditure = budgeted fixed overheads – actual fixed overheads

Variable production overhead

8. Variable overhead expenditure variance = (budgeted variable overheads for actual input volume – actual variable overhead cost)
9. Variable overhead efficiency variance = (standard quantity of input hours for actual production – actual input hours) × variable overhead rate
10. Total variable overhead variance = (actual production × standard variable overhead rate per unit) – actual variable overhead cost

Sales margins

11. Sales margin price variance = (actual unit contribution margin – standard unit contribution margin) × actual sales volume
12. Sales margin volume variance = (actual sales volume – budgeted sales volume) × standard contribution margin
13. Total sales margin variance = total actual contribution – total budgeted contribution

Key Terms and Concepts

attainable standards (p. 364)
basic cost standards (p. 364)
bill of materials (p. 361)
budgeted costs (p. 357)
engineering studies (p. 361)
fixed overhead expenditure variance (p. 376)
ideal standards (p. 364)
labour efficiency variance (p. 373)
material price variance (p. 369)
material usage variance (p. 371)
sales margin price variance (p. 378)
sales margin volume variance (p. 379)
standard costs (p. 357)
standard hours produced (p. 362)
standard hours (p. 362)
total labour variance (p. 373)
total material variance (p. 371)
total sales margin variance (p. 378)
total variable overhead variance (p. 374)
variable overhead efficiency variance (p. 375)
variable overhead expenditure variance (p. 374)
wage rate variance (p. 372).

Review Problems

1. BS Limited manufactures one standard product and operates a system of variance accounting using a fixed budget. As assistant management accountant, you are responsible for preparing the monthly operating statements. Data from the budget, the standard product cost and actual data for the month ended 31 October are given below.

   Using the data given, you are required to prepare the operating statement for the month ended 31 October to show the budgeted profit; the variances for direct materials, direct wages, overhead and sales, each analysed into causes; and actual profit.

   Budgeted and standard cost data:

   Budgeted sales and production for the month: 10 000 units
   Standard cost for each unit of product:
   Direct material: X: 10 kg at £1 per kg
   Y: 5 kg at £5 per kg
   Direct wages: 5 hours at £3 per hour
   Budgeted fixed overheads are £300 000
   Budgeted sales price has been calculated to give a contribution of 50% of sales price

   Actual data for month ended 31 October:

   Production: 9500 units sold at a price of 10% higher than that budgeted
   Direct materials consumed:
   X: 96 000 kg at £1.20 per kg
   Y: 48 000 kg at £4.70 per kg
   Direct wages incurred 46 000 hours at £3.20 per hour
   Fixed production overhead incurred £290 000

   (30 marks)
   CIMA

2. The following data relate to actual output, costs and variances for the four-weekly accounting period number 4 of a company that makes only one product. Opening and closing work in progress figures were the same.

	(£000)
Actual production of product XY	18 000 units
Actual costs incurred:	
Direct materials purchased and used (150 000 kg)	210
Direct wages for 32 000 hours	136
Variable production overhead	38

	(£000)
Variances:	
Direct materials price	15 F
Direct materials usage	9 A
Direct labour rate	8 A
Direct labour efficiency	16 F
Variable production overhead expenditure	6 A
Variable production overhead efficiency	4 F

Variable production overhead varies with labour hours worked.
A standard marginal costing system is operated.

You are required to:

(a) present a standard product cost sheet for one unit of product XY, (16 marks)
(b) describe briefly *three* types of standard that can be used for a standard costing system, stating which is usually preferred in practice and why. (9 marks)

(Total 25 marks)
CIMA

Solutions to Review Problems

SOLUTION 1

1. *Preliminary calculations*
The standard product cost and selling price are calculated as follows:

	(£)	
Direct materials		
X (10 kg at £1)	10	
Y (5 kg at £5)	25	
Direct wages (5 hours × £3)	15	
Standard cost	50	
Standard margin (contribution)	50	(50% of selling price)
Selling price	100	

The actual profit for the period is calculated as follows:

	(£)	(£)
Sales (9500 at £110)		1 045 000
Direct materials: X	115 200	
Y	225 600	
Direct wages (46 000 × £3.20)	147 200	
Fixed overhead	290 000	778 000
Actual profit		267 000

It is assumed that the term 'using a fixed budget' refers to the requirement to reconcile the budget with the original fixed budget.

	(£)	(£)
Material price variance:		
(standard price – actual price)		
× actual quantity		
X: (£1 – £1.20) × 96 000	19 200 A	
Y: (£5 – £4.70) × 48 000	14 400 F	4800 A
Material usage variance:		
(standard quantity – actual quantity)		
× standard price		
X: (9500 × 10 = 95 000 – 96 000) × £1	1000 A	
Y: (9500 × 5 = 47 500 – 48 000) × £5	2500 A	3500 A

The actual materials used are in standard proportions. Therefore there is no mix variance.

Wage rate variance:		
(standard rate – actual rate) × actual hours		
(£3 – £3.20) × 46 000	9 200 A	
Labour efficiency variance:		
(standard hours – actual hours) × standard rate		
(9500 × 5 = 47 500 – 46 000) × £3	4 500 F	4 700 A
Fixed overhead expenditure:		
budgeted fixed overheads – actual fixed overheads		
(10 000 × £30 = £300 000 – £290 000)		10 000 F
Sales margin price variance:		
(actual margin[a] – standard margin) × actual sales volume		
(£60 – £50) × 9500	95 000 F	
Sales margin volume variance:		
(actual sales volume – budgeted sales volume)		
× Standard margin		
(9500 – 10 000) × £50	25 000 A	70 000 F
Total variance		67 000 F

Note
[a]Actual margin is defined as actual selling price (£110) less standard variable cost (£50)

	(£)
Budgeted profit (10 000 units at £20)	200 000
Add favourable variances (see above)	67 000
Actual profit	267 000

SOLUTION 2

(a) *Standard product cost for one unit of product XY*

	(£)
Direct materials (8 kg (W2) at £1.50 (W1) per kg)	12.00
Direct wages (2 hours (W4) at £4 (W3) per hour)	8.00
Variable overhead (2 hours (W4) at £1 (W5) per hour)	2.00
	22.00

Workings

(W1) Actual quantity of materials purchased at standard price is £225 000 (actual cost plus favourable material price variance).
Therefore standard price = £1.50 (£225 000/150 000 kg).

(W2) Material usage variance = 6000 kg (£9000/£1.50 standard price).
Therefore standard quantity for actual production = 144 000 kg (150 000 − 6000 kg).
Therefore standard quantity per unit = 8 kg (144 000 kg/18 000 units).

(W3) Actual hours worked at standard rate = £128 000 (£136 000 − £8000).
Therefore standard rate per hour = £ 4 (£128 000/32 000 hours).

(W4) Labour efficiency variance = 4000 hours (£16 000/£4).
Therefore standard hours for actual production = 36 000 hours (32 000 + 4000).
Therefore standard hours per unit = 2 hours (36 000 hours/18 000 units).

(W5) Actual hours worked at the standard variable overhead rate is £32 000 (£38 000 actual variable overheads less £6000 favourable expenditure variance).
Therefore, standard variable overhead rate = £1 (£32 000/32 000 hours).

(b) See 'Types of cost standards' in Chapter 12 for the answer to this question.

Questions

12.1

During a period, 17 500 labour hours were worked at a standard cost of £6.50 per hour. The labour efficiency variance was £7800 favourable.

How many standard hours were produced?

A	1 200
B	16 300
C	17 500
D	18 700

12.2

T plc uses a standard costing system, which is material stock account being maintained at standard costs. The following details have been extracted from the standard cost card in respect of direct materials:

8 kg at £0.80/kg = £6.40 per unit
Budgeted production in April was 850 units.

The following details relate to actual materials purchased and issued to production during April, when actual production was 870 units:

Materials purchased	8200 kg costing £6888
Materials issued to production	7150 kg

Which of the following correctly states the material price and usage variance to be reported?

	Price	Usage
A	£286 (A)	£152 (A)
B	£286 (A)	£280 (A)
C	£286 (A)	£294 (A)
D	£328 (A)	£152 (A)
E	£328 (A)	£280 (A)

CIMA

12.3

PQ Limited operates a standard costing system for its only product. The standard cost card is as follows:

Direct material (4 kg at £2/kg)	£8.00
Direct labour (4 hours at £4/hour)	£16.00
Variable overhead (4 hours at £3/hour)	£12.00
Fixed overhead (4 hours at £5/hour)	£20.00

Fixed overheads are absorbed on the basis of labour hours. Fixed overhead costs are budgeted at £12 000 per annum, arising at a constant rate during the year.

Activity in period 3 is budgeted to be 10% of total activity for the year. Actual production during period 3 was 500 units, with actual fixed overhead costs incurred being £9800 and actual hours worked being 1970.

The fixed overhead expenditure variance for period 3 was:

A	£2200 (F)
B	£200 (F)
C	£50 (F)
D	£200 (A)
E	£2200 (A)

CIMA

12.4

In a period, 11 280 kg of material were used at a total standard cost of £46 248. The material usage variance was £492 adverse.

What was the standard allowed weight of material for the period?

A	11 520 kg
B	11 280 kg
C	11 394 kg
D	11 160 kg

CIMA

12.5

The following information relates to R plc for October:

Bought 7800 kg of material R at a total cost of £16 380
Stocks of material R increased by 440 kg
Stocks of material R are valued using standard purchase price
Material price variance was £1170 adverse

The standard price per kg for material R is:

A	£1.95
B	£2.10
C	£2.23
D	£2.25
E	£2.38

CIMA

12.6

P Limited has the following data relating to its budgeted sales for October:

Budgeted sales	£100 000	
Budgeted selling price per unit		£8.00
Budgeted contribution per unit		£4.00
Budgeted profit per unit		£2.50

During October actual sales were 11 000 units for a sales revenue of £99 000.

P Limited uses an absorption costing system.

The sales variances reported for October were:

	Price	Volume
A	£11 000 F	£3 750 A
B	£11 000 F	£6 000 A
C	£11 000 A	£6 000 A
D	£12 500 F	£12 000 A
E	£12 500 A	£12 000 A

CIMA

12.7

The following details have been extracted from a standard cost card of X plc:

	Product X
Direct labour:	4 hours at £5.40 per hour

During October the budgeted production was 5000 units of product X and the actual production was 4650 units of product X. Actual hours worked were 19 100 and the actual direct labour cost amounted to £98 350.

The labour variances reported were:

	Rate	Efficiency
A	£9650 F	£4860 F
B	£9650 F	£2700 A
C	£4790 F	£2575 A
D	£4790 F	£4860 F
E	£4790 F	£2700 A

CIMA

12.8

In a period, 5792 units were made with a standard labour allowance of 6.5 hours per unit at £5 per hour. Actual wages were £6 per hour and there was an adverse efficiency variance of £36 000.

How many labour hours were actually worked?

A 30 448
B 31 648
C 43 648
D 44 848

CIMA

12.9 Flexible budgets and computation of labour and material variances

(a) JB plc operates a standard marginal cost accounting system. Information relating to product J, which is made in one of the company departments, is given below:

Product J	Standard marginal product cost Unit (£)
Direct material	
6 kilograms at £4 per kg	24
Direct labour	
1 hour at £7 per hour	7
Variable production overhead[a]	3
	34

[a]*Variable production overhead varies with units produced*

Budgeted fixed production overhead, per month: £100 000.

Budgeted production for product J: 20 000 units per month.

Actual production and costs for *month 6* were as follows:

Units of J produced	18 500 (£)
Direct materials purchased and used: 113 500 kg	442 650
Direct labour: 17 800 hours	129 940
Variable production overhead incurred	58 800
Fixed production overhead incurred	104 000
	735 390

You are required to:

(i) prepare a columnar statement showing, by element of cost, the:
  (i) original budget;
  (ii) flexed budget;
  (iii) actual;
  (iv) total variances; (9 marks)

(ii) subdivide the variances for direct material and direct labour shown in your answer to (a) (i)–(iv) above to be more informative for managerial purposes. (4 marks)

(b) Explain the meaning and use of a 'rolling forecast'. (2 marks)

(Total 15 marks)

CIMA

12.10 Computation of labour and material variances for a hotel

You work as the assistant to the management accountant for a major hotel chain, Stately Hotels plc. The new manager of one of the largest hotels in the chain, the Regent Hotel, is experimenting with the use of standard costing to plan and control the costs of preparing and cleaning the hotel bedrooms.

Two of the costs involved in this activity are cleaning labour and the supply of presentation soap packs.

Cleaning labour:
Part-time staff are employed to clean and prepare the bedrooms for customers. The employees are paid for the number of hours that they work, which fluctuates on a daily basis depending on how many rooms need to be prepared each day.

The employees are paid a standard hourly rate for weekday work and a higher hourly rate at the weekend. The standard cost control system is based on an average of these two rates, at £3.60 per hour.

The standard time allowed for cleaning and preparing a bedroom is fifteen minutes.

Presentation soap packs:
A presentation soap pack is left in each room every night. The packs contain soap, bubble bath, shower gel, hand lotion etc. Most customers use the packs or take them home with them, but many do not. The standard usage of packs used for planning and control purposes is one pack per room night.

The packs are purchased from a number of different suppliers and the standard price is £1.20 per pack. Stocks of packs are valued in the accounts at standard price.

Actual results for May:
During May 8400 rooms were cleaned and prepared. The following data were recorded for cleaning labour and soap packs.

Cleaning labour paid for:

Weekday labour	1850 hours at £3 per hour
Weekend labour	700 hours at £4.50 per hour
	2550

Presentation soap packs purchased and used:

6530	packs at £1.20 each
920	packs at £1.30 each
1130	packs at £1.40 each
8580	

Task

(a) Using the data above, calculate the following cost variances for May:
  (i) soap pack price;
  (ii) soap pack usage;
  (iii) cleaning labour rate;
  (iv) cleaning labour utilization or efficiency.

(b) Suggest one possible cause for each of the variances which you have calculated, and outline any management action which may be necessary.

AAT

12.11 Computation of labour and material variances and reconciliation statements

Malton Ltd operates a standard marginal costing system. As the recently appointed management accountant to Malton's Eastern division, you have responsibility for the preparation of that division's monthly cost reports. The standard cost report uses variances to reconcile the actual marginal cost of production to its standard cost.

The Eastern division is managed by Richard Hill. The division only makes one product, the Beta. Budgeted Beta production for May was 8000 units, although actual production was 9500 units.

In order to prepare the standard cost report for May, you have asked a member of your staff to obtain standard and actual cost details for the month of May. This information is reproduced below:

	Unit standard cost				Actual details for May	
	Quantity	Unit price	Cost per Beta (£)		Quantity	Total cost (£)
Material	8 litres	£20	160	Material	78 000 litres	1 599 000
Labour	4 hours	£6	24	Labour	39 000 hours	249 600
			184			1 848 600

Task 1

(a) Calculate the following:
  (i) the material price variance;
  (ii) the material usage variance;
  (iii) the labour rate variance;
  (iv) the labour efficiency variance (sometimes called the utilization variance);

(b) Prepare a standard costing statement reconciling the actual marginal cost of production with the standard marginal cost of production.

After Richard Hill has received your standard costing statement, you visit him to discuss the variances and their implications. Richard, however, raises a number of queries with you. He makes the following points:

- An index measuring material prices stood at 247.2 for May but at 240.0 when the standard for the material price was set.
- The Eastern division is budgeted to run at its normal capacity of 8000 units of production per month, but during May it had to manufacture an additional 1500 Betas to meet a special order agreed at short notice by Melton's sales director.

- Because of the short notice, the normal supplier of the raw material was unable to meet the extra demand and so additional materials had to be acquired from another supplier at a price per litre of £22.
- This extra material was not up to the normal specification, resulting in 20% of the special purchase being scrapped *prior* to being issued to production.
- The work force could only produce the special order on time by working overtime on the 1500 Betas at a 50% premium.

Task 2

(a) Calculate the amounts within the material price variance, the material usage variance and the labour rate variance which arise from producing the special order.

(b) (i) Estimate the revised standard price for materials based on the change in the material price index.

(ii) For the 8000 units of normal production, use your answer in (b) (i) to estimate how much of the price variance calculated in Task 1 is caused by the general change in prices.

(c) Using your answers to parts (a) and (b) of this task, prepare a revised standard costing statement. The revised statement should subdivide the variances prepared in Task 1 into those elements controllable by Richard Hill and those elements caused by factors outside his divisional control.

(d) Write a *brief* note to Richard Hill justifying your treatment of the elements you believe are outside his control and suggesting what action should be taken by the company.

AAT

12.12 Reconciliation of standard and actual cost for a variable costing system

Data

You are employed as the assistant management accountant in the group accountant's office of Hampstead plc. Hampstead recently acquired Finchley Ltd, a small company making a specialist product called the Alpha. Standard marginal costing is used by all the companies within the group and, from 1 August, Finchley Ltd will also be required to use standard marginal costing in its management reports. Part of your job is to manage the implementation of standard marginal costing at Finchley Ltd.

John Wade, the managing director of Finchley, is not clear how the change will help him as a manager. He has always found Finchley's existing absorption costing system sufficient. By way of example, he shows you a summary of its management accounts for the three months to 31 May. These are reproduced below.

Statement of budgeted and actual cost of Alpha Production – 3 months ended 31 May

Alpha production (units)	Actual		Budget		Variance
		10 000		12 000	
	Inputs	(£)	Inputs	(£)	(£)
Materials	32 000 metres	377 600	36 000 metres	432 000	54 400
Labour	70 000 hours	422 800	72 000 hours	450 000	27 200
Fixed overhead absorbed		330 000		396 000	66 000
Fixed overhead unabsorbed		75 000		0	(75 000)
		1 205 400		1 278 000	72 600

John Wade is not convinced that standard marginal costing will help him to manage Finchley. 'My current system tells me all I need to know,' he said. 'As you can see, we are £72 600 below budget which is really excellent given that we lost production as a result of a serious machine breakdown.'

To help John Wade understand the benefits of standard marginal costing, you agree to prepare a statement for the three months ended 31 May reconciling the standard cost of production to the actual cost of production.

Task 1

(a) Use the budget data to determine:

(i) the standard marginal cost per Alpha; and

(ii) the standard cost of actual Alpha production for the three months to 31 May.

(b) Calculate the following variances:

(i) material price variance;

(ii) material usage variance;

(iii) labour rate variance;

(iv) labour efficiency variance;

(v) fixed overhead expenditure variance.

(c) Write a *short* memo to John Wade. Your memo should:

(i) include a statement reconciling the actual cost of production to the standard cost of production;

(ii) give *two* reasons why your variances

might differ from those in his original management accounting statement despite using the same basic data;

(iii) *briefly* discuss *one* further reason why your reconciliation statement provides improved management information.

Data

On receiving your memo, John Wade informs you that:

- the machine breakdown resulted in the workforce having to be paid for 12 000 hours even though no production took place;
- an index of material prices stood at 466.70 when the budget was prepared but at 420.03 when the material was purchased.

Task 2

Using this new information, prepare a revised statement reconciling the standard cost of production to the actual cost of production. Your statement should subdivide:

- both the labour variances into those parts arising from the machine breakdown and those parts arising from normal production; and
- the material price variance into that part due to the change in the index and that part arising for other reasons.

Data

Barnet Ltd is another small company owned by Hampstead plc. Barnet operates a job costing system making a specialist, expensive piece of hospital equipment.

Existing system

Currently, employees are assigned to individual jobs and materials are requisitioned from stores as needed. The standard and actual costs of labour and material are recorded for each job. These job costs are totalled to produce the marginal cost of production. Fixed production costs – including the cost of storekeeping and inspection of deliveries and finished equipment – are then added to determine the standard and actual cost of production. Any costs of remedial work are included in the materials and labour for each job.

Proposed system

Carol Johnson, the chief executive of Barnet, has recently been to a seminar on modern manufacturing techniques. As a result, she is considering introducing Just-in-Time stock deliveries and Total Quality Management. Barnet would offer suppliers a long-term contract at a fixed price but suppliers would have to guarantee the quality of their materials.

In addition, she proposes that the workforce is organised as a single team with flexible work practices. This would mean employees helping each other as necessary, with no employee being allocated a particular job. If a job was delayed, the workforce would work overtime without payment in order for the job to be completed on time. In exchange, employees would be guaranteed a fixed weekly wage and time off when production was slack to make up for any overtime incurred.

Cost of quality

Carol has asked to meet you to discuss the implications of her proposals on the existing accounting system. She is particularly concerned to monitor the *cost of quality*. This is defined as the total of all costs incurred in preventing defects plus those costs involved in remedying defects once they have occurred. It is a single figure measuring all the explicit costs of quality – that is, those costs collected within the accounting system.

Task 3

In preparation for the meeting, produce *brief* notes. Your notes should:

(a) identify *four* general headings (or classifications) which make up the *cost of quality*;

(b) give *one* example of a type of cost likely to be found within each category;

(c) assuming Carol Johnson's proposals are accepted, state, with reasons, whether or not:
  (i) a standard marginal costing system would still be of help to the managers;
  (ii) it would still be meaningful to collect costs by each individual job;

(d) identify *one* cost saving in Carol Johnson's proposals which would not be recorded in the existing costing system.

AAT

12.13 Variance analysis and reconciliation of budgeted and actual profit

The Perseus Co. Ltd, a medium-sized company, produces a single produce in its one overseas factory. For control purposes, a standard costing system was recently introduced and is now in operation.

The standards set for the month of May were as follows:

Production and sales	16 000 units
Selling price (per unit)	£140
Materials	
Material 007	6 kilos per unit at £12.25 per kilo
Material XL90	3 kilos per unit at £3.20 per kilo
Labour	4.5 hours per unit at £8.40 per hour

Overheads (all fixed) at £86 400 per month are not absorbed into the product costs.

The actual data for the month of May, are as follows:

Produced 15 400 units, which were sold at £138.25 each.

Materials

Used 98 560 kilos of material 007 at a total cost of £1 256 640

Used 42 350 kilos of material XL90 at a total cost of £132 979

Labour

Paid an actual rate of £8.65 per hour to the labour force. The total amount paid out amounted to £612 766

Overheads (all fixed) £96 840

Required:

(a) Prepare a standard costing profit statement, and a profit statement based on actual figures for the month of May. (6 marks)

(b) Prepare a statement of the variances which reconcile the actual with the standard profit or loss figure. (9 marks)

(c) Explain briefly the possible reasons for inter-relationships between material variances and labour variances. (5 marks)

(Total 20 marks)

ACCA

12.14 Material price and usage variances and calculation of material price and usage working backwards from variances

AB Ltd manufactures a range of products. One of the products, Product M, requires the use of materials X and Y. Standard material costs for the manufacture of an item of product M in period 1 included:

Material X: 9 kilos at 1.20 per kilo

Total purchases of material X in period 1, for use in all products, were 142 000 kilos, costing £171 820. 16 270 kilos were used in the period in the manufacture of 1790 units of product M.

In period 2 the standard price of material X was increased by 6%, whilst the standard usage of the material in product M was left unchanged. 147 400 kilos of material X were purchased in period 2 at a favourable price variance of £1031.80. A favourable usage variance of 0.5% of standard occurred on material X in the manufacture of product M in the period.

Required:

(a) Calculate:

(i) the total price variance on purchases of material X in period 1; (2 marks)

(ii) the material X usage variance arising from the manufacture of product M in period 1; (3 marks)

(iii) the actual cost inflation of material X from period 1 to period 2 (calculate as a percentage increase to one decimal place); (5 marks)

(iv) the percentage change in actual usage of material X per unit of product M from period 1 to period 2 (calculate to one decimal place). (5 marks)

(b) Describe, and contrast, the different types of standards that may be set for raw material usage and labour efficiency. (10 marks)

(Total 25 marks)

ACCA

12.15 Calculation of actual input data working back from variances

The following profit reconciliation statement has been prepared by the management accountant of ABC Limited for March:

			(£)
Budgeted profit			30 000
Sales volume profit variance			5 250A
Selling price variance			6 375F
			31 125
Cost variances:	A (£)	F (£)	
Material:			
price	1 985		

usage		400	
Labour:			
rate		9 800	
efficiency	4 000		
Variable overhead:			
expenditure		1 000	
efficiency	1 500		
Fixed overhead:			
expenditure		500	
volume	24 500		
	31 985	11 700	
			20 285A
Actual profit			10 840

The standard cost card for the company's only product is as follows:

		(£)
Materials	5 litres at £0.20	1.00
Labour	4 hours at £4.00	16.00
Variable overhead	4 hours at £1.50	6.00
Fixed overhead	4 hours at £3.50	14.00
		37.00
Standard profit		3.00
Standard selling price		40.00

The following information is also available:

1. There was no change in the level of finished goods stock during the month.
2. Budgeted production and sales volumes for March were equal.
3. Stocks of materials, which are valued at standard price, decreased by 800 litres during the month.
4. The actual labour rate was £0.28 lower than the standard hourly rate.

Required:

(a) Calculate the following:
  (i) the actual production/sales volume; (4 marks)
  (ii) the actual number of hours worked; (4 marks)
  (iii) the actual quantity of materials purchased; (4 marks)
  (iv) the actual variable overhead cost incurred; (2 marks)
  (v) the actual fixed overhead cost incurred. (2 marks)

(b) ABC Limited uses a standard costing system whereas other organizations use a system of budgetary control. Explain the reasons why a system of budgetary control is often preferred to the use of standard costing in non-manufacturing environments. (9 marks)

(Total 25 marks)

CIMA

12.16 Calculation of labour variances and actual material inputs working backwards from variances

A company manufactures two components in one of its factories. Material A is one of several materials used in the manufacture of both components.

The standard direct labour hours per unit of production and budgeted production quantities for a 13 week period were:

	Standard direct labour hours	Budgeted production quantities
Component X	0.40 hours	36 000 units
Component Y	0.56 hours	22 000 units

The standard wage rate for all direct workers was £5.00 per hour. Throughout the 13-week period 53 direct workers were employed, working a standard 40-hour week.

The following actual information for the 13-week period is available:

Production:
  Component X, 35 000 units
  Component Y, 25 000 units
Direct wages paid, £138 500
Material A purchases, 47 000 kilos costing £85 110
Material A price variance, £430 F
Material A usage (component X), 33 426 kilos
Material A usage variance (component X), £320.32 A

Required:

(a) Calculate the direct labour variances for the period; (5 marks)

(b) Calculate the standard purchase price for material A for the period and the standard usage of material A per unit of production of component X. (8 marks)

(c) Describe the steps, and information, required to establish the material purchase quantity

budget for material A for a period. (7 marks)
(Total 20 marks)
ACCA

12.17 Preparation of an operating control statement and the calculation of labour, material and overhead variances

The following statement has been produced for presentation to the general manager of Department X.

Month ended 31 October

	Original budget (£)	Actual result (£)	Variance (£)
Sales	600 000	550 000	(50 000)
Direct materials	150 000	130 000	20 000
Direct labour	200 000	189 000	11 000
Production overhead:			
Variable with direct labour	50 000	46 000	4 000
Fixed	25 000	29 000	(4 000)
Variable selling overhead	75 000	72 000	3 000
Fixed selling overhead	50 000	46 000	4 000
Total costs	550 000	512 000	38 000
Profit	50 000	38 000	(12 000)
Direct labour hours	50 000	47 500	
Sales and production units	5 000	4 500	

Note: There are no opening and closing stocks.

The general manager says that this type of statement does not provide much relevant information for him. He also thought that the profit for the month would be well up to budget and was surprised to see a large adverse profit variance.

You are required to

(a) re-draft the above statement in a form which would be more relevant for the general manager; (6 marks)

(b) calculate all sales, material, labour and overhead variances and reconcile to the statement produced in (a); (9 marks)

(c) produce a short report explaining the principles upon which your re-drafted statement is based and what information it provides. (7 marks)

(Total 22 marks)
CIMA

12.18 Variance analysis and reconciliation of budgeted and actual profit.

Bronte Ltd manufactures a single product, a laminated kitchen unit with a standard cost of £75 made up as follows:

	(£)
Direct materials (15 sq. metres at £3 per sq. metre)	45
Direct labour (5 hours at £4 per hour)	20
Variable overheads (5 hours at £2 per hour)	10
	75

Budgeted fixed overheads are £5000 per month.

The standard selling price of the kitchen unit is £100. The monthly budget projects production and sales of 1000 units. Actual figures for the month of April are as follows:

Sales 1400 units at £102
Production 1400 units
Direct materials 22 000 sq. metres at £4 per sq. metre
Direct wages 6800 hours at £5
Variable overheads £11 000
Fixed overheads £6000

You are required to reconcile actual and budgeted profit showing all the appropriate variances.

13

Divisional financial performance measures

Large companies produce and sell a wide variety of products throughout the world. Because of the complexity of their operations, it is difficult for top management to directly control operations. It may therefore be appropriate to divide a company into separate self-contained segments or divisions and to allow divisional managers to operate with a great deal of independence. A divisional manager has responsibility for both the production and marketing activities of the division. The danger in creating autonomous divisions is that divisional managers might not pursue goals that are in the best interests of the company as a whole. The objective of this chapter is to consider financial performance measures that will motivate managers to pursue those goals that will best benefit the company as a whole. In other words, the objective is to develop performance measures that will achieve goal congruence.

In this chapter we shall focus on financial measures of divisional performance. However, financial measures cannot adequately measure all those factors that are critical to the success of a division. Emphasis should also be given to reporting key non-financial measures relating to such areas as competitiveness, product leadership, quality, delivery performance, innovation and flexibility to respond to changes in demand. In particular, performance measures should be developed that support the objectives and competitive strategies of the organization. Divisional financial performance measures should therefore be seen as one of a range of measures that should be used to measure and control divisional performance.

Learning objectives

After studying this chapter, you should be able to:

- distinguish between functional and divisionalized organizational structures;
- explain the factors that should be considered in designing financial performance measures for evaluating divisional managers;
- explain why it is preferable to distinguish between managerial and economic performance;
- explain the meaning of return on investment, residual income and economic value added;
- compute economic value added;
- illustrate how performance measures may conflict with the net present value decision model;
- justify the use of a risk-adjusted discount rate for determining the divisional cost of capital;
- explain why it is important to include additional non-financial measures when evaluating divisional performance.

Functional and divisionalized organizational structures

A **functional organizational structure** is one in which all activities of a similar type within a company are placed under the control of the appropriate departmental head. A simplified organization chart for a functional organizational structure is illustrated in Figure 13.1(a). It is assumed that the company illustrated consists of five separate departments – production, marketing, financial administration, purchasing and research and development. In a typical functional organization none of the managers of the five departments is responsible for more than a part of the process of acquiring the raw materials, converting them into finished products, selling to customers, and administering the financial aspects of this process. For example, the production department is responsible for the manufacture of all products at a minimum cost, and of satisfactory quality, and to meet the delivery dates requested by the marketing department. The marketing department is responsible for the total sales revenue and any costs associated with selling and distributing the products, but not for the total profit. The purchasing department is responsible for purchasing supplies at a minimum cost and of satisfactory quality so that the production requirements can be met.

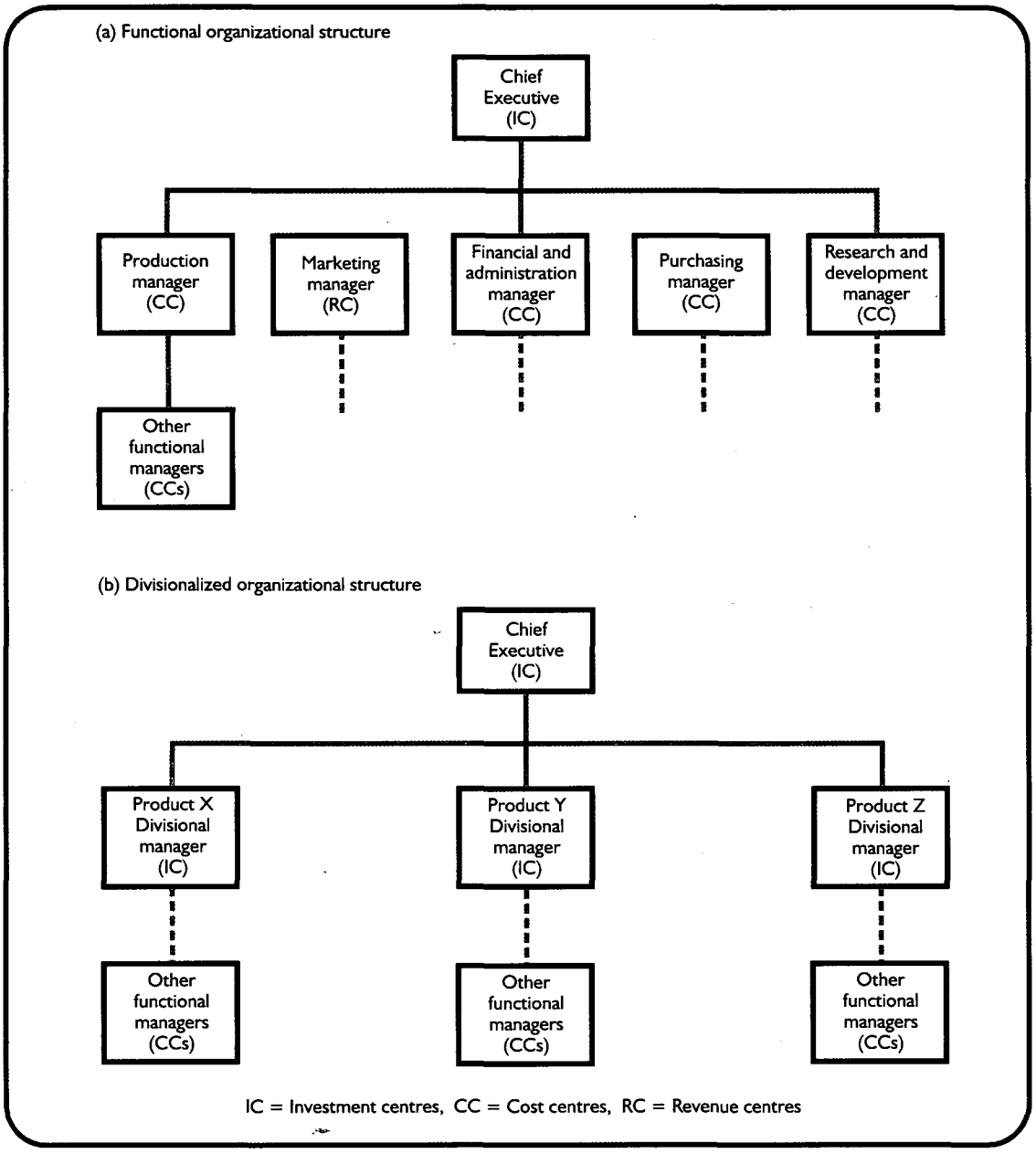
You will see from Figure 13.1 that the marketing function is a revenue centre and the remaining departments are cost centres. Revenues and costs (including the cost of investments) are combined together only at the chief executive, or corporate level, which is classified as an investment centre.

Let us now consider Figure 13.1(b), which shows a **divisionalized organizational structure**, which is split up into divisions in accordance with the products which are made. You will see from the diagram that each divisional manager is responsible for all of the operations relating to his or her particular product. To reflect this greater autonomy each division is either an investment centre or a profit centre. To simplify the presentation it is assumed that all of the divisions in Figure 13.1(b) are investment centres (we shall discuss the factors influencing the choice of investment or profit centres later in the chapter). Note that within each division there are multiple cost and revenue centres and also that a functional structure is applied within each division. Figure 13.1(b) shows a simplified illustration of a divisionalized organizational structure. In practice, however, only part of a company may be divisionalized. For example, activities such as research and development, industrial relations, and general administration may be structured centrally on a functional basis with a responsibility for providing services to all of the divisions.

The distinguishing feature between the functional structure (Figure 13.1a) and the divisionalized structure (Figure 13.1b) is that in the functional structure only the organization as a whole is an investment centre and below this level a functional structure applies throughout. In contrast, in a divisionalized structure the organization is divided into separate investment or profit centres and a functional structure applies below this level. In this chapter we shall focus on financial measures and controls at the profit or investment (i.e. divisional) level. Note that below this level the controls described in the previous two chapters should also be applied to cost centres and revenue centres that have been established within the divisionalized organizational structure.

Generally, a divisionalized organizational structure will lead to a decentralization of the decision-making process. For example, divisional managers will normally be free to set selling prices, choose which market to sell in, make product mix and output decisions, and select suppliers (this may include buying from other divisions within the company or from other companies). In a functional organizational structure pricing, product mix and output decisions will be made by central management. Consequently, the functional managers in a

FIGURE 13.1 *A functional and divisionalized organizational structure.*



centralized organization will have far less independence than divisional managers. One way to express the difference between the two organizational structures is to say that the divisional managers have profit responsibility. They are responsible for generating revenues, controlling costs and earning a satisfactory return on the capital invested in their operations. The managers of the functional organizational structure do not have profit responsibility. For example, in Figure 13.1(a) the production manager has no control over sources of supply, selling prices, or product mix and output decisions.

Profit centres and investment centres

The creation of separate divisions may lead to the delegation of different degrees of authority; for example, in some organizations a divisional manager may, in addition to having authority to make decisions on sources of supply and choice of markets, also have responsibility for making capital investment decisions. Where this situation occurs, the division is known as an **investment centre**. Alternatively, where a manager cannot control the investment and is responsible only for the profits obtained from operating the fixed assets assigned to him or her by corporate headquarters, the segment is referred to as a **profit centre**. In contrast, the term **cost centre** is used to describe a responsibility centre in a functional organizational structure where a manager is responsible for costs but not profits.

Many firms attempt to simulate a divisionalized profit centre structure by creating separate manufacturing and marketing divisions in which the supplying division produces a product and transfers it to the marketing division, which then sells the product in the external market. Transfer prices are assigned to the products transferred between the divisions. This practice creates pseudo-divisionalized profit centres. Separate profits can be reported for each division, but the divisional managers have limited authority for sourcing and pricing decisions. To meet the true requirements of a divisionalized profit centre, a division should be able to sell the majority of its output to outside customers and should also be free to choose the sources of supply.

Ezzamel and Hilton (1980) investigated the degree of autonomy allowed to divisional managers in 129 large UK companies. They found that divisional managers enjoyed substantial discretion in taking operating decisions relating to output, selling prices, setting credit terms, advertising and purchasing policies. However, close supervision by top management in choosing capital projects and specifying capital expenditures in the annual budget was observed.

Advantages of divisionalization

Divisionalization can improve the decision-making process both from the point of view of the quality of the decision and the speed of the decision. The quality of the decisions should be improved because decisions can be made by the person who is familiar with the situation and who should therefore be able to make more informed judgements than central management who cannot be intimately acquainted with all the activities of the various segments of the business. Speedier decisions should also occur because information does not have to pass along the chain of command to and from top management. Decisions can be made on the spot by those who are familiar with the product lines and production processes and who can react to changes in local conditions in a speedy and efficient manner.

In addition, delegation of responsibility to divisional managers provides them with greater freedom, thus making their activities more challenging and providing the opportunity to achieve self-fulfilment. This process should mean that motivation and efficiency will be increased not just at the divisional manager level but throughout the whole division. A study by Dittman and Ferris (1978) of the attitudes of managers in companies in the USA found that those managers in charge of profit centres had greater job satisfaction than the managers of cost centres. They conclude that wherever possible, system designers ought to try to construct profit centres for organizational units.

Another important reason for adopting a divisionalized structure is that the distribution of decision-making responsibility to divisions frees top management from detailed

involvement in day-to-day operations, and enables them to devote more effort to strategic planning and decision-making. It is also claimed that divisions can provide an excellent training ground for future members of top management by enabling trainee managers to acquire the basic managerial skills and experience in an environment that is less complex than managing the company as a whole.

Disadvantages of divisionalization

If a company is divisionalized, there is a danger that divisions may compete with each other excessively and that divisional managers may be encouraged to take action which will increase their own profits at the expense of the profits of other divisions. This may adversely affect co-operation between the divisions and lead to a lack of harmony in achieving the overall organizational goals of the company. This in turn may lead to a reduction in total company profits.

It is also claimed that the costs of activities that are common to all divisions may be greater for a divisionalized structure than for a centralized structure. For example, a large central accounting department in a centralized organizational structure may be less costly to operate than separate accounting departments for each division within a divisionalized structure. If top management are contemplating a divisionalized structure, it is important that they assess whether the additional benefits will exceed the additional costs.

A further argument against divisionalization is that top management loses some control by delegating decision-making to divisional managers. It is argued that a series of control reports is not as effective as detailed knowledge of a company's activities. However, with a good system of performance evaluation together with appropriate control information, top management should be able to effectively control operations.

Pre-requisites for successful divisionalization

A divisionalized structure is most suited to companies engaged in several dissimilar activities. The reason is that it is difficult for top management to be intimately acquainted with all the diverse activities of the various segments of the business. On the other hand, when the major activities of a company are closely related, these activities should be carefully coordinated, and this coordination is more easily achieved in a centralized organizational structure. The results from a number of surveys suggest that divisionalization is more common in companies having diversified activities than when single or related activities are undertaken (Ezzamel and Hilton, 1980).

For successful divisionalization it is important that the activities of a division be as independent as possible of other activities. However, Solomons (1965) argues that even though substantial independence of divisions from each other is a necessary condition for divisionalization, if carried to the limit it would destroy the very idea that such divisions are an integral part of any single business. Divisions should be more than investments – they should contribute not only to the success of the company but to the success of each other.

According to Solomons, a further condition for the success of divisionalization is that the relations between divisions should be regulated so that no one division, by seeking its own profit, can reduce that of the company as a whole. He states that this is not the same as seeking profit at the expense of other divisions, but the amount that a division adds to its own profit must exceed the loss that it inflicts on another division. Unfortunately, conflicts between divisions do arise, and one of the important tasks of the accountant is to design an accounting control system that will discourage a division from improving its own profit at the expense of the company as a whole.

Distinguishing between the managerial and economic performance of the division

Before discussing the factors to be considered in determining how divisional profitability should be measured, we must decide whether the primary purpose is to measure the performance of the division or that of the divisional manager. The messages transmitted from these two measures may be quite different. For example, a manager may be assigned to an ailing division to improve performance, and might succeed in substantially improving the performance of the division. However, the division might still be unprofitable because of industry factors, such as overcapacity and a declining market. The future of the division might be uncertain, but the divisional manager may well be promoted as a result of the outstanding managerial performance. Conversely, a division might report significant profits but, because of management deficiencies, the performance may be unsatisfactory when the favourable economic environment is taken into account.

If the purpose is to evaluate the divisional manager then only those items directly controllable by the manager should be included in the profitability measure. Thus all allocations of indirect costs, such as central service and central administration costs, which are not controllable by divisional managers, ought not to be included in the profitability measure. Such costs can only be controlled where they are incurred; which means that they can be controlled only by central service managers and central management.

Corporate headquarters, however, will also be interested in evaluating a division's economic performance for decision-making purposes, such as expansion, contraction and divestment decisions. In this situation a measure that includes only those amounts directly controllable by the divisional manager would overstate the economic performance of the division. This overstatement occurs because, if the divisions were independent companies, they would have to incur the costs of those services provided by head office. Therefore, to measure the economic performance of the division many items that the divisional manager cannot influence, such as interest expenses, taxes and the allocation of central administrative staff expenses, should be included in the profitability measure.

Alternative divisional profit measures

There are strong arguments for computing two measures of divisional profitability – one to evaluate managerial performance and the other to evaluate the economic performance of the division. In this chapter we shall focus on both these measures. The most common measures of divisional profitability are return on investment (that is, profit as a percentage of the investment in a division) residual income and economic value added. The reported divisional profit is a component of each of these measures. At this stage we shall restrict our attention purely to problems that are encountered with divisional profit measurement before turning our attention to the above three common measures of divisional profitability.

Exhibit 13.1 presents a divisional profit statement. You can see that there are four different profit measures that we can use to measure divisional performance. We shall focus initially on measuring *managerial* performance. The **variable short-run contribution margin** is inappropriate for performance evaluation, because it does not include fixed costs that are controllable by the divisional manager. For example, a manager may not be motivated to control non-variable labour costs or equipment rentals, since they fall below the variable short-run contribution line and are not included in the performance measure.

EXHIBIT 13.1

Alternative divisional profit measures

The **controllable contribution** is computed by deducting from total divisional revenues all those costs that are controllable by the division manager. This measure therefore includes controllable fixed costs such as non-variable

Sales to outside customers	xxx
Transfers to other divisions	xxx
Total sales revenue	xxx
Less variable costs	xxx
1. Variable short-run contribution margin	xxx
Less controllable fixed costs	xxx
2. Controllable contribution	xxx
Less non-controllable avoidable costs	xxx
3. Divisional contribution	xxx
Less allocated corporate expenses	xxx
4. Divisional net profit before taxes	xxx

labour, equipment rental and the cost of utilities. These costs are fixed in the short term, but in the longer term the divisional manager has the option of reducing them by altering the scale of operations or reducing the complexity and diversity of product lines and distribution channels. Where a division is a profit centre, depreciation is not a controllable cost, since the manager does not have authority to make capital investment decisions. Depreciation, however, should be deemed to be a controllable expense for an investment centre in respect of those assets that are controllable by the divisional manager.

Controllable contribution is the most appropriate measure of a divisional manager's performance, since it measures the ability of managers to use the resources under their control effectively. It should not be interpreted in isolation if it is used directly to evaluate the performance of a divisional manager. Instead, the controllable contribution reported by a division should be evaluated relative to a budgeted performance, so that market conditions can be taken into account.

In practice, it is extremely difficult to distinguish between controllable and non-controllable costs. However, three situations can be identified that will assist us in overcoming this problem. Where a division is completely free to shop around for a service and there is no rule requiring the division to obtain the service from within the company, the expense is clearly controllable. Alternatively, a division may not be free to choose an outside source of supply for the service in question, but it may be able to decide how much of this service is utilized. In this latter situation the quantity is controllable by the division but the price is not. An appropriate solution here is for the division to be charged with the actual quantity at the standard or budgeted cost for the service that has been obtained. Thus any difference between the budget and actual performance would relate solely to excess usage by the division recorded at the standard price. Finally, the division may not be free to decide on either the quantity of the service it utilizes or the price it will be charged. Industrial relations costs may fall into this category. Here the divisions have no choice but to accept an apportioned cost for the benefits they have received (such apportionments may be made for external reporting purposes). In situations like this, the costs charged to the division for the service can only be regarded as a non-controllable item of divisional overhead. Another general rule that can be applied for

distinguishing between controllable and non-controllable costs is to follow the guideline suggested by Merchant (1998) – that is, hold managers accountable for those costs that you want them to pay attention to.

Controllable contribution provides an incomplete measure of the *economic* performance of a division, since it does not include those costs that are attributable to the division but which are not controllable by the divisional manager. For example, depreciation of divisional assets, and head office finance and legal staff who are assigned to providing services for specific divisions, would fall into this category. These expenses would be avoidable if a decision were taken to close the division. Those non-controllable expenses that are attributable to a division, and which would be avoidable if the division was closed, are deducted from controllable contribution to derive the **divisional contribution**. This is clearly a useful figure for evaluating the *economic* contribution of the division, since it represents the contribution that a division is making to corporate profits and overheads. It should not be used, however, to evaluate managerial performance, since it includes costs that are not controllable by divisional managers.

Many companies allocate all corporate general and administrative expenses to divisions to derive a **divisional net profit before taxes**. From a theoretical point of view, it is difficult to justify such allocations since they tend to be arbitrary and do not have any connection with the manner in which divisional activities influence the level of these corporate expenses. Divisional contribution would therefore seem to be the most appropriate measure of divisions' *economic* performance, since it is not distorted by arbitrary allocations. We have noted, however, that corporate headquarters may wish to compare a division's economic performance with that of comparable firms operating in the same industry. The divisional contribution would overstate the performance of the division, because if the division were independent, it would have to incur the costs of those services performed by head office. The apportioned head office costs are an approximation of the costs that the division would have to incur if it traded as a separate company. Consequently, companies may prefer to use divisional net profit when comparing the performance of a division with similar companies.

For the reasons mentioned above, divisional net profit is not a satisfactory measure for evaluating *managerial* performance. Despite the many theoretical arguments against divisional net profit, the empirical evidence indicates that this measure is used widely to evaluate both divisional *economic* and *managerial* performance (Reece and Cool, 1978; Fremgen and Liao, 1981; Ramadan, 1989; Skinner, 1990; Drury *et al.*, 1993). In the Fremgen and Liao survey respondents were asked why they allocated indirect costs. The most important managerial performance evaluation reason was to 'remind profit centre managers that indirect costs exist and that profit centre earnings must be adequate to cover a share of these costs'. The counter-argument to this is that if central management wishes to inform managers that divisions must be profitable enough to cover not only their own operations but corporate expenses as well, it is preferable to set a high budgeted controllable contribution target that takes account of these factors. Divisional managers can then concentrate on increasing controllable contribution by focusing on those costs and revenues that are under their control and not be concerned with costs that they cannot control.

A further reason for cost allocations cited in the surveys by Fremgen and Liao and Skinner was that by allocating central overhead costs to divisions, divisional managers are made aware of these costs, so they will exert pressure on central management to minimize the costs of central staff departments. There is also some evidence to suggest that companies hold managers accountable for divisional net profit because this is equivalent to the measure that financial markets focus on to evaluate the performance of the company as a whole (Joseph *et al.*, 1996). Top management therefore require their divisional managers to concentrate on the same measures as those used by financial markets.

Return on investment

Instead of focusing purely on the absolute size of a division's profits, most organizations focus on the **return on investment** (ROI) of a division. Note that ROI is synonymous with the accounting rate of return (ARR) described in Chapter 9 for investment appraisal. In Chapter 9 our focus was on future estimates (i.e. an *ex ante* measure) for making investment decisions. In this chapter we are focusing on an historic after-the-event (i.e. *ex post*) performance measure. ROI expresses divisional profit as a percentage of the assets employed in the division. Assets employed can be defined as total divisional assets, assets controllable by the divisional manager or net assets. We shall consider the alternative measures of assets employed later in the chapter.

ROI is the most widely used financial measure of divisional performance. Why? Consider a situation where division A earns a profit of £1 million and division B a profit of £2 million. Can we conclude that Division B is more profitable than Division A? The answer is no, since we should consider whether the divisions are returning a sufficiently high return on the capital invested in the division. Assume that £4 million capital is invested in division A and £20 million in division B. Division A's ROI is 25% (£1m/£4m) whereas the return for division B is 10% (£2m/£20m). Capital invested has alternative uses, and corporate management will wish to ascertain whether the returns being earned on the capital invested in a particular division exceeds the division's opportunity cost of capital (i.e. the returns available from the alternative use of the capital). If, in the above illustration, the return available on similar investments to that in division B is 15% then the economic viability of division B is questionable if profitability cannot be improved.

ROI provides a useful overall approximation on the success of a firm's past investment policy by providing a summary measure of the *ex post* return on capital invested. Kaplan and Atkinson (1998) also draw attention to the fact that, without some form of measurement of the *ex post* returns on capital, there is little incentive for accurate estimates of future cash flows during the capital budgeting process. Measuring returns on invested capital also focuses managers' attention on the impact of levels of working capital (particularly stocks and debtors) on the ROI.

Another feature of the ROI is that it can be used as a common denominator for comparing the returns of dissimilar businesses, such as other divisions within the group or outside competitors. ROI has been widely used for many years in all types of organizations so that most managers understand what the measure reflects and consider it to be of considerable importance.

Despite the widespread use of ROI, a number of problems exist when this measure is used to evaluate the performance of divisional managers. For example, it is possible that divisional ROI can be increased by actions that will make the company as a whole worse off, and conversely, actions that decrease the divisional ROI may make the company as a whole better off. In other words, evaluating divisional managers on the basis of ROI may not encourage goal congruence. Consider the following example:

	Division X	**Division Y**
Investment project available	£10 million	£10 million
Controllable contribution	£2 million	£1.3 million
Return on the proposed project	20%	13%
ROI of divisions at present	25%	9%

It is assumed that neither project will result in any changes in non-controllable costs and that the overall cost of capital for the company is 15%. The manager of division X would

be reluctant to invest the additional £10 million because the return on the proposed project is 20%, and this would reduce the existing overall ROI of 25%. On the other hand, the manager of division Y would wish to invest the £10 million because the return on the proposed project of 13% is in excess of the present return of 9%, and it would increase the division's overall ROI. Consequently, the managers of both divisions would make decisions that would not be in the best interests of the company. The company should accept only those projects where the return is in excess of the cost of capital of 15%, but the manager of division X would reject a potential return of 20% and the manager of division Y would accept a potential return of 13%. ROI can therefore lead to a lack of goal congruence.

Residual income

To overcome some of the dysfunctional consequences of ROI, the residual income approach can be used. For the purpose of evaluating the performance of *divisional managers*, residual income is defined as controllable contribution less a cost of capital charge on the investment controllable by the divisional manager. For evaluating the *economic performance* of the division residual income can be defined as divisional contribution (see Exhibit 13.1) less a cost of capital charge on the total investment in assets employed by the division. If residual income is used to measure the managerial performance of investment centres, there is a greater probability that managers will be encouraged, when acting in their own best interests, also to act in the best interests of the company. Returning to our previous illustration in respect of the investment decision for divisions X and Y, the residual income calculations are as follows:

	Division X (£)	**Division Y (£)**
Proposed investment	10 million	10 million
Controllable contribution	2 million	1.3 million
Cost of capital charge (15% of the investment cost)	1.5 million	1.5 million
Residual income	0.5 million	– 0.2 million

This calculation indicates that the residual income of division X will increase and that of division Y will decrease if both managers accept the project. Therefore the manager of division X would invest, whereas the manager of division Y would not. These actions are in the best interests of the company as a whole.

Residual income suffers from the disadvantages of being an absolute measure, which means that it is difficult to compare the performance of a division with that of other divisions or companies of a different size. For example, a large division is more likely to earn a larger residual income than a small division. To overcome this deficiency, targeted or budgeted levels of residual income should be set for each division that are consistent with asset size and the market conditions of the divisions.

In the case of profit centres, where divisional managers are not authorized to make capital investment decisions and where they cannot influence the investment in working capital, ROI is a satisfactory performance measure, because if the return on investment is maximized on a fixed quantity of capital, the absolute return itself will also be maximized. However, in the case of investment centres, or profit centres where managers can significantly influence the investment in working capital, ROI appears to be an unsatisfactory method of measuring managerial performance, and in these circumstances the residual income is preferable.

Surveys of methods used by companies to evaluate the performance of divisional managers indicate a strong preference for ROI over residual income. For example, the UK survey by Drury *et al.* (1993) reported that the following measures were used:

	(%)
A target ROI set by the group	55
Residual income	20
A target profit *before* charging interest on investment	61
A target cash flow figure	43

Why is ROI preferred to residual income? Skinner (1990) found evidence to suggest that firms prefer to use ROI because, being a ratio, it can be used for inter-division and inter-firm comparisons. ROI for a division can be compared with the return from other divisions within the group or with whole companies outside the group, whereas absolute monetary measures such as residual income are not appropriate in making such comparisons. A second possible reason for the preference for ROI is that 'outsiders' tend to use ROI as a measure of a company's overall performance. Corporate managers therefore want their divisional managers to focus on ROI so that their performance measure is congruent with outsiders' measure of the company's overall economic performance. A further reason, suggested by Kaplan and Atkinson (1998), is that managers find percentage measures of profitability such as ROI more convenient, since they enable a division's profitability to be compared with other financial measures (such as inflation rates, interest rates, and the ROI rates of other divisions and comparable companies outside the group).

Economic value added (EVA$^{(TM)}$)

During the 1990s residual income has been refined and renamed as economic value added (**EVA$^{(TM)}$**) by the Stern Stewart consulting organization and they have registered EVA$^{(TM)}$ as their trademark. An article in an issue of *Fortune* magazine (1993) described the apparent success that many companies had derived from using EVA$^{(TM)}$ to motivate and evaluate corporate and divisional managers. *The Economist* (1997) reported that more than 300 firms world-wide had adopted EVA$^{(TM)}$ including Coca-Cola, AT&T, ICL, Boots and the Burton Group.

The EVA$^{(TM)}$ concept extends the traditional residual income measure by incorporating adjustments to the divisional financial performance measure for distortions introduced by generally accepted accounting principles (GAAP). EVA$^{(TM)}$ can be defined as:

$$\text{EVA}^{(TM)} = \text{Conventional divisional profit} \pm \text{accounting adjustments} - \text{cost of capital charge on divisional assets}$$

Our earlier discussion relating to which of the conventional alternative divisional profit measures listed in Exhibit 13.1 should be used also applies here. There are strong theoretical arguments for using controllable contribution as the divisional profit measure for *managerial* performance and divisional contribution for measuring *economic* performance. Many companies, however, use divisional net profit (after allocated costs) to evaluate both divisional managerial and economic performance.

Adjustments are made to the chosen conventional divisional profit measure in order to replace historic accounting data with a measure of economic profit and asset values. Stern Stewart have stated that they have developed approximately 160 accounting adjustments that may need to be made to convert the conventional accounting profit into a sound measure of EVA$^{(TM)}$ but they have indicated that most organizations will only need to use

about 10 of the adjustments. These adjustments result in the capitalization of many discretionary expenditures, such as research and development, marketing and advertising, by spreading these costs over the periods in which the benefits are received. Therefore adopting EVA(TM) should reduce some of the harmful side-effects arising from using financial measures that were discussed in Chapter 11. This is because managers will not bear the full costs of the discretionary expenditures in the period in which they are incurred if the expenses are capitalized. Instead, the cost will be spread across the periods when the benefits from the expenditure are received. Also because it is a restatement of the residual income measure, compared with ROI, EVA(TM) is more likely to encourage goal congruence in terms of asset acquisition and disposal decisions. Managers are also made aware that capital has a cost and they are thus encouraged to dispose of underutilized assets that do not generate sufficient income to cover their cost of capital.

Stern Stewart developed EVA(TM) with the aim of producing an overall financial measure that encourages senior managers to concentrate on the delivery of shareholder value. They consider that the aim of managers of companies, whose shares are traded in the stock market, should be to maximize shareholder value. It is therefore important that the key financial measure that is used to measure divisional or company performance should be congruent with shareholder value. Stern Stewart claim that, compared with other financial measures, EVA(TM) is more likely to meet this requirement and also to reduce dysfunctional behaviour.

There are a number of issues that apply to ROI, residual income or its replacement (EVA(TM)). They concern determining which assets should be included in a division's asset base, and the adjustments that should be made to financial accounting practices to derive managerial information that is closer to economic reality.

Determining which assets should be included in the investment base

We must determine which assets to include in a division's asset base to compute both ROI and EVA(TM). (Note that for the remainder of the chapter we shall use the term EVA(TM) to incorporate residual income.) If the purpose is to evaluate the performance of the divisional manager then only those assets that can be directly traced to the division and that are controllable by the divisional manager should be included in the asset base. Assets managed by central headquarters should not be included. For example, if debtors and cash are administered centrally, they should not be included as part of the asset base. On the other hand, if a divisional manager can influence these amounts, they should be included in the investment base. If they were not included, divisional managers could improve their profits by granting over-generous credit terms to customers; they would obtain the rewards of the additional sales without being charged with any cost for the additional capital that would be tied up in debtors.

Any liabilities that are within the control of the division should be deducted from the asset base. For example, a division may finance its investment in stocks by the use of trade creditors; this liability for creditors should therefore be deducted. The term **controllable investment** is used to refer to the net asset base that is controllable by divisional managers. Our overall aim in analysing controllable and non-controllable investment is to produce performance measures that will encourage a manager to behave in the best interests of the organization and also to provide a good approximation of managerial performance. It is therefore appropriate to include in the investment base only those assets that a manager can influence, and any arbitrary apportionments should be excluded.

If the purpose is to evaluate the economic performance of the division, the profitability of the division will be overstated if controllable investment is used. This is because a division could not operate without the benefit of corporate assets such as buildings, cash and debtors managed at the corporate level. These assets would be included in the investment base if the divisions were separate independent companies. Therefore many divisionalized companies allocate corporate assets to divisions when comparing divisional profitability with comparable firms in the same industry.

The impact of depreciation

It is common to find fixed assets valued at either their original cost or their written down value for the purpose of calculating return on investment and EVA$^{(TM)}$, but both of these valuation methods are weak. Consider, for example, an investment in an asset of £1 million with a life of five years with annual cash flows of £350 000 and a cost of capital of 10%. This investment has a positive NPV of £326 850, and should be accepted. You can see from Exhibit 13.2 that the annual profit is £150 000 when straight line depreciation is used. If the asset is *valued at original cost*, there will be a return of 15% per annum for five years. This will understate the true return, because the economic valuation is unlikely to remain at £1 million each year for five years and then immediately fall to zero. If ROI is based on the *written-down value*, you can see from Exhibit 13.2 that the investment base will decline each year – and, with constant profits, the effect will be to show a steady increase in return on investment. This steady increase in return on investment will suggest an improvement in managerial performance when the economic facts indicate that performance has remained unchanged over the five-year period.

Similar inconsistencies will also occur if the EVA$^{(TM)}$ method is used. If the asset is valued at the original cost, EVA$^{(TM)}$ of £50 000 will be reported each year (£150 000 profit − (10% cost of capital × 1 million)). On the other hand, if the cost of capital charge is based on the written-down value of the asset, the investment base will decline each year, and EVA$^{(TM)}$ will increase (see Exhibit 13.2).

Exhibit 13.2 serves to illustrate that if asset written-down values are used to determine the division's investment base, managers can improve their ROI or EVA$^{(TM)}$ by postponing new investments and operating with older assets with low written-down values. In contrast, divisional managers who

EXHIBIT 13.2

Profitability measures using straight-line depreciation

	1 (£)	2 (£)	3 (£)	4 (£)	5 (£)
Net cash flow	350 000	350 000	350 000	350 000	350 000
Depreciation	200 000	200 000	200 000	200 000	200 000
Profit	150 000	150 000	150 000	150 000	150 000
Cost of capital (10% of WDV)	100 000	80 000	60 000	40 000	20 000
EVA$^{((TM))}$	50 000	70 000	90 000	110 000	130 000
Opening WDV of the asset	1 000 000	800 000	600 000	400 000	200 000
ROI	15%	18.75%	25%	37.5%	75%

invest in new equipment will have a lower ROI or EVA$^{(TM)}$. This situation arises because financial accounting depreciation methods (including the reducing balance method) produce lower profitability measures in the earlier years of an asset's life.

To overcome this problem, it has been suggested that ROI or EVA$^{(TM)}$ calculations should be based on the original cost (i.e. gross book value) of the assets. When assets are measured at gross book value, managers will have an incentive to replace existing assets with new assets. This is because the increase in the investment base is only the difference between the original cost of the old asset and the purchase cost of the new asset. This difference is likely to be significantly less than the incremental cash flow (purchase cost less sale proceeds of the old asset) of the new asset. Managers may therefore be motivated to replace old assets with new ones that have a negative NPV.

To overcome the problems created by using financial accounting depreciation methods, alternative depreciation models have been recommended. For a discussion of these methods you should refer to Drury (2000, ch. 20). The theoretically correct solution to the problem is to value assets at their economic cost (i.e. the present value of future net cash inflows) but this presents serious practical difficulties. An appropriate solution to the practical problems is to value assets at their replacement cost (see Lee, 1996 for a discussion of this topic). Although this method is conceptually distinct from the present value method of valuation, it may provide answers which are reasonable approximations of what would be obtained using a present value approach. In addition, replacement cost is conceptually superior to the historical cost method of asset valuation. It follows that the depreciation charge on controllable investment based on replacement cost is preferable to a charge based on historical cost. The ROI and EVA$^{(TM)}$ for measuring managerial performance would then be calculated on controllable investment valued at replacement cost.

The effect of performance measurement on capital investment decisions

Capital investment decisions are the most important decisions that a divisional manager will have to make. We noted in Chapter 9 that these decisions should be taken on the basis of the net present value (NPV) decision rule. The way in which the performance of the divisional manager is measured, however, is likely to have a profound effect on the decisions that he or she will make. There is a danger that, because of the way in which divisional performance is measured, the manager may be motivated to take the wrong decision and not follow the NPV rule. We noted in an earlier example (page 406) that the residual income (or EVA$^{(TM)}$) method of evaluation appeared to encourage a divisional manager to make capital investment decisions that are consistent with the NPV rule, but there is no guarantee that this or any other financial measure will in fact motivate the manager to act in this way. Consider the information presented in Exhibit 13.3, which relates to three mutually exclusive projects: X, Y and Z.

Applying the NPV rule, you will see from the information presented that the manager should choose project X in preference to project Z, and should reject project Y.

PROFITS AND RETURN ON INVESTMENT

Divisional managers are likely to estimate the outcomes from alternative investments and choose the investment that maximizes their performance measure. Exhibit 13.4 shows the

EXHIBIT 13.3

Mutually exclusive capital projects NPV ranking[1]

estimated profits and ROIs for projects X, Y and Z. The calculations in Exhibit 13.4 are based on the net cash flows for each year presented in Exhibit 13.3, less straight-line depreciation of £287 000 per year. The ROI is calculated on the *opening* written-down value at the start of the year. From

	X (£000s)	Y (£000s)	Z (£000s)
Machine cost initial outlay (time zero)	861	861	861
Estimated net cash flow (year 1)	250	390	50
Estimated net cash flow (year 2)	370	250	50
Estimated net cash flow (year 3)	540	330	1100
Estimated net present value at 10% cost of capital[a]	77	(52)	52
Ranking on the basis of NPV	1	3	2

Note
[a] The net present value calculations are to the nearest £000.

the calculation in Exhibit 13.4 you will see that a manager who is anxious to improve his or her *short-term* performance will choose project Y if he or she is evaluated on total profits or return on investment, since project Y earns the largest profits and ROI in year 1; but project Y has a negative net present value, and should be rejected. Alternatively, a manager who assesses the impact of the project on his or her performance measure *over the three years* will choose project Z, because this yields the highest total profits and average ROI.

EXHIBIT 13.4

Estimated profit and ROI from mutually exclusive projects

Profits	X (£000s)	Y (£000s)	Z (£000s)
Year 1	(37)	103	(237)
Year 2	83	(37)	(237)
Year 3	253	43	813
Total profits	299	109	339
ROI	**X (%)**	**Y (%)**	**Z (%)**
Year 1	(4.3)	11.9	(27.5)
Year 2	14.5	(6.4)	(41.3)
Year 3	88.1	15.0	283.2
Average	32.8	6.8	71.5

ECONOMIC VALUE ADDED (EVA$^{(TM)}$)

Let us now consider whether the EVA$^{(TM)}$ calculations are consistent with the NPV calculations. Exhibit 13.5 presents the estimated EVA$^{(TM)}$ calculations for project X.

The total present value of EVA$^{(TM)}$ for project X is £77 000 and this is identical with the NPV of project X which was calculated in Exhibit 13.3. EVA$^{(TM)}$ is therefore the long-term counterpart of the discounted NPV. Thus, given that maximizing NPV is equivalent to maximizing shareholder value, then maximizing the present value of EVA$^{(TM)}$ is also equivalent to maximizing shareholder value and Stern Stewart's claim that EVA$^{(TM)}$ is congruent with shareholder value would appear to be justified. Consequently, if divisional managers are evaluated on the basis of the long-run present value of EVA$^{(TM)}$, their capital investment decisions should be consistent with the decisions that would be taken using the NPV rule.

However, there is no guarantee that the short-run EVA$^{(TM)}$ measure will be consistent with the longer-run measure if conventional depreciation methods are used. To ensure consistency with the long-run measure and NPV an adjustment must be made within the EVA$^{(TM)}$ accountancy adjustments so that depreciation is based on economic values and not historic book values. For example, if conventional depreciation is used the EVA$^{(TM)}$ for year 1 for each of the projects will be as follows:

	(£000s)
Project X	(−123)
Project Y	17
Project Z	(−323)

The *short-term* measure of EVA$^{(TM)}$ may lead to acceptance of project Y. In addition, a manager concerned about a possible deterioration in his or her expected EVA$^{(TM)}$, in the short-term, may reject project X even when he or she is aware that acceptance will mean an increase in long-term EVA$^{(TM)}$.

Let us now repeat the facts that we have established in our discussion so far. Decisions taken on the basis of a project's impact on divisional profit and return on investment are not consistent with the NPV rule. If managerial performance is evaluated on this basis of either of these two measures, there is a danger that managers will make decisions that will improve their own performance measure, even if such decisions are not in the best interests of the organization. The present-value of EVA$^{(TM)}$ is the long-run counterpart of the

EXHIBIT 13.5

Estimated EVA$^{(TM)}$ calculations for project X[a]

	Year 1 (£000s)	**Year 2 (£000s)**	**Year 3 (£000s)**	**Total (£000s)**
Profit before interest	(37)	83	253	
10% interest on opening written-down value	86	57	29	
EVA$^{(TM)}$	(123)	26	224	
PV of EVA$^{(TM)}$	(112)	21	168	77

Note

[a] All calculations are to the nearest £000

discounted NPV, but the short-run measure may not signal the same decision as the long-run measure. Hence there is a need to establish a short-term measure of EVA(TM) that signals the same decision as the long-run measure. If this can be achieved and managers are evaluated on this basis, decisions based on improving their own short-term performance will be consistent with decisions taken using the NPV rule. Alternative depreciation models can be applied that ensure that the short-term EVA(TM) measure does not conflict with the long-term measure and that are therefore consistent with the NPV rule. These models are not widely used in practice. The problems identified in Exhibits 13.3–13.5 can be overcome by comparing budgeted and actual project cash flows. Theory therefore recommends that the most appropriate method of measuring divisional financial managerial performance is to compare the budgeted aggregate of divisional project cash flows with actual cash flows. The rationale for this recommendation is beyond the scope of this book. For a discussion of this rationale, you should refer to Drury (2000, ch. 20). For various reasons, however, managers may prefer to use financial performance measures based on using conventional financial accounting methods. Where conventional financial accounting methods are employed the EVA(TM) approach should be used to measure managerial performance.

Addressing the dysfunctional consequences of short-term financial performance measures

The primary objective of profit-making organizations is to maximize shareholder value. Therefore performance measures should be based on the value created by each division. Unfortunately, direct measures of value creation are not possible because the shares for only the business as a whole are traded on the stockmarket. It is not possible to derive stock market values at the segmental or business unit level of an organization. Instead, most firms use accounting profit or ROI measures as a surrogate for changes in market values. Also, even if market measures could be derived, they may not be ideal performance measures because they are affected by many factors that managers cannot control (such as changes in investor expectations, interest rate changes and rumours). In contrast, accounting performance measures are not affected to the same extent by some of the uncontrollable factors that cause the volatile changes in share values.

Unfortunately, using accounting measures such as ROI or EVA(TM) as performance measures can encourage managers to become short-term oriented. For example, it has been shown that in the short term managers can improve both of these measures, by rejecting profitable long-term investments. By not making the investments, they can reduce expenses in the current period and not suffer the lost revenues until future periods. Managers can also boost their performance measure in a particular period by destroying customer and employee goodwill. For example, they can force employees to work excessive overtime towards the end of a measurement period so that goods can be delivered and their sales revenues and profits reported for the period. If the products are of lower quality, customer satisfaction (and future sales) may diminish. In addition, the effects of increased work pressure may result in staff absenteeism, demotivation and increased labour turnover. These harmful effects are unlikely to have much impact on the financial performance measure in the short term and will only become apparent in future periods.

Consider also the situation where two divisional managers using exactly the same amount of investment produce exactly the same EVA(TM) or ROI. Does this mean that their

performances are the same? The answer is no. Even though their performance measures would be identical this does not mean their performances are the same. One manager may have built up customer goodwill by offering excellent customer service, and also have paid great attention to training, education, research and development, etc., while another may not have given these items any consideration. Differences such as these would not show up initially in financial performance measures.

Return on investment and EVA$^{(TM)}$ are short-run concepts that deal only with the current reporting period, whereas managerial performance measures should focus on future results that can be expected because of present actions. Ideally, divisional performance should be evaluated on the basis of economic income by estimating future cash flows and discounting them to their present value. This calculation could be made for a division at the beginning and the end of a measurement period. The difference between the beginning and ending values represents the estimate of economic income.

The main problem with using estimates of economic income to evaluate performance is that it lacks precision and objectivity. It is also inconsistent with external financial accounting information that is used by financial markets to evaluate the performance of the company as a whole. It is likely that corporate managers may prefer their divisional managers to focus on the same financial reporting measures that are used by financial markets to evaluate the company as a whole. A final difficulty with measuring economic income is that the individual that is most knowledgeable and in the best position to provide the cash flow estimates is usually the individual whose performance is being evaluated. Thus, managers will be tempted to bias their estimates.

Various approaches can be used to overcome the short-term orientation that can arise when accounting profit-related measures are used to evaluate divisional performance. One possibility is to improve the accounting measures. EVA$^{(TM)}$ represents such an approach. If you refer back to the formula for calculating EVA$^{(TM)}$ you will see that it is computed by making accounting adjustments to the conventional financial accounting divisional profit calculation. These adjustments, such as capitalizing research and development and advertising expenditure, represent an attempt to approximate economic income. Incorporating a cost of capital charge is also a further attempt to approximate economic income. However, it should be noted that conventional accounting profits are the starting point for calculating EVA$^{(TM)}$ and these are based on historic costs, and not future cash flows, so that EVA$^{(TM)}$ can only provide a rough approximation of economic income.

Another alternative for reducing the short-term orientation, and increasing congruence of accounting measures with economic income is to lengthen the measurement period. The longer the measurement period, the more congruent accounting measures of performance are with economic income. For example, profits over a three-year measurement period are a better indicator of economic income than profits over a six-monthly period. The disadvantage of lengthening the measurement period is that rewards are tied to the performance evaluation, and if they are provided a long time after actions are taken, there is a danger that they will lose much of their motivational effects.

Probably the most widely used approach to mitigate against the dysfunctional consequences that can arise from relying excessively on financial measures is to supplement them with non-financial measures that measure those factors that are critical to the long-term success and profits of the organization. These measures focus on areas such as competitiveness, product leadership, productivity, quality, delivery performance, innovation and flexibility in responding to changes in demand. If managers focus excessively on the short-term, the benefits from improved short-term financial performance may be counter-balanced by a deterioration in the non-financial measures. Such non-financial measures should provide a broad indication of the contribution of a divisional manager's current actions to the long-term success of the organization.

The incorporation of non-financial measures creates the need to link financial and non-financial measures of performance. In particular, there is a need for a balanced set of measures that provide both short-term performance measures and also leading indicators of future financial performance from current actions. The **balanced scorecard** emerged in the 1990s to meet these requirements. The balanced scorecard will be covered extensively in Chapter 16 but at this stage you should note that the financial performance evaluation measures discussed in this chapter ought to be seen as one of the elements within the balanced scorecard. Divisional performance evaluation should be based on a combination of financial and non-financial measures using the balanced scorecard approach.

Summary

The major organizational device for maximizing decentralization is the creation of divisions. These may consist of investment centres or profit centres. In an investment centre a divisional manager can significantly influence the size of the investment, whereas in a profit centre managers are only responsible for obtaining profits from the assets that are assigned to them. The major challenge to the accountant is to design performance measures that create a situation where managers acting in their own best interests also act in the best interests of the company as a whole.

The most common methods of measuring divisional performance are absolute profits, profit expressed as a percentage of investment (ROI) and residual income. During the 1990s residual income was replaced by the economic value added (EVA$^{(TM)}$) measure. EVA$^{(TM)}$ extends the traditional residual income measure by incorporating adjustments to the conventional divisional profit measure for distortions introduced by generally accepted accounting principles.

ROI suffers from the disadvantage that the managers of those divisions with an existing ROI in excess of the cost of capital may incorrectly reject projects with positive NPVs. Similarly, managers with an existing ROI that is lower than the cost of capital may accept projects with returns that are less than the cost of capital. ROI is therefore an unsatisfactory method of measuring managerial performance in investment centres or those profit centres where a manager can significantly influence the amount invested in working capital.

In the long-run, the EVA$^{(TM)}$ method leads to a calculation that is consistent with the net present value rule, but if conventional accounting methods of depreciation are used, the short-term EVA$^{(TM)}$ calculation may not motivate a decision that is consistent to the NPV rule. This problem can be resolved by using unconventional methods of depreciation that do not meet external financial accounting requirements. An alternative solution is to compare the budgeted and actual cash flows, which approximates comparing budgeted and actual EVAs$^{(TM)}$.

The choice is between using accounting methods that will lead to decisions that maximize NPV more often than other methods, or comparing budgeted and actual cash flows. If the former approach is chosen, it appears that EVA$^{(TM)}$ is the most appropriate financial measure, and performance should be evaluated based on a comparison of budgeted and actual EVA$^{(TM)}$.

The dysfunctional effects of focusing on short-term performance will be minimized if financial measures of performance are supplemented with non-financial performance measures that provide a broad indication of the contribution of a divisional manager's current actions to the long-term success of the organization. The balanced scorecard emerged in the 1990s to provide a balanced set of financial and non-financial measures in order to obtain a comprehensive view of a business. The financial performance evaluation measures discussed in this chapter ought to be seen as one of the elements within the balanced scorecard. Divisional performance evaluation should therefore be based on a combination of financial and non-financial measures using the balanced scorecard approach.

Notes

1 This exhibit and subsequent comments were adapted from Flower, J.F. (1977). Measurement of divisional performance, *Readings in Accounting and Business Research, Accounting and Business Research Special Issue*, pp. 121–30.

Key Terms and Concepts

balanced scorecard (p. 415)
controllable contribution (p. 403)
controllable investment (p. 408)
cost centre (p. 400)
divisional contribution (p. 404)
divisional net profit before taxes (p. 404)
divisionalized organizational structure (p. 398)
economic value added (EVA™) (p. 407)
functional organizational structure (p. 398)
investment centre (p. 400)
profit centre (p. 400)
residual income (p. 406)
return on investment (ROI) (p. 405)
variable short-run contribution margin (p. 402)

Recommended Reading

For further reading on economic value added you should refer to Stewart (1991, 1994 and 1995) and the articles in *Fortune* (The Real Key to Creating Wealth – 20 September 1993) and *The Economist* (Valuing companies: A star to sail by? – 2 August 1997, pp. 61–3).

Review Problem

The CP division of R plc has budgeted a net profit before tax of £3 million per annum over the period of the foreseeable future, based on a net capital employed of £10 million.

Plant replacement anticipated over this period is expected to be approximately equal to the annual depreciation each year. These figures compare well with the organization's required rate of return of 20% before tax.

CP's management is currently considering a substantial expansion of its manufacturing capacity to cope with the forecast demands of a new customer. The customer is prepared to offer a five-year contract providing CP with annual sales of £2 million.

In order to meet this contract, a total additional capital outlay of £2 million is envisaged, being £1.5 million of new fixed assets plus £0.5 million working capital. A five-year plant life is expected.

Operating costs on the contract are estimated to be £1.35 million per annum, excluding depreciation.

This is considered to be low-risk venture as the contract would be firm for five years and the manufacturing processes are well understood within CP.

You are required

(a) to calculate the impact of accepting the contract on the CP divisional Return on Capital Employed (ROCE) and Residual Income (RI), indicating whether it would be attractive to CP's management;

(8 marks)

(b) to explain the basis of the calculations in the statements you have produced and discuss the suitability of each method in directing divisional management toward the achievement of corporate goals

(10 marks)

(Total 18 marks)

CIMA

Solution to Review Problem

(a) *Calculation of written values (WDVs) and capital employed*

Year	1 (£m)	2 (£m)	3 (£m)	4 (£m)	5 (£m)
Opening WDV	1.5	1.2	0.9	0.6	0.3
Depreciation (straight line)	0.3	0.3	0.3	0.3	0.3
Closing WDV	1.2	0.9	0.6	0.3	–
Opening capital employed (opening WDV + WC)	2.0	1.7	1.4	1.1	0.8

Calculation of residual income and return on capital employed (ROCE)

Year	1 (£m)	2 (£m)	3 (£m)	4 (£m)	5 (£m)
Sales	2.0	2.0	2.0	2.0	2.0
Operating costs	(1.35)	(1.35)	(1.35)	(1.35)	(1.35)
Depreciation	(0.30)	(0.30)	(0.30)	(0.30)	(0.30)
Net profit	0.35	0.35	0.35	0.35	0.35
Imputed interest (20%)	0.40	0.34	0.28	0.22	0.16
Residual income	(0.05)	0.01	0.07	0.13	0.19
ROCE	17.5%	20.6%	25%	31.8%	43.7%

The existing budgeted ROCE (also known as return on investment (ROI)) over the period of the foreseeable future is 30% (£3m/£10m).

CP's management would be unlikely to undertake the project if they are evaluated on the basis of ROCE, since it yields a return of less than 30% for each of the first three years. Consequently, the total ROCE will be less than 30% during the first three years. Residual income is negative in the first year and positive for the remaining four years. If the management of CP place more emphasis on the impact on the performance measure on the first year, they may reject the project but they will accept if they adopt a longer term perspective.

(b) The calculation of NPV is as follows:

	(£m)
PV of net inflows (£0.65m × 2.991 discount factor)	1.944
Working capital released at the end of the project (0.5 m × 0.4019)	0.201
Initial outlay	(2.000)
NPV	0.145

The project should be accepted, since it has a positive NPV. The objective is to design a performance measurement system that is consistent with the NPV rule. The ROCE measure may not encourage goal congruence, because managers of divisions with a ROCE in excess of the cost of capital may incorrectly reject projects with positive

NPVs. Alternatively, managers of divisions with a ROCE that is less than cost of capital may incorrectly accept projects with negative NPVs. This situation arises because managers who are evaluated on the basis of ROCE may base their investment decisions on the impact on ROCE and use the existing ROCE as the cut-off rate.

The project outlined in the question has a positive NPV, but the ROCE is less than 30% for the first three years where straight-line depreciation is used. The manager is therefore unlikely to accept the investment, since it will result in a decline in the overall ROCE of the division.

In the long run, the residual income method produces a calculation that is consistent with the NPV rule. The short-term residual income calculated may not, however, motivate managers to select projects that are consistent with applying the NPV rule. In the case of constant cash flows the problem can be resolved by using the annuity method of depreciation, but when annual cash flows fluctuate, this method of depreciation does not ensure that the short-term residual income measure is consistent with the NPV rule. For a discussion of how this problem might be resolved you should refer to Drury (2000) ch. 20.

Questions

13.1

A large organisation, with a well-developed cost centre system, is considering the introduction of profit centres and/or investment centres throughout the organization, where appropriate. As management accountant, you will be providing technical advice and assistance for the proposed scheme.

You are required:

(a) to describe the main characteristics and objectives of profit centres and investment centres; (4 marks)

(b) to explain what conditions are necessary for the successful introduction of such centres; (5 marks)

(c) to describe the main behavioural and control consequences which may arise if such centres are introduced; (4 marks)

(d) to compare two performance appraisal measures that might be used if investment centres are introduced. (4 marks)

CIMA

13.2

A long-established, highly centralized company has grown to the extent that its chief executive, despite having a good supporting team, is finding difficulty in keeping up with the many decisions of importance in the company.

Consideration is therefore being given to reorganizing the company into profit centres. These would be product divisions, headed by a divisional managing director, who would be responsible for all the division's activities relating to its products.

You are required to explain, in outline:

(a) the types of decision areas that should be transferred to the new divisional managing directors if such a reorganization is to achieve its objectives;

(b) the types of decision areas that might reasonably be retained at company head office;

(c) the management accounting problems that might be expected to arise in introducing effective profit centre control. (20 marks)

CIMA

13.3

Divisionalization is a common form of organizational arrangement but there is some diversity of opinion as to the best measure of divisional performance.

Discuss this topic and describe and compare the main performance measures that have been suggested. (17 marks)
ACCA

13.4
'In the control of divisional operations within a large company, conflicts often arise between the aims of the organization as a whole and the aspirations of the individual divisions.'

What forms may these conflicts take, and how would you expect the finance function to assist in the resolution of such conflicts?

13.5
Residual Income and Return on Investment are commonly used measures of performance. However, they are frequently criticised for placing too great an emphasis on the achievement of short-term results, possibly damaging longer-term performance.

You are required to discuss
(a) the issues involved in the long-term:short-term conflict referred to in the above statement; (11 marks)
(b) suggestions which have been made to reconcile this difference. (11 marks)
(Total 22 marks)
CIMA

13.6
(a) Explain the meaning of each of the undernoted measures which may be used for divisional performance measurement and investment decision-making. Discuss the advantages and problems associated with the use of each.
    (i) Return on capital employed.
    (ii) Residual income.
    (iii) Discounted future earnings. (9 marks)
(b) Comment on the reasons why the measures listed in (a) above may give conflicting investment decision responses when applied to the same set of data. Use the following figures to illustrate the conflicting responses which may arise:
    Additional investment of £60 000 for a 6 year life with nil residual value.
    Average net profit per year: £9000 (after depreciation).
    Cost of capital: 14%.
    Existing capital employed: £300 000 with ROCE of 20%. (8 marks)
(Solutions should ignore taxation implications.)
(Total 17 marks)
ACCA

13.7
Divisionalised structures are normal in large firms, and occur even when centralised structures would be feasible.

Requirements:
(a) Explain and discuss the arguments for divisionalised structures in large firms. (6 marks)
(b) Explain the costs and potential inefficiencies of a divisionalised structure. (6 marks)
(c) Explain how adoption of a divisionalised structure changes the role of top management and their control of subordinates. (8 marks)
(Total 20 marks)
CIMA

13.8 Establishing a system of divisional performance measurement in a hospital
(a) Briefly explain how the measurement of divisional performance differs when assessing the achievement of strategic targets as distinct from operational targets. (5 marks)
(b) J is a hospital which supplies a wide range of healthcare services. The government has created a competitive internal market for healthcare by separating the function of service delivery from purchasing. The government provides funds for local health organisations to identify healthcare needs and to purchase services from different organisations which actually supply the service. The service suppliers are mainly hospitals.

J is service supplier and has established contracts with some purchasing organisations. The healthcare purchasing organisations are free to contract with any supplier for the provision of their healthcare requirements.

Previously, J was organised and controlled on the basis of functional responsibility. This meant that each specialist patient function, such as medical, nursing and pharmacy services, was led by a manager who held operational and financial responsibility for its activities throughout the hospital. J now operates a system of control based on devolved financial accountability. Divisions comprising different functions have been established and are responsible for particular categories of patient care such as general medical or general surgical services. Each division is managed by a senior medical officer.

J's Board recognises that it exists in a competitive environment. It believes there is a need to introduce a system of divisional appraisal. This measures performance against strategic as well as operational targets, using both financial and non-financial criteria. The Board is concerned to develop a system which improves the motivation of divisional managers. This will encourage them to accept responsibility for achieving strategic as well as operational organisational targets. In particular, the Board wishes to encourage more contractual work to supply services to healthcare purchasing organisations from both within and outside its local geographical area. It is a clear aim of the Board that a cultural change in the management of the organisation will result from the implementation of such a system.

Requirement:
Discuss the issues which the Board of J should take into consideration in establishing a system of performance measurement for divisional managers in order to ensure the attainment of its strategic targets. (15 marks)
(Total 20 marks)
CIMA

13.9 Calculation of NPV and ROI and a discussion as to whether goal congruence exists plus a further discussion relating to resolving the conflict between decision-making and performance evaluation models

J plc's business is organized into divisions. For operating purposes, each division is regarded as an investment centre, with divisional managers enjoying substantial autonomy in their selection of investment projects. Divisional managers are rewarded via a remuneration package which is linked to a Return on Investment (ROI) performance measure. The ROI calculation is based on the net book value of assets at the beginning of the year. Although there is a high degree of autonomy in investment selection, approval to go ahead has to be obtained from group management at the head office in order to release the finance.

Division X is currently investigating three independent investment proposals. If they appear acceptable, it wishes to assign each a priority in the event that funds may not be available to cover all three. Group finance staff assess the cost of capital to the company at 15%.

The details of the three proposals are:

	Project A (£000)	Project B (£000)	Project C (£000)
Initial cash outlay on fixed assets	60	60	60
Net cash inflow in year 1	21	25	10
Net cash inflow in year 2	21	20	20
Net cash inflow in year 3	21	20	30
Net cash inflow in year 4	21	15	40

Ignore tax and residual values.

Depreciation is straight-line over asset life, which is four years in each case.

You are required
(a) to give an appraisal of the *three* investment proposals from a divisional and from a company point of view; (13 marks)
(b) to explain any divergence between these two points of view and to demonstrate techniques by which the views of both the division and the company can be brought into line. (12 marks)
(Total 25 marks)
CIMA

13.10 Conflict between NPV and performance measurement

Linamix is the chemicals division of a large industrial corporation. George Elton, the divisional general manager, is about to purchase new plant in order to manufacture a new product. He can buy either the Aromatic or the Zoman plant, each of which have the same capacity and expected four year life, but which differ in their capital costs and expected net cash flows, as shown below:

	Aromatic	Zoman
Initial capital investment	£6 400 000	£5 200 000
Net cash flows (before tax)		
2001	£2 400 000	£2 600 000
2002	£2 400 000	£2 200 000
2003	£2 400 000	£1 500 000
2004	£2 400 000	£1 000 000
Net present value (@ 16% p.a.)	£ 315 634	£ 189 615

In the above calculations it has been assumed that the plant will be installed and paid for by the

end of December 2000, and that the net cash flows accrue at the end of each calendar year. Neither plant is expected to have a residual value after decommissioning costs.

Like all other divisional managers in the corporation, Elton is expected to generate a before tax return on his divisional investment in excess of 16% p.a., which he is currently just managing to achieve. Anything less than a 16% return would make him ineligible for a performance bonus and may reduce his pension when he retires in early 2003. In calculating divisional returns, divisional assets are valued at net book values at the beginning of the year. Depreciation is charged on a straight line basis.

Requirements:

(a) Explain, with appropriate calculations, why neither return on investment nor residual income would motivate Elton to invest in the process showing the higher net present value. To what extent can the use of alternative accounting techniques assist in reconciling the conflict between using accounting-based performance measures and discounted cash flow investment appraisal techniques? (12 marks)

(b) Managers tend to use post-tax cash flows to evaluate investment opportunities, but to evaluate divisional and managerial performance on the basis of pre-tax profits. Explain why this is so and discuss the potential problems that can arise, including suggestions as to how such problems can be overcome. (8 marks)

(c) Discuss what steps can be taken to avoid dysfunctional behaviour which is motivated by accounting-based performance targets. (5 marks)

(Total 25 marks)

ICAEW

13.11 Appropriate performance measures for different goals

The executive directors and the seven divisional managers of Kant Ltd spent a long weekend at a country house debating the company's goals. They concluded that Kant had multiple goals, and that the performance of senior managers should be assessed in terms of all of them.

The goals identified were:

(i) to generate a reasonable financial return for shareholders;
(ii) to maintain a high market share;
(iii) to increase productivity annually;
(iv) to offer an up-to-date product range of high quality and proven reliability;
(v) to be known as responsible employers;
(vi) to acknowledge social responsibilities;
(vii) to grow and survive autonomously.

The finance director was asked to prepare a follow-up paper, setting-out some of the implications of these ideas. He has asked you, as his personal assistant, to prepare comments on certain issues for his consideration.

You are required to set out briefly, with reasons:

(a) suitable measures of performance for each of the stated goals for which you consider this to be possible. (18 marks)

(b) an outline of your view as to whether any of the stated goals can be considered to be sufficiently general to incorporate all of the others. (7 marks)

(Total 25 marks)

ICAEW

13.12 Discussion of various divisional performance measures

You are the highly trusted chief accountant of Ragwort Ltd, a manufacturer of sports equipment, and you have strong private hopes of joining the board in the next year or two in a newly created post of finance director.

Ragwort is organized into three divisions, each of which is formed as a separate subsidiary company; you have a seat on the board of each of them. The three divisions and their general manager are North-West (Christopher Perkins), Home Counties (Geoffrey Gilmore), and Eastern Counties (Morton Jackson). The group executive committee consists of the three general managers, under the chairmanship of group chairman and chief executive Thomas Ragwort. It meets monthly, and the meeting usually lasts two days.

At the end of the first day of this month's meeting Ragwort calls you to his office, and tells you that he has a problem. 'You know', he says, 'that for some time now I've been concerned about what is the best measure for us to use to compare the performance of the divisions. You know what I mean – what is the right sort of target to set for them? It's not good if I impose something without agreement, and we simply didn't manage to get it today. I'm going to re-open the discussion

tomorrow, and I want a decision but first I want some advice from you.'

You ask him what has happened.

'Well', he says, 'you know that we've been working out a divisional return on investment. We find pre-tax profits for each division, after charging out group head office costs in proportion to divisional turnover. We set that against a base of written down net assets, excluding cash.

Gilmore is satisfied with that, but Perkins came up with something he called residual income – he argued that we have to make absolute profits, not just a return on investment. And then Jackson said that what we really want is growth, and that the only way to get that in the long run is to set the target as percentage sales growth.

They were obviously split, so I let it run on.

To cut a long story short, Gilmore said he could certainly accept that residual income was a better measure than looking just at growth. Jackson wouldn't accept that, and still wanted the growth measure, but he agreed with Gilmore's view that it was better to stick with our present ROI than to change to this new residual income idea.

Perkins stuck to his guns over residual income. He's smart. He told Jackson that he could see at least some merit in the growth idea, because in the end it would probably correlate with residual income. But he still thought that the ROI figure should be dropped. I tried a compromise approach then. I suggested that we took the measure in pairs, starting with ROI and residual income. After all, they sound pretty similar. Gilmore and Jackson voted for ROI, and only Perkins supported residual income. So I had them compare ROI with growth, thinking I was home and dry and we needn't change anything. And Perkins joined Jackson in supporting the growth idea! I had to admit that he'd said as much.

But Gilmore is pretty smart too, you know. He whispered something to Perkins. Then he reminded us that Perkins wanted us to try out residual income, and that he had already told the meeting that in his view residual income was a better control measure than percentage sales growth. So if we were going to make a change the majority obviously preferred residual income to growth.

By then, I felt that it was time to adjourn!

You'd better keep all this under your hat. But give me a short report summarizing the pros and cons of these three possibilities, and giving me your view on which one would be best in principle for us to use in future. If I eventually have to lay the law down I want to get it right. But make sure you keep it short – not more than about four pages.'

On returning to your office you cancel your previous arrangements for the evening, and then quickly work out the following table, showing the average annual performance of the divisions over the last three years in historic cost terms:

Division	Manager	Residual ROI %	Sales income £	growth %
Home Counties	Geoffrey Gilmore	10	80 000	15
Eastern Counties	Morton Jackson	8	60 000	25
North West	Christopher Perkins	6	100 000	20

You send a copy of the table to Mr Ragwort with a note commenting that it may help to explain the attitudes being taken in the meeting. You then settle down to think about the three measures proposed as means of controlling divisional performance.

You are required to write a report for Mr Ragwort about the proposed methods of measuring divisional performance, to comply with the terms of his instruction

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14

Transfer pricing in divisionalized companies

In the previous chapter alternative financial measures for evaluating divisional performance were examined. However, all of the financial measure outcomes will be significantly affected when divisions transfer goods and services to each other. The established transfer price is a cost to the receiving division and revenue to the supplying division, which means that whatever transfer price is set, will affect the profitability of each division. In addition, this transfer price will also significantly influence each division's input and output decisions, and thus total company profits.

In this chapter we shall examine the various approaches that can be adopted to arrive at transfer prices between divisions. Although our focus will be on transfer pricing between divisions (i.e. profit or investment centres) transfer pricing can also apply between cost centres (typically support/service centres) or from cost centres to profit/investment centres. The same basic principles apply as those that apply between divisions, the only difference being that there is no need for a profit element to be included in the transfer price to reimburse the supplying cost centre.

Learning objectives

After studying this chapter, you should be able to:

- describe the different purposes of a transfer pricing system;
- describe the five different transfer pricing methods;
- explain why the correct transfer price is the external market price when there is a perfectly competitive market for the intermediate product;
- explain why cost-plus transfer prices will not result in the optimum output being achieved;
- explain the two methods of transfer pricing that have been advocated to resolve the conflicts between decision-making, performance evaluation and autonomy objectives;
- explain the domestic transfer pricing recommendations;
- describe the additional factors that must be considered when setting transfer prices for multinational transactions.

Purposes of transfer pricing

A transfer pricing system is required to meet the following purposes:

1. To provide information that motivates divisional managers to make good economic decisions. This will happen when actions that divisional managers take to improve the reported profit of their divisions also improves the profit of the company as a whole.
2. To provide information that is useful for evaluating the managerial and economic performance of the divisions.
3. To intentionally move profits between divisions or locations.
4. To ensure that divisional autonomy is not undermined.

PROVIDING INFORMATION FOR MAKING GOOD ECONOMIC DECISIONS

Goods transferred from the supplying division to the receiving division are known as **intermediate products**. The products sold by a receiving division to the outside world are known as **final products**. The objective of the receiving division is to subject the intermediate product to further processing before it is sold as a final product in the outside market. The transfer price of the intermediate product represents a cost to the receiving division and a revenue to the supplying division. Therefore transfer prices are used to determine how much of the intermediate product will be produced by the supplying division and how much will be acquired by the receiving division. In a centralized company the decision as to whether an intermediate product should be sold or processed further is determined by comparing the incremental cost of, and the revenues from, further processing. In a divisionalized organization structure, however, the manager of the receiving division will treat the price at which the intermediate product is transferred as an incremental cost, and this may lead to incorrect decisions being made.

For example, let us assume that the incremental cost of the intermediate product is £100, and the additional further processing costs of the receiving division are £60. The incremental cost of producing the final product will therefore be £160. Let us also assume that the supplying division has a temporary excess capacity which is being maintained in order to meet an expected resurgence in demand and that the market price of the final product is £200. To simplify the illustration, we assume there is no market for the intermediate product. The correct short-term decision would be to convert the intermediate product into the final product. In a centralized company this decision would be taken, but in a divisionalized organization structure where the transfer price for the intermediate product is £150 based on full cost plus a profit margin, the incremental cost of the receiving division will be £210 (£150 + £60). The divisional manager would therefore incorrectly decide not to purchase the intermediate product for further processing. This problem can be overcome if the transfer price is set at the incremental cost of the supplying division, which in this example is £100.

EVALUATING MANAGERIAL PERFORMANCE

When goods are transferred from one division to another, the revenue of the supplying division becomes a cost of the receiving division. Consequently, the prices at which goods are transferred can influence each division's reported profits, and there is a danger that an unsound transfer price will result in a misleading performance measure that may cause

divisional managers to believe that the transfer price is affecting their performance rather unfairly. This may lead to disagreement and negative motivational consequences.

CONFLICT OF OBJECTIVES

Unfortunately, no single transfer price is likely to perfectly serve all of the four specified purposes. They often conflict and managers are forced to make trade-offs. In particular, the decision-making and the performance evaluation purposes may conflict with each other. For example, in some situations the transfer price that motivates the short-run optimal economic decision is marginal cost. If the supplier has excess capacity, this cost will probably equal variable cost. The supplying division will fail to cover any of its fixed costs when transfers are made at variable cost, and will therefore report a loss. Furthermore, if a transfer price equal to variable cost (£100 in the above example) is imposed on the manager of the supplying division, the concept of divisional autonomy and decentralization is undermined. On the other hand, a transfer price that may be satisfactory for evaluating divisional performance (£150 in the above example) may lead divisions to make suboptimal decisions when viewed from the overall company perspective.

Alternative transfer pricing methods

There are five primary types of transfer prices that companies can use to transfer goods and services.

1. Market-based transfer prices: These are usually based on the listed price of an identical or similar products or services, the actual price the supplying division sells the intermediate product to external customers (possibly less a discount that reflects the lower selling costs for inter-group transfers), or the price a competitor is offering.
2. Marginal cost transfer prices: Most accountants assume that marginal cost can be approximated by short-run variable cost which is interpreted as direct costs plus variable indirect costs.
3. Full cost transfer prices: The terms full cost or long-run cost are used to represent the sum of the cost of all of those resources that are committed to a product or service in the long-term. Some firms add an arbitrary mark-up to variable costs in order to cover fixed costs and thus approximate full costs. Such an approach is likely to result in an inaccurate estimate of full cost.
4. Cost-plus a mark-up transfer prices: With cost-based transfer prices the supplying divisions do not make any profits on the products or services transferred. Therefore they are not suitable for performance measurement. To overcome this problem a mark-up is added to enable the supplying divisions to earn a profit on inter-divisional transfers.
5. Negotiated transfer prices: In some cases transfer prices are negotiated between the managers of the supplying and receiving divisions. Information about the market prices and marginal or full costs often provide an input into these negotiations, although there is no requirement that they must do so.

Exhibit 14.1 shows the results of surveys of the primary transfer pricing methods used in various countries. This exhibit shows that in the USA transfer prices are used by the vast majority of the firms surveyed. It is apparent from all of the surveys that a small minority (less than 10%) transfer at marginal or variable cost. A significant proportion of firms use each of the other methods with the largest proportions transferring goods or services at

EXHIBIT 14.1

Surveys of company practice

The studies listed below relate to surveys of transfer pricing practices in various countries. It is apparent from these surveys that variable/marginal costs are not widely used, whereas full cost or full cost plus a mark-up are used extensively. Market price methods are also widely used.

Australian and Canadian Surveys

	Australia Joye and Blayney (1991)	**Canada Tang (1992)**
Market price-based	13%	34%
Cost-based:		
Variable Costs		6
Full costs		37
Other		3
Total	65	46
Negotiated	11	18
Other	11	2
	100	100

The Canadian survey asked the respondents to name the dominant objective of the transfer pricing system. Approximately 50% stated that it was performance evaluation and one third stated that it was for profit maximization of the consolidated firm.

UK Survey (Drury et al., 1993)

	Extent of use		
	Never/rarely	**Sometimes**	**Often/always**
Unit variable cost	94%	4%	2%
Unit full cost	66	13	21
Unit variable cost-plus mark-up	83	6	11
Unit full cost-plus mark-up	55	18	27
Marginal/incremental cost	93	6	1
Market price/adjusted market price	53	14	33
Negotiated	41	29	30
Lump sum payment plus cost per unit transferred	95	4	1

USA Survey (Borkowski, 1990)

Number of Companies Participating	**215**	
Percentage Using Transfer Prices	**89.6%**	
Percentage using transfers on following bases		
Market price		
Full market price	20.2	
Adjusted market price	12.5	32.7
Negotiated		
To external price	13.6	
To manufacturing costs	3.0	
With no restrictions	6.0	22.6
Full cost		
Standard	14.3	
Actual	7.1	
Plus profit based on cost	14.9	
Plus fixed profit	2.4	
Other	2.4	41.1
Variable cost		
Standard	2.4	
Actual	0.6	
Plus contribution based on cost	0.6	
Plus fixed contribution	0.0	
Plus opportunity cost	0.0	3.6
Marginal (incremental) cost		0.0
Mathematical/programming models		0.0
Dual pricing		0.0
Total		100.00

market prices or either full cost or full cost plus a mark-up. The following sections describe in detail each of the transfer pricing methods and the circumstances when they are appropriate.

Market-based transfer prices

In most circumstances, where a perfectly competitive market for an intermediate product exists it is optimal for both decision-making and performance evaluation purposes to set transfer prices at competitive market prices. A perfectly competitive market exists where the product is homogeneous and no individual buyer or seller can affect the market prices.

When transfers are recorded at market prices divisional performance is more likely to represent the real economic contribution of the division to total company profits. If the supplying division did not exist, the intermediate product would have to be purchased on the outside market at the current market price. Alternatively, if the receiving division did not exist, the intermediate product would have to be sold on the outside market at the current market price. Divisional profits are therefore likely to be similar to the profits that would be calculated if the divisions were separate organizations. Consequently, divisional profitability can be compared directly with the profitability of similar companies operating in the same type of business.

In a perfectly competitive market the supplying division should supply as much as the receiving division requires at the current market price, so long as the incremental cost is lower than the market price. If this supply is insufficient to meet the receiving division's demand, it must obtain additional supplies by purchasing from an outside supplier at the current market price. Alternatively, if the supplying division produces more of the intermediate product than the receiving division requires, the excess can be sold to the outside market at the current market price.

Where the selling costs for internal transfers of the intermediate product are identical with those that arise from sales in the outside market, it will not matter whether the supplying division's output is sold internally or externally. To illustrate this we shall consider two alternatives. First, assume initially that the output of the supplying division is sold *externally* and that the receiving division purchases its requirements *externally*. Now consider a second situation where the output of the intermediate product is transferred *internally* at the market price and is not sold on the outside market. You should now refer to Exhibit 14.2. The aim of this diagram is to show that divisional and total profits are not affected, whichever of these two alternatives is chosen.

Exhibit 14.2 illustrates a situation where the receiving division sells 1000 units of the final product in the external market. The incremental costs of the supplying divison for the production of 1000 units of the intermediate product are £5000, with a market price for the output of £8000. The incremental costs of the receiving division for the additional processing of the 1000 units of the intermediate product are £4000. This output can be sold for £18 000. You will see that it does not matter whether the intermediate product is transferred internally or sold externally – profits of each division and total company profits remain unchanged.

This of course assumes that the supplying division can sell all its output either internally or externally at the going market price. If this were not the case then it would be necessary to instruct the receiving division to purchase from the supplying division the quantity that it is prepared to supply at the market price. This is because the receiving division is indifferent to whether it purchases the intermediate product from the supplying division or from the external market.

If the supplying division cannot make a profit in the long run at the current outside market price then the company will be better off not to produce the product internally but to obtain its supply from the external market. Similarly, if the receiving division cannot make a long-run profit when transfers are made at the current market price, it should cease processing this product, and the supplying division should be allowed to sell all its output to the external market. Where there is a competitive market for the intermediate product, the market price can be used to allow the decisions of the supplying and receiving division to be made independently of each other.

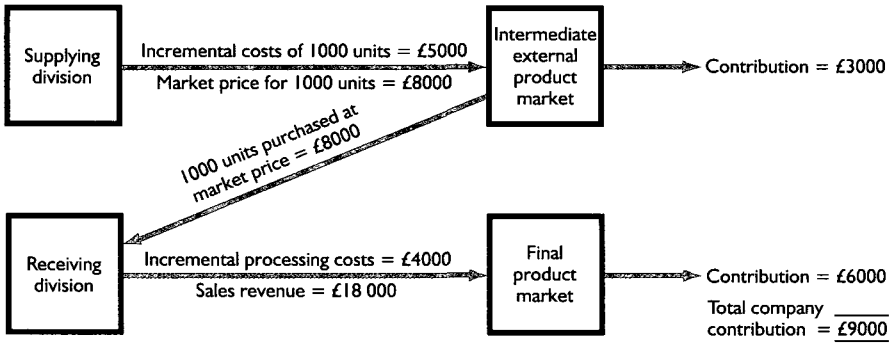
THE EFFECT OF SELLING EXPENSES

In practice, it is likely that total company profits will be different when the intermediate product is acquired internally or externally. The supplying division will incur selling expenses when selling the intermediate product on the external market, but such expenses will not be incurred on inter-divisional transfers. If the transfer price is set at the current market price, the receiving division will be indifferent to whether the intermediate product is obtained internally or externally. However, if the receiving division purchases the intermediate product externally, the company will be worse off to the extent of the selling expenses incurred by the supplying division in disposing of its output on the external market. In practice, many companies modify the market price rule for pricing inter-divisional transfers and deduct a margin to take account of the savings in selling and collection expenses.

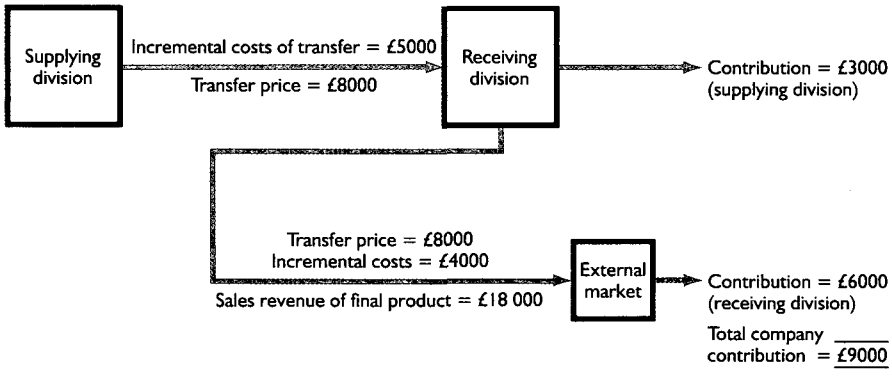
EXHIBIT 14.2

Profit impact using market-based transfer prices

(a) Purchase and sale of intermediate product in the external market



(b) Purchase and sale of intermediate product internally



OTHER MARKET IMPERFECTIONS

One of the major problems with using market prices is that the market is unlikely to be perfectly competitive. In addition, the transferred product may have special characteristics that differentiate it from other varieties of the same product. The market price for the intermediate product is appropriate only when quality, delivery, discounts and back-up

services are identical. Furthermore, it may be possible to purchase the intermediate product in the external market from suppliers who are selling at a temporary distress price that is below total cost but above variable cost. If the supplying division has excess capacity, incorrect decisions may arise because of strict adherence to the market price rule.

For example, suppose that the supplying division has spare capacity and produces an intermediate product at an incremental cost of £1000; the transfer price for this product is set at the external market price of £1600. Now suppose that a supplier of the intermediate product is selling at a temporary distress price of £1500. Given this situation, the manager of the receiving division will prefer to purchase the intermediate product from the external supplier at £1500 than from the supplying division at a cost of £1600. Because the supplying division has spare capacity, the relevant cost of making the product internally is £1000, and the strict adherence to the market price rule can therefore motivate managers to take decisions that are not in the best interests of the company.

The complications indicated in the previous paragraphs arise because the market for the intermediate product is not perfectly competitive. It is therefore important to ascertain whether market conditions do approximate closely to those of perfect competition. If they do, the transfer price should be set at the market price of the intermediate product, and any excess of inter-divisional demand over supply, or supply over demand, can be resolved by the purchase and sale of the intermediate product on the external market.

Many companies use market-based transfer prices where competition is not perfect by making adjustments from observed market prices. These adjustments may reflect the belief that the price quoted by an external supplier is a short-run distress price that is not sustainable in the long term. Market-based adjusted transfer prices may still suffice where imperfections exist provided that the lost profits from deviating from the optimal output levels is not too great. The lost profits may be counter-balanced by the fact that the transfer price is perceived as being fair by the divisional managers for performance evaluation and also divisional autonomy is unlikely to be undermined.

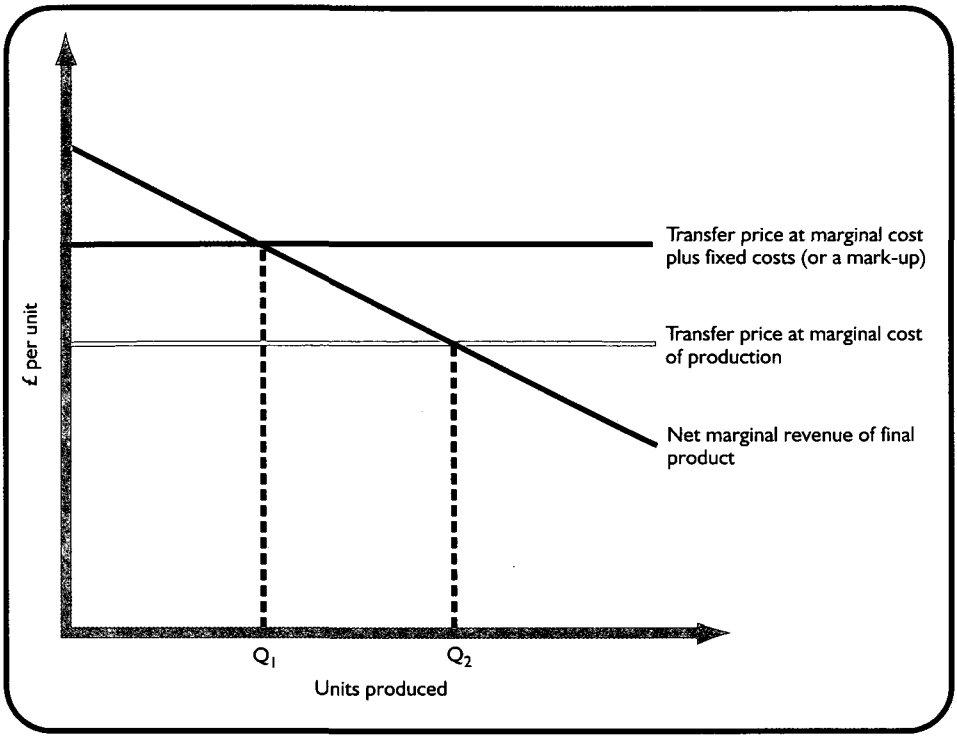
Marginal cost transfer prices

When the market for the intermediate product is imperfect or even non-existent marginal cost transfer prices can motivate both the supplying and receiving division managers to operate at output levels that will maximize overall company profits. Economic theory indicates that the theoretically correct transfer price to encourage total organizational optimality is, in the absence of capacity constraints, the marginal cost of producing the intermediate product at the optimal output level for the company as a whole.

Most accountants have adopted a short-term perspective to derive marginal cost and assume that marginal cost is constant per unit throughout the relevant output range and equivalent to short-term variable cost. In this situation the theoretically correct transfer price can be interpreted as being equivalent to the variable cost of the supplying division of providing an intermediate product or service. However, using short-term variable cost is only optimal when a short-term perspective is adopted.

Figure 14.1 illustrates how setting transfer prices at marginal cost will provide information that will motivate the divisional managers to operate at output levels that will maximize overall company profits. This diagram assumes that marginal cost is equal to variable cost and constant throughout the entire production range. It therefore relates to a short-term time horizon. To keep things simple we shall assume that there is no market for the intermediate product. Note also that the net marginal revenue curve of the final product declines to reflect the fact that to sell more the price must be lowered. The term net

FIGURE 14.1 *A comparison of marginal cost and full cost or cost-plus transfer pricing.*



marginal revenue refers to the marginal revenue of the final product less the marginal conversion costs (excluding the transfer price) incurred by the receiving division. The receiving division will purchase the intermediate product up to the point where net marginal revenue equals its marginal costs, as reflected by the transfer price. It will therefore be the optimal output from the overall company perspective (Q_2) only if the transfer price is set at the marginal cost of the intermediate product or service. If a higher price is set (as indicated by the green line) to cover full cost, or a mark-up is added to marginal cost, then the supplying division will restrict output to the sub-optimal level Q_1.

It is apparent from the surveys of company practice shown in Exhibit 14.1 that less than 10% of the companies transfer goods and services at marginal cost. The major reason for its low use is that when marginal cost is interpreted as being equivalent to variable cost it does not support the profit or investment responsibility structure because it provides poor information for evaluating the performance of either the supplying or receiving divisions. The supplying division will record losses on the capacity allocated to inter-divisional transfers because it bears the full cost of production but only receives revenues that cover variable cost. Conversely the profit of the receiving division will be overstated because it will not bear any of the fixed capacity costs of the supplying division.

A further problem is that marginal costs may not be constant over the entire range of output because step increases in fixed costs can occur. Measuring marginal cost is also difficult in practice beyond a short-term period. The low usage of marginal cost transfer prices suggests that managers reject the short-term interpretation of approximating marginal costs with variable costs. Instead, they view product-related decisions as long-range decisions that must reflect long-run pricing considerations and therefore the

appropriate marginal cost to use is long-run marginal cost. We shall examine how long-run marginal cost can be derived later in the chapter.

Full cost transfer prices

Exhibit 14.1 shows that full costs or full cost plus a mark-up are widely used in practice. Their attraction is that, as indicated above, managers view product-related decisions as long-run decisions and therefore require a measure of long-run marginal cost. Full costs attempt to meet this requirement. In addition, they are preferable to short-run variable costs for performance evaluation purposes since the supplying division can recover the full costs of production, although no profit will be obtained on the goods or services transferred.

The major problem with full cost transfer prices is that they are derived from traditional costing systems which, as was pointed out in Chapter 6, can provide poor estimates of long-run marginal costs. Ideally, full cost transfer prices should be derived from an activity-based costing system. A further problem with full cost transfer prices is that they do not provide an incentive for the supplying division to transfer goods and services internally because they do not include a profit margin. If internal transfers are a significant part of the supplying division's business, they will understate the division's profits.

Cost-plus a mark-up transfer prices

Cost-plus a mark-up transfer prices represent an attempt to meet the performance evaluation purpose of transfer pricing by enabling the supplying divisions to obtain a profit on the goods and services transferred. Where full cost is used as the cost base the mark-up is intended to provide a profit margin for the supplying division. Sometimes variable costs are used as the cost base and the mark-up is intended to cover both fixed costs and a profit contribution

Because they include a margin in excess of either short-run or long-run variable cost, transfer prices based on cost-plus a mark-up will cause inter-divisional transfers to be less than the optimal level for the company as a whole. You will see why if you refer back to Figure 14.1. The green horizontal line in this diagram represents the transfer price and at this price the receiving division manager will restrict output to OQ_1 compared to the optimal output level of OQ_2.

A further problem arises if we extend our analysis beyond two divisions to several divisions. If the first division in the process transfers goods to the second division at cost plus 20%, and the goods received from the second division are further processed and transferred at cost plus 20% to a third division, and so on, then the percentage margin becomes enormous by the time a mark-up is added by the final division in the process. Similar situations will also arise where the cost of shared resources, such as central administrative costs, are assigned to divisions and their costs are incorporated into the products or services that are transferred between several divisions such that the output cost of one division becomes the input costs of other divisions.

Negotiated transfer prices

The difficulties encountered in establishing a sound system of transfer pricing have led to suggestions that negotiated transfer prices should be used. Negotiated transfer prices are

most appropriate in situations where some market imperfections exist for the intermediate product, particularly when there are different selling costs for internal and external sales, or where there exist several different market prices. When there are such imperfections in the market, the respective divisional managers must have the freedom to buy and sell outside the company to enable them to engage in a bargaining process. It is claimed that if this is the case then the friction and bad feeling that may arise from a centrally controlled market transfer price will be eliminated without incurring a mis-allocation of resources.

There are strong arguments for believing that in certain situations, if divisions are allowed to bargain freely with each other, they will usually make decisions that will maximize total company profits – this is of course assuming that managers are competent and know how to use the accounting information. For negotiation to work effectively it is important that managers have equal bargaining power. If the receiving division has many sourcing possibilities for the intermediate product or service, but the supplying division has limited outlets, the bargaining power of the managers will be unequal. Unequal bargaining power can also occur if the transfers are a relatively small proportion of the business for one of the divisions and a relatively large proportion of the business of the other. The manager of the division where transfers are a small proportion of business has considerably more bargaining power because he, or she, will not suffer serious consequences if agreement is not reached on the proposed inter-divisional transfers.

The situation may arise where divisional managers cannot agree on a mutually satisfactory transfer price, or where one division refuses to deal with another division. Central headquarters may then have to resolve the dispute, but the difficulty here is that the managers involved can no longer be said to have complete responsibility for the activities of their divisions. This not only raises immediate behavioural problems with respect to morale and motivation, but it also means that, when divisional performance is evaluated, the managers will be held responsible for the results of decisions that they did not make. The overall effect is a breakdown in decentralized profit responsibility and a move towards centralized decision-making. Nevertheless, the support and involvement of top management must be available to mediate the occasional unresolvable dispute or to intervene when it sees that the bargaining process is leading to suboptimal decisions.

It is important to note that negotiated transfer prices are inappropriate where there is a perfect market for the intermediate product, since in a perfect market situation transfer prices can be based on the competitive market price without the need for the managers to engage in a negotiating process. At the other extreme, where there is no market for the intermediate product, it is most unlikely that managers can engage in meaningful negotiation. Negotiated transfer prices are therefore best suited to situations where there is an imperfect external market for the intermediate product or service. Negotiated transfer prices do, however, suffer from the following limitations:

- because the agreed transfer price can depend on the negotiating skills and bargaining power of the managers involved, the final outcome may not be close to being optimal;
- they can lead to conflict between divisions and the resolution of such conflicts may require top management to mediate;
- measurement of divisional profitability can be dependent on the negotiating skills of managers, who may have unequal bargaining power;
- they are time-consuming for the managers involved, particularly where a large number of transactions are involved.

Even if negotiated prices do not result in an optimum output level, the motivational advantages of giving managers full independence over their input and output decisions may lead to increased profits that outweigh the loss of profits from negotiated non-optimal transfer prices.

An illustration of transfer pricing

The data used in Example 14.1 will now be used to illustrate the impact that transfer prices can have on divisional profitability and decision-making. You should now refer to Example 14.1.

At *the full cost plus a mark-up transfer price* of £35 the profit computations for each division will be as follows:

Oslo Division (Supplying division)

Output level (units)	Transfer price revenues	Variable costs	Fixed costs	Total profit/(loss)
1000	35 000	11 000	60 000	(36 000)
2000	70 000	22 000	60 000	(12 000)
3000	105 000	33 000	60 000	12 000
4000	140 000	44 000	60 000	36 000
5000	175 000	55 000	60 000	60 000
6000	210 000	66 000	60 000	84 000

Bergen Division (Receiving division)

Output level (units)	Total revenues	Variable costs	Total cost of transfers	Fixed costs	Total profit/(loss)
1000	100 000	7 000	35 000	90 000	(32 000)
2000	180 000	14 000	70 000	90 000	6 000
3000	240 000	21 000	105 000	90 000	24 000
4000	280 000	28 000	140 000	90 000	22 000
5000	300 000	35 000	175 000	90 000	0
6000	300 000	42 000	210 000	90 000	(42 000)

The supplying division maximizes profits at an output level of 6000 units whereas the receiving division maximizes profits at an output level of 3000 units. The receiving division will therefore purchase 3000 units from the supplying division. This is because the Bergen division will compare its net marginal revenue with the transfer price and expand output as long as the net marginal revenue of the additional output exceeds the transfer price. Remember that net marginal revenue was defined as the marginal revenue from the sale of the final product less the marginal conversion costs (excluding the transfer price). The calculations are as follows:

Units	Net marginal revenue(£)
1000	93 000 (100 000 – 7000)
2000	73 000 (80 000 – 7000)
3000	53 000 (60 000 – 7000)
4000	33 000 (40 000 – 7000)
5000	13 000 (20 000 – 7000)
6000	–7 000 (0 – 7 000)

Faced with a transfer price of £35 000 per 1000 units the Bergen division will not expand output beyond 3000 units because the transfer price paid for each batch exceeds the net marginal revenue.

EXAMPLE 14.1

The Oslo division and the Bergen division are divisions within the Baltic Group. One of the products manufactured by the Oslo division is an intermediate product for which there is no external market. This intermediate product is transferred to the Bergen division where it is converted into a final product for sale on the external market. One unit of the intermediate product is used in the production of the final product. The expected units of the final product which the Bergen division estimates it can sell at various selling prices are as follows:

Net selling price (£)	Quantity sold Units
100	1000
90	2000
80	3000
70	4000
60	5000
50	6000

The costs of each division are as follows:

(£)	Oslo (£)	Bergen (£)
Variable cost per unit	11	7
Fixed costs attributable to the products	60 000	90 000

The transfer price of the intermediate product has been set at £35 based on a full cost plus a mark-up.

Let us now look at the profit at the different output levels for the company as a whole. Note that these calculations do not incorporate the transfer price since it represents intercompany trading with the revenue from the supplying division cancelling out the cost incurred by the receiving division.

Whole company profit computations

Output level (units)	Total revenues	Company variable costs	Company fixed costs	Company profit/(loss)
1000	100 000	18 000	150 000	(68 000)
2000	180 000	36 000	150 000	(6 000)
3000	240 000	54 000	150 000	36 000
4000	280 000	72 000	150 000	58 000
5000	300 000	90 000	150 000	60 000
6000	300 000	108 000	150 000	42 000

The profit maximizing output for the company as a whole is 5000 units. Therefore the current transfer pricing system does not motivate the divisional managers to operate at the optimum output level for the company as a whole.

To induce overall company optimality the *transfer price must be set at the marginal cost of the supplying division*, which over the time horizon and output levels under considera-

tion, is the unit variable cost of £11 per unit. Therefore the transfer price for each batch of 1000 units would be £11 000. The receiving division will expand output as long as net marginal revenue exceeds the transfer price. Now look at the net marginal revenue that we calculated for the receiving division. You will see that the net marginal revenue from expanding output from 4000 to 5000 units is £13 000 and the transfer price that the receiving division must pay to acquire this batch of 1000 units is £11 000. Therefore expanding the output will increase the profits of the supplying division. Will the manager of the receiving division be motivated to expand output from 5000 to 6000 units? The answer is no because the net marginal revenue (−£7000) is less than the transfer price of purchasing the 1000 units.

Setting the transfer price at the unit marginal (variable) cost of the supplying division will motivate the divisional managers to operate at the optimum output level for the company as a whole provided that the supplying division manager is instructed to meet the demand of the receiving division at this transfer price. Although the variable cost transfer price encourages overall company optimality it is a poor measure of divisional performance. The supplying division manager will be credited with transfer price revenues of £11 000 per 1000 units. If you look back at the profit computations for the Oslo division you will see that the transfer price revenues will be identical to the variable cost column and therefore a loss equal to the fixed costs of £60 000 will be reported for all output levels. In the short-term the fixed costs are unavoidable and therefore the divisional manager is no worse off since these fixed costs will be still incurred but in the longer-term some, or all of them, may be avoidable and the manager would not wish to produce the intermediate product. The performance measure will overstate the performance of the receiving division because all of the contribution (sales less variable costs) from the sale of the final product will be credited to the manager of the receiving division.

Let us now consider a *full cost transfer price without the mark-up.* We need to estimate unit fixed costs at the planning stage for making decisions relating to output levels. You will also recall from Chapter 5 that it was pointed out that pre-determined fixed overhead rates should be established. Let us assume that the 5000 units optimal output level for the company as a whole is used to determine the fixed overhead rate per unit. Therefore the fixed cost per unit for the intermediate product will be £12 per unit (£60 000 fixed costs/5 000 units) giving a full cost of £23 (£11 variable cost plus £12 fixed cost). If the transfer price is set at £23 per unit (i.e. £23 000 per 1000 batch) the receiving division manager will expand output as long as net marginal revenues exceeds the transfer price. If you refer to the net marginal revenue schedule you will see that the receiving division manager will choose to purchase 4000 units. The manager will choose not to expand output to the 5000 units optimal level for the company as a whole because the transfer cost of £23 000 exceeds the net marginal revenue of £13 000. Also at the selected output level of 4000 units the total transfer price revenues of the receiving division will be £92 000 (4000 units at £23) but you will see from the profit calculations for the Oslo division that the total costs are £104 000 (£44 000 + £60 000). Therefore the supplying division will report a loss because all of its fixed costs have not been recovered. Hence the transfer price is suitable for neither performance evaluation nor ensuring that optimal output decisions are made.

Would the managers be able to *negotiate a transfer price* that meets the decision-making and performance evaluation requirements? If the manager of the supplying division cannot avoid the fixed costs in the short-run he or she will have no bargaining power because there is no external market for the intermediate product and would accept any price as long as it is not below variable cost. Meaningful negotiation is not possible. If the fixed costs are avoidable the manager has some negotiating power since he or she can avoid £60 000 by not producing the intermediate product. The manager will try and negotiate a selling price in excess of full cost. If an output level of 5000 units is used to calculate the full cost the unit cost from our earlier calculations was £23 and the manager

will try and negotiate a price in excess of £23. If you examine the net marginal revenue of the receiving division you will see that the manager of the receiving division will not expand output to 5000 units if the transfer price is set above £23 per unit. As indicated earlier negotiation is only likely to work when there is an external market for the intermediate market.

We can conclude from this illustration that to ensure overall company optimality the transfer price must be set at the marginal cost of the supplying division. Our analysis has focused on the short term, a period during which we have considered that fixed costs are irrelevant and unavoidable. In the longer term fixed costs are relevant and avoidable and thus represent a marginal cost that should be considered for decision-making. Thus for long-term decisions marginal cost should incorporate avoidable fixed costs but we have noted in earlier chapters that they should not be unitized since this is misleading because it gives the impression that they are variable with output. To incorporate avoidable fixed costs within long-run marginal cost they should be added as a lump-sum to short-run marginal (variable) costs. This is a feature of one of the proposals that we shall look at in the next section.

Proposals for resolving transfer pricing conflicts

Our discussion so far has indicated that in the absence of a perfect market for the intermediate product none of the transfer pricing methods can perfectly meet both the decision-making and performance evaluation requirements and also not undermine divisional autonomy. It has been suggested that if the external market for the intermediate product does not approximate closely those of perfect competition, then if long-run marginal cost can be accurately estimated, transfers at marginal cost should motivate decisions that are optimal from the overall company's perspective. However, transfers at marginal cost are unsuitable for performance evaluation since they do not provide an incentive for the supplying division to transfer goods and services internally. This is because they do not contain a profit margin for the supplying division. Central headquarters intervention may be necessary to instruct the supplying division to meet the receiving division's demand at the marginal cost of the transfers. Thus, divisional autonomy will be undermined. Transferring at cost-plus a mark-up creates the opposite conflict. Here the transfer price meets the performance evaluation requirement but will not induce managers to make optimal decisions.

To resolve the above conflicts the following transfer pricing methods have been suggested:

1. adopt a dual-rate transfer pricing system;
2. transfer at a marginal cost plus a fixed lump-sum fee.

DUAL-RATE TRANSFER PRICING SYSTEM

Dual-rate transfer pricing uses two separate transfer prices to price each inter-divisional transaction. For example, the supplying division may receive the full cost plus a mark-up on each transaction and the receiving division may be charged at the marginal cost of the transfers. The former transfer price is intended to approximate the market price of the goods or services transferred. Exhibit 14.3, which relates to inter-divisional trading between two divisions in respect of 100 000 units on an intermediate product, is used to illustrate the application of a dual-rate transfer pricing system. You will see that if the transfer price is set at the supplying division's marginal cost of £10 per unit for the intermediate product, the supplying division will be credited with a zero contribution from

the transfers, and all of the total contribution of £1 million from inter-divisional trading will be assigned to the receiving division.

Dual-rate transfer pricing can be implemented by setting the transfer price to be charged to the receiving division at the marginal cost of the supplying division (£10 per unit). To keep things simple here, the transfer price that the supplying division receives is set at marginal cost plus 50%, giving a price of £15. It is assumed that the mark-up added will be sufficient to cover the supplying division's fixed costs and also provide a profit contribution. Therefore the receiving division manager will use the marginal cost of the supplying division which should ensure that decisions are made that are optimal from the company's perspective. The transfer price should also meet the performance evaluation requirements of the supplying division since each unit transferred generates a profit. Thus the supplying division manager is motivated to transfer the intermediate product internally. The reported outcomes for each division using the above dual-rate transfer prices, and the information shown in Exhibit 14.3 would be as follows:

Supplying division	(£)	*Receiving division*	(£)
Transfers to the supplying division at £15 (100 000 units at £10 plus 50%)	1 500 000	Sales of the final product at £50 (100 000 units)	5 000 000
Less: marginal processing costs	1 000 000	Less marginal costs:	
		Supplying division transfers (100 000 units at £10)	(1 000 000)
		Conversion costs (100 000 units at £30)	(3 000 000)
Profit contribution	500 000	Profit contribution	1 000 000

Note that the contribution for the company as a whole shown in Exhibit 14.3 is less than the sum of the above divisional profits by £500 000, but this can be resolved by a simple accounting adjustment.

Dual-rate transfer prices are not widely used in practice for several reasons. First, the use of different transfer prices causes confusion, particularly when the transfers spread beyond two divisions. Secondly, they are considered to be artificial. Thirdly, they reduce divisional incentives to compete effectively. For example, the supplying division can easily generate internal sales to the receiving divisions when they are charged at marginal cost. This protects them from competition and gives them little incentive to improve their productivity. Finally, top-level managers do not like to

EXHIBIT 14.3

Projected financial statement from inter-group trading

	(£)	(£)
Sale of final product: 100 000 units at £50		5 000 000
Marginal costs:		
Supplying division processing costs (100 000 units at £10)	1 000 000	
Receiving division conversion costs (100 000 units at £30)	3 000 000	4 000 000
Total contribution from inter-divisional trading		1 000 000

double count internal profits because this can result in misleading information and create a false impression of divisional profits. Furthermore, the inter-divisional profits can be considerably in excess of total company profits where a sequence of transfers involves several divisions. At the extreme all of the divisions may report profits when the company as a whole is losing money.

MARGINAL COSTS PLUS A FIXED LUMP-SUM FEE

A solution that has been proposed where the market for the intermediate product is imperfect or non-existent, and where the supplying division has no capacity constraints, is to price all transfers at the short-run marginal cost and for the supplying division to also charge the receiving division a fixed fee for the privilege of obtaining these transfers at short-run marginal cost. This approach is sometimes described as a two-part transfer pricing system. With this system, the receiving division acquires additional units of the intermediate product at the marginal cost of production. Therefore when it equates its marginal costs with its marginal revenues to determine the optimum profit-maximizing output level, it will use the appropriate marginal costs of the supplying division. The supplying division can recover its fixed costs and earn a profit on the inter-divisional transfers through the fixed fee charged each period. The fixed fee is intended to compensate the supplying division for tying up some of its fixed capacity for providing products or services that are transferred internally. The fixed fee should cover a share of fixed costs of the supplying division and also provide a return on capital. For example, it can be based on the receiving division's budgeted use of the average capacity of the supplying division. Therefore if a particular receiving division plans to use 25% of a supplying division's average capacity, the division would be charged 25% of the fixed costs plus a further charge to reflect the required return on capital. The fixed fee plus the short-run marginal cost represents an estimate of long-run marginal cost.

The advantage of this approach is that transfers will be made at the marginal cost of the supplying division, and both divisions should also be able to report profits from inter-divisional trading. Furthermore, the receiving divisions are made aware, and charged for the full cost of obtaining intermediate products from other divisions, through the two components of the two-part transfer pricing system. It also stimulates planning, communication and coordination amongst the divisions because the supplying and receiving divisions must agree on the capacity requirements in order to determine the bases for the fixed fee.

If you refer back to Example 14.1 you will see that this proposal would result in a transfer price at the short-run marginal (variable) cost of £11 per unit for the intermediate product plus a fixed fee lump-sum payment of £60 000 to cover the fixed costs of the capacity allocated to producing the intermediate product. In addition, a fixed sum to reflect the required return on the capital employed would be added to the £60 000. Adopting this approach the receiving division will use the short-run variable cost to equate with its net marginal revenue and choose to purchase the optimal output level for the company as a whole (5000 units). For longer-term decisions the receiving division will made aware that the revenues must be sufficient to cover the full cost of producing the intermediate product (£11 unit variable cost plus £60 000 fixed costs plus the opportunity cost of capital). When the lump-sum fixed fee is added to the short-run transfer price (£11 per unit) you will see that the supplying division will report a profit at all output levels.

Domestic transfer pricing recommendations

This chapter has described the various approaches that can be adopted to arrive at transfer prices for transactions between different units within an organization and the circumstances where they are appropriate. The following is a summary of the recommendations that can be derived from our discussion of the different transfer pricing methods:

1. Where a competitive market exists for the intermediate product, the market price (less any adjustments to reflect additional selling and distribution and collection expenses to outside customers) should be used as the transfer price. To ensure overall company optimality it will also be necessary, where the supplying division has excess capacity, to instruct the receiving division to purchase from the supplying division the quantity that it is prepared to supply at the market price.
2. Where no external market exists for the intermediate product, transfers should be made at the long-run marginal cost of producing a product or delivering a service. The long-run marginal cost should consist of two elements – a short-run variable cost per unit of the product or service transferred and a fixed lump-sum fee based on the receiving division's budgeted use of the average capacity of the supplying division. The fixed fee should include a share of the fixed capacity costs of the supplying division plus an opportunity cost of capital in terms of a required return on the capital employed. The short-run marginal cost per unit plus the lump-sum fixed fee ensures that the receiving division incorporates the full costs of the supplying division's resources required to produce the intermediate product and also motivates the supplying divisions because they are reimbursed for the capacity utilized.
3. Where an imperfect market for the intermediate product or service exists and a small number of products, or transactions, are involved, a negotiated transfer pricing system is likely to be the most suitable method. Here some form of external benchmark price is likely to be available to enable a meaningful bargaining process to take place between the supplying and receiving divisional managers.
4. Where cost-based transfer prices are used standard costs, and not actual costs, per unit of output should be used. If actual costs are used the supplying divisions will be able to pass on the cost of any inefficiencies to the receiving divisions. Using standard costs ensures that the cost of inefficiencies are allocated to the supplying divisions.

International transfer pricing

So far we have concentrated on domestic transfer pricing. International transfer pricing is concerned with the prices that an organization uses to transfer products between divisions in different countries. The rise of multinational organizations introduces additional issues that must be considered when setting transfer prices.

When the supplying and the receiving divisions are located in different countries with different taxation rates, and the taxation rates in one country are much lower than those in the other, it would be in the company's interest if most of the profits were allocated to the division operating in the low taxation country. For example, consider an organization that manufactures products in Country A, which has a marginal tax rate of 25% and sells those products to country B, which has a marginal tax rate of 40%. It is in the company's best interests to locate most of its profits in country A, where the tax rate is lowest. Therefore it will wish to use the highest possible transfer price so that the receiving division operating

in country B will have higher costs and report lower profits whereas the supplying division operating in country A will be credited with higher revenues and thus report the higher profits. In many multinational organizations, the taxation issues outweigh other transfer pricing issues and the dominant consideration in the setting of transfer prices is the minimization of global taxes.

Taxation authorities in each country are aware that companies can use the transfer pricing system to manipulate the taxable profits that are declared in different countries and investigate the transfer pricing mechanisms of companies to ensure that they are not using the transfer pricing system to avoid paying local taxes. For example, in the UK the Income and Corporate Taxes Act 1988, Section 770 and the Finance Act 1998 (Chapter 36 – Schedules 16 and 17) deal with international transfer pricing issues. In an attempt to provide a world-wide consensus on the pricing of international intra-firm transactions the Organization for Economic Co-operation and Development issued a guideline statement in 1995 (OECD, Paris, 1995). This document is important because the taxation authorities in most countries have used it as the basis for regulating transfer pricing behaviour of international intra-firm transactions. The OECD guidelines are based on the arms length price principle which relates to the price that would have resulted if the prices actually used had been between two unrelated parties.

It would appear that multinational companies should use two transfer pricing systems – one for internal purposes based on our discussion in the earlier part of this chapter and another for taxation purposes. However, evidence of two transfer pricing systems is likely to attract the attention of the taxation authorities. It is easier for companies to claim that they are not manipulating profits to evade taxes if they use the same transfer pricing method for taxation and internal purposes. For this reason, and the greater simplicity, multinational companies tend to use the same transfer pricing method for both domestic and international transfers.

Summary

A transfer pricing system is required for meeting the following purposes:

1. to provide information that motivates divisional managers to make good economic decisions.
2. to provide information that is useful for evaluating performance of the managerial and economic performance of the divisions;
3. to intentionally move profits between divisions or locations;
4. to ensure that divisional autonomy is not undermined.

It is unlikely that a single transfer price can be established that perfectly serves all four purposes. The following five primary transfer pricing methods were described:

1. market-based transfer prices;
2. marginal cost transfer prices;
3. full cost transfer prices;
4. cost-plus a mark-up transfer prices;
5. negotiated transfer prices.

In most circumstances, where there is a perfectly competitive market for an intermediate product it is optimal for both decision-making and performance evaluation purposes to set transfer prices at the competitive market prices. If there is no external market for the intermediate product or the market is imperfect, marginal cost transfer prices will motivate both supplying and receiving divisions to operate at output levels that will maximize overall company profits. However, marginal cost transfer prices are unsatisfactory for performance evaluation because the supplying division will record losses equal to the fixed costs allocated to the intermediate product and the profits of the receiving division will be overstated. Full cost and cost-plus a mark-up transfer prices do not motivate managers to choose the optimal output levels.

To overcome the decision-making and performance evaluation conflicts that occur with the cost-based transfer pricing methods a two-part transfer pricing system was recommended involving a variable cost per unit transferred plus a fixed lump-sum fee based on the receiving division's budgeted use of the average capacity of the supplying division.

Attention was drawn to the fact that where divisions operate in different countries taxation implications can be a dominant influence. The aim is to set transfer prices at levels which will ensure that most of the profits are allocated to divisions operating in low taxation countries. However, taxation authorities in each country are aware that companies can use the transfer pricing system to manipulate the taxable profits that are declared in different countries and investigate the transfer pricing mechanisms of companies to ensure that they are not using the transfer pricing system to avoid paying local taxes.

Key Terms and Concepts

dual-rate transfer pricing (p. 439)
cost-plus a mark-up transfer prices (p. 427)
final products (p. 426)
full cost transfer prices (p. 427)
intermediate products (p. 426)
marginal cost transfer prices (p. 427)
market-based transfer prices (p. 427)
negotiated transfer prices (p. 427)
net marginal revenue (p. 432)
perfectly competitive market (p. 429)
two-part transfer pricing system (p. 441)

Review Problem

Enormous Engineering (EE) plc is a large multidivisional engineering company having interests in a wide variety of product markets. The Industrial Products Division (IPD) sells component parts to consumer appliance manufacturers, both inside and outside the company. One such part, a motor unit, it sells solely to external customers, but buys the motor itself internally from the Electric Motor Division. The Electric Motor Division (EMD) makes the motor to IPD specifications and it does not expect to be able to sell it to any other customers.

In preparing the 2001 budgets IPD estimated the number of motor units it expects to be able to sell at various prices as follows:

Price (ex works) (£)	Quantity sold (units)
50	1000
40	2000
35	3000
30	4000
25	6000
20	8000

It then sought a quotation from EMD, who offered to supply the motors at £16 each based on the following estimate:

	(£)
Materials and bought-in parts	2
Direct labour costs	4
Factory overhead (150% of direct labour costs)	6
Total factory cost	12
Profit margin ($33\frac{1}{3}$% on factory cost)	4
Quoted price	£16

Factory overhead costs are fixed. All other costs are variable.

Although it considered the price quoted to be on the high side, IPD nevertheless believed that it could still sell the completed unit at a profit because it incurred costs of only £4 (material £1 and direct labour £3) on each unit made. It therefore placed an order for the coming year.

On reviewing the budget for 2001 the finance director of EE noted that the projected sales of the motor unit were considerably less than those for the previous year, which was disappointing as both divisions concerned were working well below their capacities. On making enquiries he was told by IPD that the price reduction required to sell more units would reduce rather than increase profit and that the main problem was the high price charged by EMD. EMD stated that they required the high price in order to meet their target profit margin for the year, and that any reduction would erode their pricing policy.

You are required to:

(a) develop tabulations for each division, and for the company as a whole, that indicate the anticipated effect of IPD selling the motor unit at each of the prices listed, (10 marks)

(b) (i) show the selling price which IPD should select in order to maximize its own divisional profit on the motor unit, (2 marks)

(ii) show the selling price which would be in the best interest of EE as a whole, (2 marks)

(iii) explain why this latter price is not selected by IPD, (1 mark)

(c) state:

(i) what changes you would advise making to the transfer pricing system so that it will motivate divisional managers to make better decisions in future, (5 marks)

(ii) what transfer price will ensure overall optimality in this situation. (5 marks)

(Total 25 marks)

ICAEW

Solution to Review Problem

(a) The effects on each division and the company as a whole of selling the motor unit at each possible selling price are presented in the following schedules:

(i) *EM division*

Output level (units)	Total revenues (£)	Variable costs (£)	Total contribution (£)
1000	16 000	6 000	10 000
2000	32 000	12 000	20 000
3000	48 000	18 000	30 000
4000	64 000	24 000	40 000
6000	96 000	36 000	60 000
8000	128 000	48 000	**80 000**

(ii) *IP division*

Output level (units)	Total revenues (£)	Variable costs (£)	Total cost of transfers (£)	Total contribution (£)
1000	50 000	4 000	16 000	30 000
2000	80 000	8 000	32 000	40 000
3000	105 000	12 000	48 000	**45 000**
4000	120 000	16 000	64 000	40 000
6000	150 000	24 000	96 000	30 000
8000	160 000	32 000	128 000	nil

(iii) *Enormous Engineering plc*

Output level (units)	Total revenues (£)	Variable costs (EMD) (£)	Variable costs (IPD) (£)	Total contribution (£)
1000	50 000	6 000	4 000	40 000
2000	80 000	12 000	8 000	60 000
3000	105 000	18 000	12 000	75 000
4000	120 000	24 000	16 000	80 000
6000	150 000	36 000	24 000	**90 000**
8000	160 000	48 000	32 000	80 000

The above schedules indicate that EM division maximizes profits at an output of 8000 units, whereas IP division maximizes profits at an output level of 3000 units. Profits are maximized for the company as a whole at an output level of 6000 units.

(b) (i) Based on the tabulation in (a), IPD should select a selling price of £35 per unit. This selling price produces a maximum divisional contribution of £45 000.

(ii) The company as a whole should select a selling price of £25 per unit. This selling price produces a maximum company contribution of £90 000.

(iii) If IPD selected a selling price of £25 per unit instead of £35 per unit, its overall marginal revenue would increase by £45 000 but its marginal cost would increase by £60 000. Consequently it is not in IPD's interest to lower the price from £35 to £25 when the transfer price of the intermediate product is set at £16.

(c) (i) Presumably profit centres have been established so as to provide a profit incentive for each division and to enable divisional managers to exercise a high degree of divisional autonomy. The maintenance of divisional autonomy and the profitability incentive can lead to sub-optimal decisions. The costs of sub-optimization may be acceptable to a certain extent in order to preserve the motivational advantages which arise with divisional autonomy.

Within the EE group, EMD has decision-making autonomy with respect to the setting of transfer prices. EMD sets transfer prices on a full cost-plus basis in order to earn a target profit. The resulting transfer price causes IPD to restrict output to 3000 units, which is less than the group optimum. The cost of this sub-optimal decision is £15 000 (£90 000 − £75 000). A solution to the problem is to set the transfer price at the variable cost per unit of the supplying division. This transfer price will result in IPD selecting the optimum output level, but will destroy the profit incentive for the EM division. Note that fixed costs will not be covered and there is no external market for the intermediate product.

Possible solutions to achieving the motivational and optimality objectives include:

1. operating a dual transfer pricing system;
2. lump sum payments.

See 'Proposals for resolving transfer pricing conflicts' in Chapter 14 for an explanation of the above items.

(ii) Where there is no market for the intermediate product and the supplying division has no capacity constraints, the correct transfer price is the marginal cost of the supplying division for that output at which marginal cost equals the receiving division's net marginal revenue from converting the intermediate product. When unit variable cost is constant and fixed costs remain unchanged, this rule will result in a transfer price which is equal to the supplying division's unit variable cost. Therefore the transfer price will be set at £6 per unit when the variable cost transfer pricing rule is applied. IPD will then be faced with the following marginal cost and net marginal revenue schedule:

Output level (units)	Marginal cost of transfers (£)	Net marginal revenue of IPD (£)
1000		
2000	6000	26000
3000	6000	21000
4000	6000	11000
6000	12000	22000
8000	12000	2000

IPD will select an output level of 6000 units and will not go beyond this because NMR < marginal cost. This is the optimal output for the group, but the profits from the sale of the motor unit will accrue entirely to the IP division, and the EM division will make a loss equal to the fixed costs.

Questions

14.1

The production director of a company is concerned with the problem of measuring the efficiency of process managers. In the production department there are six processes and all products processed pass through a combination of these processes. One specific area of investigation is the measurement of output values which involves the use of transfer prices.

You have been asked by the production director to tabulate the advantages and disadvantages of using each of the following systems of transfer pricing as related to process costing:

(a) absorption cost;
(b) marginal cost;
(c) cost plus profit;
(d) standard cost. (20 marks)

CIMA

14.2

It has been argued that full cost is an inappropriate basis for setting transfer prices. Outline the objections which can be levied at this basis. (9 marks)

ACCA

14.3

(a) Outline and discuss the main objectives of a transfer pricing system. (5 marks)
(b) Consider the advantages and disadvantages of
(i) market price-based transfer prices; and
(ii) cost-based transfer prices.
Outline the main variants that exist under each heading. (9 marks)

(Total 14 marks)

ACCA

14.4 Discussion of transfer price where there is an external market for the intermediate product

Fabri Division is part of the Multo Group. Fabri Division produces a single product for which it has an external market which utilizes 70% of its production capacity. Gini Division, which is also part of the Multo Group requires units of the product available from Fabri Division which it will then convert and sell to an external customer. Gini Division's requirements are equal to 50% of Fabri Division's production capacity. Gini Division has a potential source of supply from outside the Multo Group. It is not yet known if this source is willing to supply on the basis of (i) only supplying *all* of Gini Division's requirements or (ii) supplying any part of Gini Division's requirements as requested.

(a) Discuss the transfer pricing method by which Fabri Division should offer to transfer its product to Gini Division in order that group profit maximization is likely to follow.
You may illustrate your answer with figures of your choice. (14 marks)
(b) Explain ways in which (i) the degree of divisional autonomy allowed and (ii) the divisional performance measure in use by Multo Group may affect the transfer pricing policy of Fabri Division. (6 marks)

(Total 20 marks)

ACCA

14.5

(a) Spiro Division is part of a vertically integrated group of divisions allocated in one country. All divisions sell externally and also transfer goods to other divisions within the group. Spiro Division performance is measured using profit before tax as a performance measure.
(i) Prepare an outline statement which shows the costs and revenue elements which should be included in the calculation of divisional profit before tax. (4 marks)
(ii) The degree of autonomy which is allowed to divisions may affect the absolute value of profit reported.
Discuss the statement in relation to Spiro Division. (6 marks)
(b) Discuss the pricing basis on which divisions should offer to transfer goods in order that

corporate profit maximising decisions should take place. (5 marks)

(Total 15 marks)

ACCA

14.6

(a) The transfer pricing method used for the transfer of an intermediate product between two divisions in a group has been agreed at standard cost plus 30% profit markup. The transfer price may be altered after taking into consideration the planning and operational variance analysis at the transferor division.

Discuss the acceptability of this transfer pricing method to the transferor and transferee divisions. (5 marks)

(b) Division A has an external market for product X which fully utilises its production capacity.

Explain the circumstances in which division A should be willing to transfer product X to division B of the same group at a price which is less than the existing market price. (5 marks)

(c) An intermediate product which is converted in divisions L, M and N of a group is available in limited quantities from other divisions within the group and from an external source. The total available quantity of the intermediate product is insufficient to satisfy demand.

Explain the procedure which should lead to a transfer pricing and deployment policy resulting in group profit maximisation. (5 marks)

(Total 15 marks)

ACCA

14.7

P plc is a multi-national conglomerate company with manufacturing divisions, trading in numerous countries across various continents. Trade takes place between a number of the divisions in different countries, with partly-completed products being transferred between them. Where a transfer takes place between divisions trading in different countries, it is the policy of the Board of P plc to determine centrally the appropriate transfer price without reference to the divisional managers concerned. The Board of P plc justifies this policy to divisional managers on the grounds that its objective is to maximise the conglomerate's post-tax profits and that the global position can be monitored effectively only from the Head Office.

Requirements:

(a) Explain and critically appraise the possible reasoning behind P plc's policy of centrally determining transfer prices for goods traded between divisions operating in different countries. (10 marks)

(b) Discuss the ethical implications of P plc's policy of imposing transfer prices on its overseas divisions in order to maximise post-tax profits. (10 marks)

(Total 20 marks)

CIMA

14.8 Comparison of divisional and group profits using different transfer prices

B Limited, producing a range of minerals, is organized into two trading groups: one handles wholesale business and the other sales to retailers.

One of its products is a moulding clay. The wholesale group extracts the clay and sells it to external wholesale customers as well as to the retail group. The production capacity is 2000 tonnes per month but at present sales are limited to 1000 tonnes wholesale and 600 tonnes retail.

The transfer price was agreed at £200 per tonne in line with the external wholesale trade price at 1 July, which was the beginning of the budget year. As from 1 December, however, competitive pressure has forced the wholesale trade price down to £180 per tonne. The members of the retail group contend that the transfer price to them should be the same as for outside customers. The wholesale group refute the argument on the basis that the original budget established the price for the whole budget year.

The retail group produces 100 bags of refined clay from each tonne of moulding clay which it sells at £4 a bag. It would sell a further 40 000 bags if the retail trade price were reduced to £3.20 a bag.

Other data relevant to the operation are:

	Wholesale £	Retail £
Variable cost per tonne	70	60
Fixed cost per month	100 000	40 000

You are required to

(a) prepare estimated profit statements for the month of December for each group and for B Limited as a whole based on transfer prices of £200 per tonne and of £180 per tonne when producing at:

(i) 80% capacity
(ii) 100% capacity utilizing the extra sales to supply the retail trade;

(b) comment on the results achieved under (a) and the effect of the change in the transfer price;

(c) propose an alternative transfer price for the retail sales which would provide greater incentive for increasing sales, detailing any problems that might be encountered.

(30 marks)

CIMA

14.9 Calculating the effects of a transfer pricing system on divisional and company profits

Division A of a large divisionalized organization manufactures a single standardized product. Some of the output is sold externally whilst the remainder is transferred to Division B where it is a sub-assembly in the manufacture of that division's product. The unit costs of Division A's product are as follows:

	(£)
Direct material	4
Direct labour	2
Direct expense	2
Variable manufacturing overheads	2
Fixed manufacturing overheads	4
Selling and packing expense – variable	1
	15

Annually 10 000 units of the product are sold externally at the standard price of £30.

In addition to the external sales, 5000 units are transferred annually to Division B at an internal transfer charge of £29 per unit. This transfer price is obtained by deducting variable selling and packing expense from the external price since this expense is not incurred for internal transfers.

Division B incorporates the transferred-in goods into a more advanced product. The unit costs of this product are as follows:

	(£)
Transferred-in item (from Division A)	29
Direct material and components	23
Direct labour	3
Variable overheads	12
Fixed overheads	12
Selling and packing expense – variable	1
	80

Division B's manager disagrees with the basis used to set the transfer price. He argues that the transfers should be made at variable cost plus an agreed (minimal) mark-up since he claims that his division is taking output that Division A would be unable to sell at the price of £30.

Partly because of this disagreement, a study of the relationship between selling price and demand has recently been made for each division by the company's sales director. The resulting report contains the following table:

Customer demand at various selling prices:

Division A			
Selling price	£20	£30	£40
Demand	15 000	10 000	5000
Division B			
Selling price	£80	£90	£100
Demand	7200	5000	2800

The manager of Division B claims that this study supports his case. He suggests that a transfer price of £12 would give Division A a reasonable contribution to its fixed overheads while allowing Division B to earn a reasonable profit. He also believes that it would lead to an increase of output and an improvement in the overall level of company profits.

You are required:

(a) to calculate the effect that the transfer pricing system has had on the company's profits, and (16 marks)

(b) to establish the likely effect on profits of adopting the suggestion by the manager of Division B of a transfer price of £12. (6 marks)

(Total 22 marks)

ACCA

14.10 Resolving a transfer price conflict

Alton division (A) and Birmingham division (B) are two manufacturing divisions of Conglom plc. Both of these divisions make a single standardized product; A makes product I and B makes product J. Every unit of J requires one unit of I. The required input of I is normally purchased from division A but sometimes it is purchased from an outside source.

The following table gives details of selling price and cost for each product:

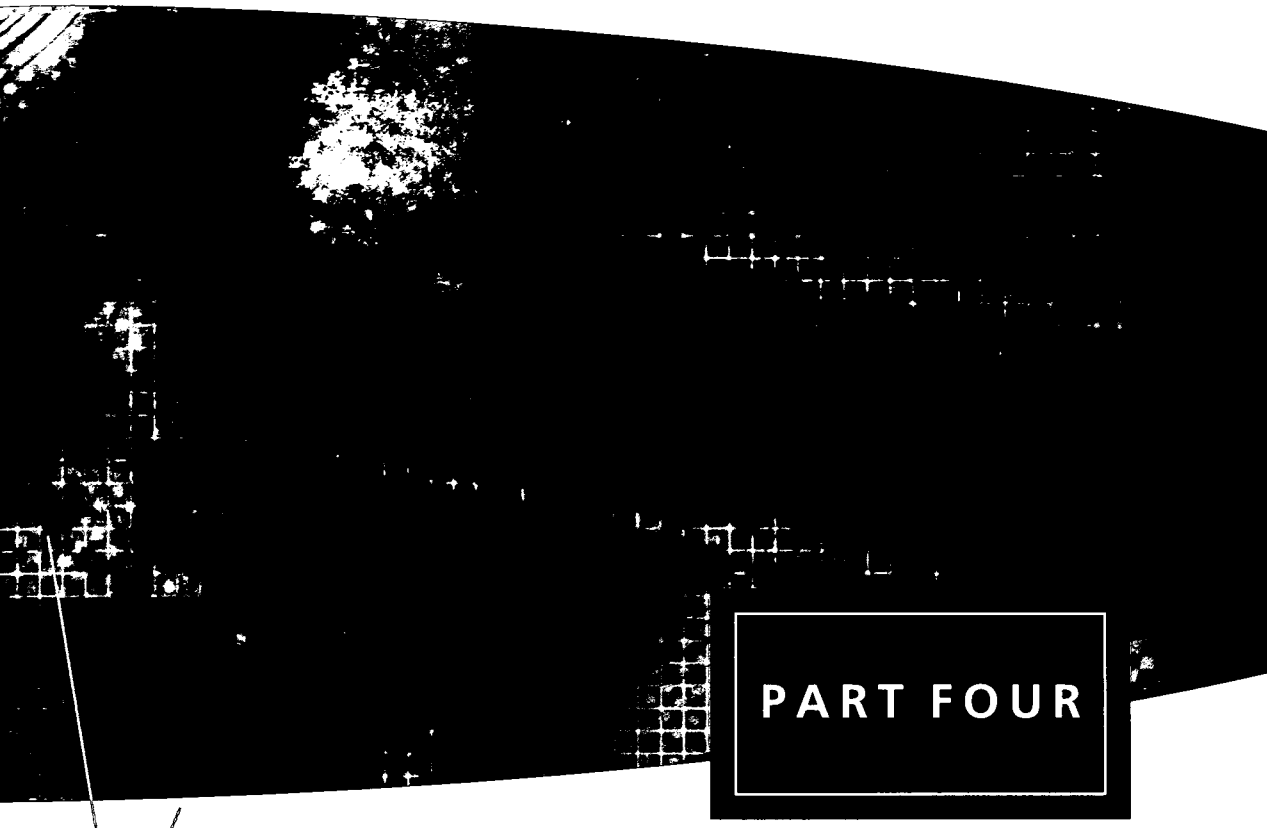
	Product I (£)	Product J (£)
Established selling price	30	50
Variable costs		
Direct material	8	5
Transfers from A	—	30
Direct labour	5	3
Variable overhead	2	2
	15	40
Divisional fixed cost (per annum)	£500 000	£225 000
Annual outside demand with current selling prices (units)	100 000	25 000
Capacity of plant (units)	130 000	30 000
Investment in division	£6 625 000	£1 250 000

Division B is currently achieving a rate of return well below the target set by the central office. Its manager blames this situation on the high transfer price of product I. Division A charges division B for the transfers of I at the outside supply price of £30. The manager of division A claims that this is appropriate since this is the price 'determined by market forces'. The manager of B has consistently argued that intra group transfers should be charged at a lower price based on the costs of the producing division plus a 'reasonable' mark-up.

The board of Conglom plc is concerned about B's low rate of return and the divisional manager has been asked to submit proposals for improving the situation. The board has now received a report from B's manager in which he asks the board to intervene to reduce the transfer price charged for product I. The manager of B also informs the board that he is considering the possibility of opening a branch office in rented premises in a nearby town, which should enlarge the market for product J by 5000 units per year at the existing price. He estimates that the branch office establishment costs would be £50 000 per annum.

You have been asked to write a report advising the board on the response that it should make to the plans and proposals put forward by the manager of division B. Incorporate in your report a calculation of the rates of return currently being earned on the capital employed by each division and the changes to these that should follow from an implementation of any proposals that you would recommend.

(22 marks)
ACCA



PART FOUR

Cost Management and Strategic Management Accounting

In Part Three the major features of traditional management accounting control systems and the mechanisms that can be used to control costs were described. The focus was on comparing actual results against a pre-set standard (typically the budget), identifying and analysing variances and taking remedial action to ensure that future outcomes conform with budgeted outcomes. Traditional cost control systems tend to be based on the preservation of the *status-quo* and the ways of performing existing activities are not reviewed. The emphasis is on cost containment rather than cost reduction. In contrast, cost management focuses on cost reduction rather than cost containment. Chapter 15 examines the various approaches that fall within the area of cost management.

During the late 1980s criticisms of traditional management accounting practices were widely publicized and new approaches were advocated which are more in tune with today's competitive and business environment. In particular, strategic management accounting has been identified as a way forward. However, there is still no comprehensive framework as to what

constitutes strategic management accounting. Chapter 16 examines the elements of strategic management accounting and describes the different contributions that have been made to its development. In addition, recent developments that seek to incorporate performance measurement within the strategic management process are described.

CHAPTER 15 COST MANAGEMENT
CHAPTER 16 STRATEGIC MANAGEMENT ACCOUNTING

15

Cost management

In Chapters 11–13 the major features of traditional management accounting control systems and the mechanisms that can be used to control costs were described. The focus was on comparing actual results against a pre-set standard (typically the budget), identifying and analysing variances and taking remedial action to ensure that future outcomes conform with budgeted outcomes. Traditional cost control systems tend to be based on the preservation of the *status quo* and the ways of performing existing activities are not reviewed. The emphasis is on cost containment rather than cost reduction.

Cost management focuses on cost reduction and continuous improvement and change rather than cost containment. Indeed, the term cost reduction could be used instead of cost management but the former is an emotive term. Therefore cost management is preferred. Whereas traditional cost control systems are routinely applied on a continuous basis, cost management tends to be applied on an *ad hoc* basis when an opportunity for cost reduction is identified. Also many of the approaches that are incorporated within the area of cost management do not involve the use of accounting techniques. In contrast, cost control relies heavily on accounting techniques.

Cost management consists of those actions that are taken by managers to reduce costs, some of which are prioritized on the basis of information extracted from the accounting system. Other actions, however, are undertaken without the use of accounting information. They involve process improvements, where an opportunity has been identified to perform processes more effectively and efficiently, and which have obvious cost reduction outcomes. It is important that you are aware of all the approaches that can be used to reduce costs even if these methods do not rely on accounting information. You should also note that although cost management seeks to reduce costs, it should not be at the expense of customer satisfaction. Ideally, the aim is to take actions that will both reduce costs and enhance customer satisfaction.

Learning objectives

After studying this chapter, you should be able to:

- explain the typical pattern of cost commitment and cost incurrence during the three stages of a product's life cycle;
- describe the target costing approach to cost management;
- describe tear-down analysis, value engineering and functional analysis;
- distinguish between target costing and *kaizen* costing;
- describe activity-based cost management;
- distinguish between value added and non-value added activities;
- explain the purpose of a cost of quality report;
- describe how value chain analysis can be used to increase customer satisfaction and manage costs more effectively;
- explain the role of benchmarking within the cost management framework;
- outline the main features of a just-in-time philosophy.

Life-cycle costing

Traditional management accounting control procedures have focused primarily on the manufacturing stage of a product's life cycle. Pre-manufacturing costs, such as research and development and design and post-manufacturing abandonment and disposal costs are treated as period costs. Therefore they are not incorporated in the product cost calculations, nor are they subject to the conventional management accounting control procedures.

Life-cycle costing estimates and accumulates costs over a product's entire life cycle in order to determine whether the profits earned during the manufacturing phase will cover the costs incurred during the pre- and post-manufacturing stages. Identifying the costs incurred during the different stages of a product's life cycle provides an insight into understanding and managing the total costs incurred throughout its life cycle. In particular, life-cycle costing helps management to understand the cost consequences of developing and making a product and to identify areas in which cost reduction efforts are likely to be most effective.

Figure 15.1 illustrates a typical pattern of cost commitment and cost incurrence during the three stages of a product's life cycle – the planning and design stage, the manufacturing stage and the service and abandonment stage. **Committed or locked-in costs** are those costs that have not been incurred but that will be incurred in the future on the basis of decisions that have already been made. It is difficult to significantly alter costs after they have been committed. For example, the product design specifications determine a product's material and labour inputs and the production process. At this stage costs become committed and broadly determine the future costs that will be incurred during the manufacturing stage.

You will see from Figure 15.1 that approximately 80% of a product's costs are *committed* during the planning and design stage. At this stage product designers determine the product's design and the production process. In contrast, the majority of costs are *incurred* at the manufacturing stage, but they have already become locked-in at the planning and design stage and are difficult to alter.

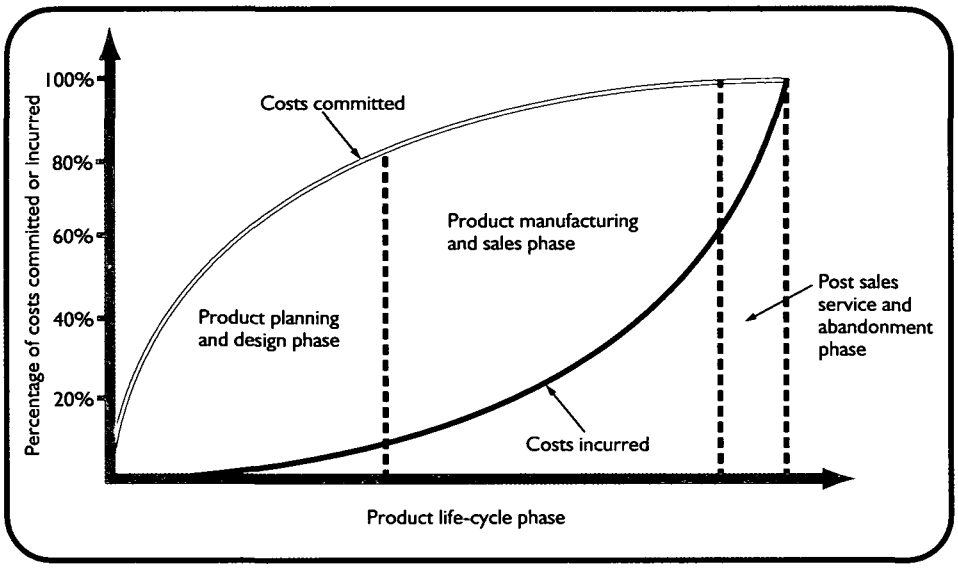
It is apparent from Figure 15.1 that cost management can be most effectively exercised during the planning and design stage and not at the manufacturing stage when the product design and processes have already been determined and costs have been committed. At this latter stage the focus is more on cost containment than cost management. An understanding of life-cycle costs and how they are committed and incurred at different stages throughout a product's life cycle led to the emergence of **target costing**, a technique that focuses on managing costs during a product's planning and design phase.

Target costing

In Chapter 7 we briefly looked at target costing as a mechanism for determining selling prices. We shall now consider how target costing can be used as a cost management tool. Target costing involves the following stages:

Stage 1: Determine the target price which customers will be prepared to pay for the product.
Stage 2: Deduct a target profit margin from the target price to determine the target cost.
Stage 3: Estimate the actual cost of the product.
Stage 4: If estimated actual cost exceeds the target cost investigate ways of driving down the actual cost to the target cost.

FIGURE 15.1 *Product life-cycle phases: relationship between costs committed and costs incurred.*



Target costing is a customer-oriented technique that is widely used by Japanese companies and which has recently been adopted by companies in Europe and the USA. The first stage requires market research to determine the customers' perceived value of the product based on its functions and its attributes (i.e. its functionality), its differentiation value relative to competing products and the price of competing products. The target profit margin depends on the planned return on investment for the organization as a whole and profit as a percentage of sales. This is then decomposed into a target profit for each product which is subsequently deducted from the target price to give the target cost. The target cost is compared with the predicted actual cost. If the predicted actual cost is above the target cost intensive efforts are made to close the gap so that the predicted cost equals the target cost.

A major feature of target costing is that a team approach is adopted to achieve the target cost. The team members include designers, engineers, purchasing, manufacturing, marketing and management accounting personnel. Their aim is to achieve the target cost specified for the product at the prescribed level of functionality and quality. The discipline of a team approach ensures that no particular group is able to impose their functional preferences. For example, design engineers pursuing their flair for design may design into products features that increase a product's costs but which customers do not value, or features that require the use of unique parts when alternative designs requiring standardized parts may meet customer requirements. Similarly, without a multi-functional team approach a marketing emphasis might result in the introduction of product features that customers find attractive, but not essential, and so they are not prepared to pay to have them included in the product's design. Therefore the aim during the product design process is to eliminate product functions that add cost but which do not increase the market price.

In some organizations representatives from the suppliers are included in the design team in order to obtain their expertise. They can often provide suggestions of design changes that will enable standard parts to replace custom-designed parts, thus reducing the product's cost. Alternatively, suppliers have the expertise to suggest alternative parts or components at the lowest cost for a given level of functionality.

The major advantage of adopting target costing is that it is deployed during a product's design and planning stage so that it can have a maximum impact in determining the level of the locked-in costs. It is an iterative process with the design team, which ideally should result in the design team continuing with its product and process design attempts until it finds designs that give an expected cost that is equal or less than the target cost. If the target cost cannot be attained then the product should not be launched. Design teams should not be allowed to achieve target costs by eliminating desirable product functions. Thus, the aim is to design a product with an expected cost that does not exceed target cost and that also meets the target level of functionality. Design teams use tear-down analysis and value engineering to achieve the target cost.

TEAR-DOWN ANALYSIS

Tear-down analysis (also known as reverse engineering) involves examining a competitor's product in order to identify opportunities for product improvement and/or cost reduction. The competitor's product is dismantled to identify its functionality and design and to provide insights about the processes that are used and the cost to make the product. The aim is to benchmark provisional product designs with the designs of competitors and to incorporate any observed relative advantages of the competitor's approach to product design.

VALUE ENGINEERING

Value engineering (also known as value analysis) is a systematic interdisciplinary examination of factors affecting the cost of a product or service in order to devise means of achieving the specified purpose at the required standard of quality and reliability at the target cost. The aim of value engineering is to achieve the assigned target cost by (i) identifying improved product designs that reduce the product's cost without sacrificing functionality and/or (ii) eliminating unnecessary functions that increase the product's costs and for which customers are not prepared to pay extra for.

Value engineering requires the use of functional analysis. This process involves decomposing the product into its many elements or attributes. For example, in the case of automobiles, functions might consist of style, comfort, operability, reliability, quality, attractiveness and many others (Kato, 1993). A price, or value, for each element is determined which reflects the amount the customer is prepared to pay. To obtain this information companies normally conduct surveys and interviews with customers. The total of the values for each function gives the estimated selling price from which the target profit is deducted to derive the target cost. The cost of each function of a product is compared with the benefits perceived by the customers. If the cost of the function exceeds the benefit to the customer, then the function should be either eliminated, modified to reduce its cost, or enhanced in terms of its perceived value so that its value exceeds the cost. Also by focusing on the product's functions, the design team will often consider components that perform the same function in other products, thus increasing the possibility of using standard components and reducing costs.

THE NEED FOR ACCURATE COST MEASUREMENT SYSTEMS

It is important that target costing is supported by an accurate cost system. In particular, cost drivers should be established that are the significant determinants of the costs of the activities so that cause-and-effect allocations are used. Arbitrary cost allocations should be avoided. If arbitrary cost allocations are used the allocation base will not be a significant

determinant of cost. Let us assume that an arbitrary allocation base, say direct labour hours, is used to allocate support costs to products. To reduce the projected cost towards the target cost the target costing team will be motivated to focus on reducing direct labour hours. Why? Because this will result in a smaller proportion of the support costs being assigned to the product. However, the support costs incurred by the organization will not be reduced because there is no cause-and-effect relationship between direct labour hours and the resulting costs. Therefore the target costing exercise will merely result in a reduction in the costs that are allocated to the product but organizational costs will not be reduced. In contrast, if cause-and-effect allocation bases (i.e. cost drivers) are established, reductions in cost driver usage should be followed by a reduction in organizational support costs.

Therefore it is very important that cost systems use cost drivers that are the determinants of costs so that they will motivate designers to take actions that will reduce organizational costs. Decisions taken at the design stage lead to the committed usage of cost drivers which can be difficult to change in the future.

AN ILLUSTRATION OF TARGET COSTING

Example 15.1 is used to illustrate the target costing process. You will have noted from reading the information presented in this example that the projected cost of the product is £700 compared with a target cost of £560. To achieve the target cost the company establishes a project team to undertake an intense target costing exercise. Example 15.1 indicates that the end result of the target costing exercise is a projected cost of £555 which is marginally below the target cost of £560. Let us now look at how the company has achieved the target cost and also how the costs shown in Example 15.1 have been derived.

In response to the need to reduce the projected cost the project team starts by purchasing video cameras from its main competitors and undertaking a tear-down analysis. This process involves dismantling the cameras to provide insights into potential design improvements for the new camera that will be launched. Value engineering is also undertaken with the project team working closely with the design engineers. Their objective is to identify new designs that will accomplish the same functions at a lower cost and also to eliminate any functions that are deemed to be unnecessary. This process results in a simplified design, the reduction in the number of parts and the replacement of some customized parts with standard parts. The outcome of the tear-down analysis and value engineering activities is a significant reduction in the projected direct materials, labour and rework costs, but the revised cost estimates still indicate that the projected cost exceeds the target cost.

Next the team engages in functional analysis. They identify the different elements, functions and attributes of the camera and potential customers are interviewed to ascertain the values that they place on each of the functions. This process indicates that several functions that have been included in the prototype are not valued by customers. The team therefore decide to eliminate these functions. The functional analysis results in further cost reductions being made, principally in the areas of materials and direct labour assembly costs but the revised cost estimates still indicate that the target cost has not been attained.

The team now turn their attention to redesigning the production and support processes. They decide to redesign the ordering and receiving process by reducing the number of suppliers and working closely with a smaller number of suppliers. The suppliers are prepared to enter into contractual arrangements whereby they are periodically given a pre-determined production schedule and in return they will inspect the shipments and guarantee quality prior to delivery. In addition, the marketing, distribution and customer after-sales services relating to the product are subject to an intensive review, and process

EXAMPLE 15.1

The Digital Electronics Company manufactures cameras and video equipment. It is in the process of introducing a new digital video camera. The company has undertaken market research to ascertain the customers' perceived value of the product based on its special features and a comparison with competitors' products. The results of the survey, and a comparison of the new camera with competitors' products and market prices, have been used to establish a target selling price and projected lifetime volume. In addition, cost estimates have been prepared based on the proposed product specification. The company has set a target profit margin of 30% on the proposed selling price and this has been deducted from the target selling price to determine the target cost. The following is a summary of the information that has been presented to management:

Projected lifetime sales volume	300 000 units
Target selling price	£800
Target profit margin (30% of selling price)	£240
Target cost (£800 – £240)	£560
Projected cost	£700

The excess of the projected cost over the target cost results in an intensive target costing exercise. After completing the target costing exercise the projected cost is £555 which is marginally below the target cost of £560. The analysis of the projected cost before and after the target costing exercise is as follows:

	Before		**After**	
	(£)	**(£)**	**(£)**	**(£)**
Manufacturing cost				
Direct material (bought in parts)	390		325	
Direct labour	100		80	
Direct machining costs	20		20	
Ordering and receiving	8		2	
Quality assurance	60		50	
Rework	15		6	
Engineering and design	10	603	8	491
Non-manufacturing costs				
Marketing	40		25	
Distribution	30		20	
After-sales service and warranty costs	27	97	19	64
Total cost		700		555

improvements are made that result in further reductions in costs that are attributable to the camera. The projected cost after undertaking all of the above activities is £555 compared with the target cost of £560 and at this point the target costing exercise is concluded.

Having described the target costing approach that the Digital Electronics Company has used let us now turn our attention to the derivation of the projected costs shown in Example 15.1. The projected cost for direct materials prior to the target costing exercise is £390 but value engineering and the functional analysis have resulted in a reduction in the number of parts that are required to manufacture the video camera. The elimination of most of the unique parts, and the use of standard parts that the company currently

purchases in large volumes, also provides scope for further cost savings. The outcome of the redesign process is a direct material cost of £325.

The simplified product design enables the assembly time to be reduced thus resulting in the reduction of direct labour costs from £100 to £80. The direct machine costs relate to machinery that will be used exclusively for the production of the new product. The estimated cost of acquiring, maintaining and operating the machinery throughout the product's life cycle is £6 million. This is divided by the projected lifetime sales volume of the camera (300 000 units) giving a unit cost of £20. However, it has not been possible to reduce the unit cost because the machinery costs are committed, and fixed, and the target costing exercise has not resulted in a change in the predicted lifetime volume.

Prior to the target costing exercise 80 separate parts were included in the product specification. The estimated number of orders placed for each part throughout the product's life cycle is 150 and the predicted cost per order for the order and receiving activity is £200. Therefore the estimated lifetime costs are £2.4 million (80 parts × 150 orders × £200 per order) giving a unit cost of £8 (£2.4 million/300 000 units). The simplified design, and the parts standardization arising from the functional analysis and the value engineering activities, have enabled the number of parts to be reduced to 40. The redesign of the ordering and receiving process has also enabled the number of orders and the ordering cost to be reduced (the former from 150 to 100 and the latter from £200 to £150 per order). Thus the projected lifetime ordering and receiving costs after the target costing exercise are £600 000 (40 parts × 100 orders × £150 per order) giving a revised unit cost of £2 (£600 000/300 000 units).

Quality assurance involves inspecting and testing the cameras. Prior to the target costing exercise the projected cost was £60 (12 hours at £5 per hour) but the simplified design means that the camera will be easier to test resulting in revised cost of £50 (10 hours at £5 per hour). Rework costs of £15 represent the average rework costs per camera. Past experience with manufacturing similar products suggests that 10% of the output will require rework. Applying this rate to the estimated total lifetime volume of 300 000 cameras results in 30 000 cameras requiring rework at an estimated average cost of £150 per reworked camera. The total lifetime rework cost is therefore predicted to be £4.5 million (30 000 × £150) giving an average cost per unit of good output of £15 (£4.5 million/300 000). Because of the simplified product design the rework rate and the average rework cost will be reduced. The predicted rework rate is now 5% and the average rework cost will be reduced from £150 to £120. Thus, the revised estimate of the total lifetime cost is £1.8 million (15 000 reworked units at £120 per unit) and the projected unit cost is £6 (£1.8 million/300 000 units).

The predicted total lifetime engineering and design costs and other product sustaining costs are predicted to be £3 million giving a unit cost of £10. The simplified design and reduced number of parts enables the lifetime cost to be reduced by 20%, to £2.4 million, and the unit cost to £8. The planned process improvements have also enabled the predicted marketing, distribution and after-sales service costs to be reduced. In addition, the simplified product design and the use of fewer parts has contributed to the reduction to the after-sales warranty costs. However, to keep our example brief the derivation of the non-manufacturing costs will not be presented, other than to note that the company uses an activity-based-costing system. All costs are assigned using cost drivers that are based on established cause-and-effect relationships.

Kaizen costing

In addition to target costing *kaizen* costing is widely used by Japanese organizations as a mechanism for reducing and managing costs. *Kaizen* is the Japanese term for making

improvements to a process through small incremental amounts, rather than through large innovations. The major difference between target and *kaizen* costing is that target costing is applied during the design stage whereas *kaizen* costing is applied during the manufacturing stage of the product life cycle. With target costing the focus is on the product, and cost reductions are achieved primarily through product design. In contrast, *kaizen* costing focuses on the production processes and cost reductions are derived primarily through the increased efficiency of the production process. Therefore the potential cost reductions are smaller with *kaizen* costing because the products are already in the manufacturing stage of their life cycles and a significant proportion of the costs will have become locked-in.

The aim of *kaizen* costing is to reduce the cost of components and products by a pre-specified amount. Monden and Hamada (1991) describe the application of *kaizen* costing in a Japanese automobile plant. Each plant is assigned a target cost reduction ratio and this is applied to the previous year's actual costs to determine the target cost reduction. *Kaizen* costing relies heavily on employee empowerment. They are assumed to have superior knowledge about how to improve processes because they are closest to the manufacturing processes and customers and are likely to have greater insights into how costs can be reduced. Thus, a major feature of *kaizen* costing is that workers are given the responsibility to improve processes and reduce costs. Unlike target costing it is not accompanied by a set of techniques or procedures that are automatically applied to achieve the cost reductions.

Activity-based management

The early adopters of activity-based costing (ABC) used it to produce more accurate product (or service) costs but it soon became apparent to the users that it could be extended beyond purely product costing to a range of cost management applications. The terms activity-based management (ABM) or activity-based cost management (ABCM) are used to describe the cost management applications of ABC. To implement an ABM system only the first three of the four stages described in Chapter 6 for designing an activity-based product costing system are required. They are:

1. identifying the major activities that take place in an organization;
2. assigning costs to cost pools/cost centres for each activity;
3. determining the cost driver for each major activity.

Thus, firms can omit the final stage of assigning activity costs to products and adopt ABC solely for cost management without activity-based product costing. Alternatively, organizations can design an activity-based system that incorporates both ABM and activity-based product costing but note that only the first three stages are required for ABM.

ABM views the business as a set of linked activities that ultimately add value to the customer. It focuses on managing the business on the basis of the activities that make up the organization. ABM is based on the premise that activities consume costs. Therefore by managing activities costs will be managed in the long term. The goal of ABM is to enable customer needs to be satisfied while making fewer demands on organizational resources. Besides providing information on what activities are performed, ABM provides information on the cost of activities, why the activities are undertaken, and how well they are performed.

Traditional budget and control reports analyse costs by types of expense for each responsibility centre. In contrast, ABM analyses costs by activities and thus provides management with information on why costs are incurred and the output from the activity (in terms of cost drivers). Exhibit 15.1 illustrates the difference between the conventional

EXHIBIT 15.1

Customer order processing activity

analysis and the activity-based analysis in respect of customer order processing. The major differences are that the ABM approach reports by *activities* whereas the traditional analysis is by *departments*. Also ABM reporting is by sub-activities but traditional reporting is by expense categories. Another

	(£000s)
Traditional analysis	
Salaries	320
Stationery	40
Travel	140
Telephone	40
Depreciation of equipment	40
	580
ABM analysis	
Preparing quotations	120
Receiving customer orders	190
Assessing the creditworthiness of customers	100
Expediting	80
Resolving customer problems	90
	580

distinguishing feature of ABM reporting is that it often reports information on activities that cross departmental boundaries. For example, different production departments and the distribution department might undertake customer processing activities. They may resolve customer problems by expediting late deliveries. The finance department may assess customer credit worthiness and the remaining customer processing activities might be undertaken by the customer service department. Therefore the total cost of the customer processing activity could be considerably in excess of the costs that are assigned to the customer service department. However, to simplify the presentation it is assumed in Exhibit 15.1 that the departmental and activity costs are identical but if the cost of the customer order processing activity was found to be, say, three times the amount assigned to the customer service department, this would be important information because it may change the way in which the managers view the activity. For example, the managers may give more attention to reducing the costs of the customer processing activity.

It is apparent from an examination of Exhibit 15.1 that the ABM approach provides more meaningful information. It gives more visibility to the cost of undertaking the activities that make up the organization and may raise issues for management action that are not highlighted by the traditional analysis. For example, why is £90 000 spent on resolving customer problems? Attention-directing information such as this is important for managing the cost of the activities.

Johnson (1990) suggests that knowing costs by activities is a catalyst that eventually triggers the action necessary to become competitive. Consider a situation where sales-persons, as a result of costing activities, are informed that it costs £50 to process a customer's order. They therefore become aware that it is questionable to pursue orders with a low sales value. By eliminating many small orders, and concentrating on larger value orders, the demand for customer-processing activities should decrease, and future spending on this activity should be reduced.

Prior to the introduction of ABM most organizations have been unaware of the cost of undertaking the activities that make up the organization. Knowing the cost of activities enables those activities with the highest cost to be highlighted so that they can be prioritized for detailed studies to ascertain whether they can be eliminated or performed more efficiently. To identify and prioritize the potential for cost reduction many organizations have found it useful to classify activities as either value added or non-value added. Definitions of what constitutes value added and non-value added activities vary. A common definition is that a value added activity is an activity that customers perceive as adding usefulness to the product or service they purchase. For example, painting a car would be a value added activity in an organization that manufactures cars. Other definitions are an activity that is being performed as efficiently as possible or an activity that supports the primary objective of producing outputs.

In contrast, a non-value added activity is an activity where there is an opportunity for cost reduction without reducing the product's service potential to the customer. Examples of non-value added activities include inspecting, storing and moving raw materials. The cost of these activities can be reduced without reducing the value of the products to the customers. Non-value added activities are essentially those activities that customers should not be expected to pay for. Reporting the cost of non-value added activities draws management's attention to the vast amount of waste that has been tolerated by the organization. This should prioritize those activities with the greatest potential for cost reduction by eliminating or carrying them out more effectively, such as reducing material movements, improving production flows and taking actions to reduce stock levels. Taking action to reduce or eliminate non-value added activities is given top priority because by doing so the organization permanently reduces the cost it incurs without reducing the value of the product to the customer.

Kaplan and Cooper (1998) criticize the classification of activities by simplistic value added and non-value added categories. They point out, that apart from the extreme examples similar to the ones illustrated above, people cannot consistently define what constitutes a value added or non-value added activity. To reinforce this point they discuss whether the activity of setting up a machine is value added or non-value added. One view is that customers do not perceive performing set-ups as adding usefulness to products and the activity is non-value added. However, without set-ups a plant can only produce single products. If customers value customized or diverse products, changing machine settings from the ability to produce different product varieties creates value for customers. Kaplan and Cooper also point out the demotivating impact when employees are informed that they are performing non-value added activities.

To overcome the above problems Kaplan and Cooper advocate that instead of using a value added/non-value added classification the following simple five point scale should be used to summarize an ABC project team's initial judgement about the current efficiency of an activity:

1. highly efficient, with little (less than 5%) apparent opportunity for improvement;
2. modestly efficient, some (5–15%) opportunity for improvement;
3. average efficiency, good opportunities (15–25%) for improvement;
4. inefficient, major opportunities (25–50%) for improvement;
5. highly inefficient, perhaps should not be done at all; 50–100% opportunity for improvement.

By identifying the cost of activities that make up their organization and classifying them into the above five categories, opportunities for cost reduction can be prioritized. Cost reduction can be achieved by either eliminating the activities, performing them more

efficiently with fewer organizational resources or redesigning them so that they are performed in an entirely different and more cost efficient way. We shall consider how activities can be redesigned later in the chapter.

Our discussion so far has related to the application of ABM during the manufacturing or service phase of a product's life cycle. However, some organizations have used their activity-based costing systems to influence future costs at the design stage within the target costing process. For example, the Tektronix Portable Instruments Division assigned material support expenses using a single cost driver-number of part numbers. The company wanted to encourage design engineers to focus their attention on reducing the number of part numbers, parts and vendors in future generations of products. Product timeliness was seen as a critical success factor and this was facilitated by designs which simplified parts procurement and production processes. The cost system motivated engineers to design simpler products requiring less development time because they had fewer parts and part numbers. The cost system designers knew that most of the material support expenses were not incurred in direct proportion to the single cost driver chosen, but the simplified and imprecise cost system focused attention on factors deemed to be most critical to the division's future success.

A survey of activity-based costing applications by Innes and Mitchell (1995a) indicated that many organizations use cost driver rates as a measure of cost efficiency and performance for the activity concerned. The cost driver rate is computed by dividing the activity costs by the cost driver volume. For example, if the cost of processing 10 000 purchase orders is £100 000, the cost per purchasing order is £10. Assume now that improvements in procedures in the purchasing activity enable costs to be reduced to £80 000. If the same number of orders can be processed with fewer resources the cost of processing an order will be reduced to £8. Reporting and focusing on cost driver rates can thus be used to motivate managers to reduce the cost of performing activities.

There is a danger, however, that cost driver rates can encourage dysfunctional behaviour. An improvement in the cost driver rate can be achieved by splitting some purchase orders and increasing the orders processed to, say, 12 000. Assuming that the cost of the activity remains unchanged at £100 000 the cost per purchasing order will be reduced from £10 to £8.33 if all costs are fixed in the short term. The overall effect is that the workload will be increased and, in the long term, this could result in an increase in costs. Care should therefore be taken to avoid these dysfunctional consequences by using cost driver rates as feedback information to guide employees in improving the efficiency of performing activities. If the measures are interpreted in a recriminatory or threatening manner, there is a danger that they will lead to dysfunctional behaviour.

Business process re-engineering

Business process re-engineering involves examining business processes and making substantial changes to how the organization currently operates. It involves the redesign of how work is done through activities. A business process consists of a collection of activities that are linked together in a co-ordinated manner to achieve a specific objective. For example, material handling might be classed as a business process consisting of separate activities relating to scheduling production, storing materials, processing purchase orders, inspecting materials and paying suppliers.

The aim of business process re-engineering is to improve the key business processes in an organization by focusing on simplification, cost reduction, improved quality and enhanced customer satisfaction. Consider the materials handling process outlined in the above paragraph. The process might be re-engineered by sending the production schedule

direct to nominated suppliers and entering into contractual agreements to deliver the materials in accordance with the production schedule and also guaranteeing their quality by inspecting them prior to delivery. The end result might be the elimination, or a permanent reduction, of the storing, purchasing and inspection activities. These activities are non-value added activities since they represent an opportunity for cost reduction without reducing the products' service potentials to customers.

A distinguishing feature of business process re-engineering is that it involves radical and dramatic changes in processes by abandoning current practices and reinventing completely new methods of performing business processes. The focus is on major changes rather than marginal improvements. A further example of business process re-engineering is moving from a traditional functional plant layout to a just-in-time cellular product layout and adopting a just-in-time philosophy. Adopting a just-in-time (JIT) system and philosophy has important implications for cost management and performance reporting. It is therefore important that you understand the nature of such systems and how they differ from traditional systems, but rather than deviating at this point from our discussion of cost management the description of a JIT system will be deferred until the end of the chapter.

Cost of quality

To compete successfully in today's global competitive environment companies are becoming 'customer-driven' and making customer satisfaction an overriding priority. Customers are demanding ever-improving levels of service regarding cost, quality, reliability, delivery and the choice of innovative new products. Quality has become one of the key competitive variables and this has created the need for management accountants to become more involved in the provision of information relating to the quality of products and services and activities that produce them. In the UK quality related costs have been reported to range from 5 to 15% of total company sales revenue (Plunkett *et al.*, 1985). Eliminating inferior quality can therefore result in substantial savings and higher revenues.

Total quality management (TQM), a term used to describe a situation where *all* business functions are involved in a process of continuous quality improvement, has been adopted by many companies. TQM has broadened, from its early concentration on the statistical monitoring of manufacturing processes, to a customer-oriented process of continuous improvement that focuses on delivering products or services of consistent high quality in a timely fashion. In the 1980s most European and American companies considered quality to be an additional cost of manufacturing, but by the end of the decade they began to realize that quality saved money. The philosophy of emphasizing production volume over quality resulted in high levels of stocks at each production stage in order to protect against shortages caused by inferior quality at previous stages and excessive expenditure on inspection, rework, scrap and warranty repairs. Companies discovered that it was cheaper to produce the items correctly the first time rather than wasting resources by making substandard items that have to be detected, reworked, scrapped or returned by customers.

Management accounting systems can help organizations achieve their quality goals by providing a variety of reports and measures that motivate and evaluate managerial efforts to improve quality. These will include financial and non-financial measures. Many companies are currently not aware of how much they are spending on quality. Managers need to know the costs of quality and how they are changing over time. A cost of quality report should be prepared to indicate the total cost to the organization of producing products or services that do not conform with quality requirements. Four categories of costs should be reported.

1. **Prevention costs** are the costs incurred in preventing the production of products that do not conform to specification. They include the costs of preventive maintenance, quality planning and training and the extra costs of acquiring higher quality raw materials.
2. **Appraisal costs** are the costs incurred to ensure that materials and products meet quality conformance standards. They include the costs of inspecting purchased parts, work in process and finished goods, quality audits and field tests.
3. **Internal failure costs** are the costs associated with materials and products that fail to meet quality standards. They include costs incurred before the product is despatched to the customer, such as the costs of scrap, repair, downtime and work stoppages caused by defects.
4. **External failure costs** are the costs incurred when products and services fail to conform to requirements or satisfy customer needs after they have been delivered. They include the costs of handling customer complaints, warranty replacement, repairs of returned products and the costs arising from a damaged company reputation. Costs within this category can have a dramatic impact on future sales.

Exhibit 15.2 presents a typical cost of quality report. Note that some of the items in the report will have to be estimated. For example, included in the external failure costs category is the forgone contribution from lost sales arising from poor quality. This cost is extremely difficult to estimate. Nevertheless, the lost contribution can be substantial and it is preferable to include an estimate rather than omit it from the report. By expressing each category of costs as a percentage of sales revenues comparisons can be made with previous periods, other organizations and divisions within the same group. Such comparisons can highlight problem areas. For example, comparisons of external failure costs with other companies can provide an indication of the current level of customer satisfaction.

The cost of quality report can be used as an attention-directing device to make the top management of a company aware of how much is being spent on quality-related costs. The report can also draw management's attention to the possibility of reducing total quality costs by a wiser allocation of costs among the four quality categories. For example, by spending more on the prevention costs, the amount of spending in the internal and external failure categories can be substantially reduced, and therefore total spending can be lowered. Also, by designing quality into the products and processes, appraisal costs can be reduced, since far less inspection is required.

Prevention and appraisal costs are sometimes referred to as the **costs of quality conformance** or **compliance** and internal and external failure costs are also known as the **costs of non-conformance** or **non-compliance**. Costs of compliance are incurred with the intention of eliminating the costs of failure. They are discretionary in the sense that they do not have to be incurred whereas costs of non-compliance are the result of production imperfections and can only be reduced by increasing compliance expenditure. The optimal investment in compliance costs is when total costs of quality reach a minimum. This can occur when 100 per cent quality compliance has not been achieved. It is virtually impossible to measure accurately all quality costs (particularly the lost contribution from forgone sales) and determine the optimal investment in conformance costs. However, some people argue that a failure to achieve 100 per cent quality compliance is non-optimal and that a **zero-defects policy** is optimal. With a zero-defects policy the focus is on continuous improvement with the ultimate aim of achieving zero-defects and eliminating all internal and external failure costs.

A zero-defects policy does not use percentages as the unit of measurement because a small percentage defect rate can result in a large number of defects. For example, a 1% defect rate from an output of 1 million units results in 10 000 defective units. To overcome

EXHIBIT 15.2

Cost of quality report

	(£000s)		% of sales (£50 million)
Prevention costs			
Quality training	1 000		
Supplier reviews	300		
Quality engineering	400		
Preventive maintenance	500		
		2 200	4.4
Appraisal costs			
Inspection of materials received	500		
Inspection of WIP and completed units	1 000		
Testing equipment	300		
Quality audits	800		
		2 600	5.2
Internal failure costs			
Scrap	800		
Rework	1 000		
Downtime due to quality problems	600		
Retesting	400	2 800	5.6
External failure costs			
Returns	2 000		
Recalls	1 000		
Warranty repairs	800		
Handling customer complaints	500		
Foregone contribution from lost sales	3 000		
		7 300	14.6
		14 900	29.8

this problem the attainment of a zero-defects goal is measured in parts per million (PPM) so that seemingly small numbers can be transferred into large numbers. Thus, instead of reporting a 1% defect rate, a measure of 10 000 PPM is more likely to create pressure for action and highlight the trend in defect rates. Cost of quality reports provide a useful summary of quality efforts and progress to top management, but at lower management levels non-financial quality measures provide more timely and appropriate target measures for quality improvement. These measures will be discussed in the next chapter.

Cost management and the value chain

Increasing attention is now being given to value-chain analysis as a means of increasing customer satisfaction and managing costs more effectively. The value chain is illustrated in Figure 15.2. It is the linked set of value-creating activities all the way from basic raw

material sources for component suppliers through to the ultimate end-use product or service delivered to the customer. Coordinating the individual parts of the value chain together creates the conditions to improve customer satisfaction, particularly in terms of cost efficiency, quality and delivery. A firm which performs the value chain activities more efficiently, and at a lower cost, than its competitors will gain a competitive advantage. Therefore it is necessary to understand how value chain activities are performed and how they interact with each other. The activities are not just a collection of independent activities but a system of inter-dependent activities in which the performance of one activity affects the performance and cost of other activities.

It is also appropriate to view the value chain from the customer's perspective, with each link being seen as the customer of the previous link. If each link in the value chain is designed to meet the needs of its customers, then end-customer satisfaction should ensue. Furthermore, by viewing each link in the value chain as a supplier–customer relationship, the opinions of the customers can be used to provide useful feedback information on assessing the quality of service provided by the supplier. Opportunities are thus identified for improving activities throughout the entire value chain.

Shank and Govindarajan (1992) point out that focusing on the value chain results in the adoption of a broader strategic approach to cost management. They argue that traditional management accounting adopts an internal focus which, in terms of the value chain, starts too late and stops too soon. Starting cost analysis with purchases misses all the opportunities for exploiting linkages with the firm's suppliers and stopping cost analysis at the point of sale eliminates all opportunities for exploiting linkages with customers. Shank (1989) illustrates how an American automobile company failed to use the value chain approach to exploit links with suppliers and enhance profitability. The company had made significant internal savings from introducing JIT manufacturing techniques, but, at the same time, price increases from suppliers more than offset these internal cost savings. A value chain perspective revealed that 50% of the firm's costs related to purchases from parts suppliers. As the automobile company reduced its own need for buffer stocks, it placed major new strains on the manufacturing responsiveness of suppliers. The increase in the suppliers' manufacturing costs was greater than the decrease in the automobile company's internal costs. Shank states:

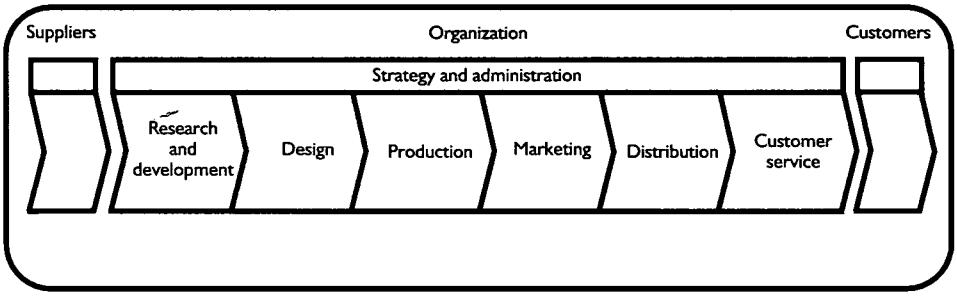
> For every dollar of manufacturing cost the assembly plants saved by moving towards JIT management concepts, the suppliers' plant spent much more than one dollar extra because of schedule instability arising from the introduction of JIT. Because of its narrow value added perspective, the auto company had ignored the impact of its changes on its suppliers' costs. Management had ignored the idea that JIT involves a partnership with suppliers (Shank, 1989: 51).

Similarly, by developing linkages with customers mutually beneficial relationships can be established. For example, Shank and Govindarajan (1992), drawing off research by Hergert and Morris (1989) point out that some container producers in the USA have constructed manufacturing facilities near beer breweries and deliver the containers through overhead conveyers directly onto the customers' assembly lines. This practice results in significant cost reductions for both the container producers and their customers by expediting the transport of empty containers, which are bulky and heavy.

Benchmarking

In order to identify the best way of performing activities and business processes organizations are turning their attention to benchmarking, which involves comparing

FIGURE 15.2 *The value chain.*



key activities with world-class best practices. Benchmarking attempts to identify an activity, such as customer order processing, that needs to be improved and finding a non-rival organization that is considered to represent world-class best practice for the activity and studying how it performs the activity. The objective is to find out how the activity can be improved and ensure that the improvements are implemented.

Benchmarking is cost beneficial since an organization can save time and money avoiding mistakes that other companies have made and/or the organization can avoid duplicating the efforts of other companies. The overall aim should be to find and implement best practice.

Just-in-time systems

Earlier in this chapter it was pointed out that re-organizing business processes and adopting a just-in-time (JIT) system was an illustration of business process engineering but so far a JIT system has not been explained. Given that implementing a JIT system is a mechanism for reducing non-value added costs and long-run costs it is important that you understand the nature of such a system and its cost management implications.

The success of Japanese firms in international markets generated interest among many Western companies as to how this success was achieved. The implementation of **just-in-time (JIT) production methods** was considered to be one of the major factors contributing to this success. The JIT approach involves a continuous commitment to the pursuit of excellence in all phases of manufacturing systems design and operations. The aims of JIT are to produce the required items, at the required quality and in the required quantities, at the precise time they are required. In particular, JIT seeks to achieve the following goals:

- elimination of non-value added activities;
- zero inventory;
- zero defects;
- batch sizes of one;
- zero breakdowns;
- a 100% on-time delivery service.

The above goals represent perfection, and are most unlikely to be achieved in practice. They do, however, offer targets, and create a climate for continuous improvement and excellence. Let us now examine the major features of a JIT manufacturing philosophy.

ELIMINATION OF NON-VALUE ADDED ACTIVITIES

JIT manufacturing is best described as a philosophy of management dedicated to the elimination of waste. Waste is defined as anything that does not add value to a product. The lead or cycle time involved in manufacturing and selling a product consists of process time, inspection time, move time, queue time and storage time. Of these five steps, only process time actually adds value to the product. All the other activities add cost but no value to the product, and are thus deemed non-value added processes within the JIT philosophy. According to Berliner and Brimson (1988), process time is less than 10% of total manufacturing lead time in many organizations in the USA. Therefore 90% of the manufacturing lead time associated with a product adds costs, but no value, to the product. By adopting a JIT philosophy and focusing on reducing lead times, it is claimed that total costs can be significantly reduced. The ultimate goal of JIT is to convert raw materials to finished products with lead times equal to processing times, thus eliminating all non-value added activities.

FACTORY LAYOUT

The first stage in implementing JIT manufacturing techniques is to rearrange the factory floor away from a batch production functional layout towards a product layout using flow lines. With a functional plant layout products pass through a number of specialist departments that normally contain a group of similar machines. Products are processed in large batches so as to minimize the set-up times when machine settings are changed between processing batches of different products. Batches move via different and complex routes through the various departments, travelling over much of the factory floor before they are completed. Each process normally involves a considerable amount of waiting time. In addition, much time is taken transporting items from one process to another. A further problem is that it is not easy at any point in time to determine what progress has been made on individual batches. Therefore detailed cost accumulation records are necessary to track work in progress. The consequences of this complex routing process are high work in progress levels and long manufacturing cycle times.

The JIT solution is to reorganize the production process by dividing the many different products that an organization makes into families of similar products or components. All of the products in a particular group will have similar production requirements and routings. Production is rearranged so that each product family is manufactured in a well-defined production cell based on flow line principles. In a product flow line, specialist departments containing *similar* machines no longer exist. Instead groups of *dissimilar* machines are organized into product or component family flow lines that function like an assembly line. For each product line the machines are placed close together in the order in which they are required by the group of products to be processed. Items in each product family can now move, one at a time, from process to process more easily, thereby reducing work in progress and lead times. The aim is to produce products or components from start to finish without returning to the stock room.

The ideal layout of each flow line is normally U-shaped. This layout, which is called cellular manufacturing, allows the operatives access to a number of machines, thus enabling each to operate several machines. Operatives are trained to operate all machines on the line and undertake routine preventive maintenance. Any worker can stop the production line if a problem arises. The emphasis is on employee empowerment, involving a high level of trust and greater responsibility for workers. It is assumed that workers will perform better when they are given greater authority to control their activities.

JIT manufacturing aims to produce the right parts at the right time, only when they are needed, and only in the quantity needed. This philosophy has resulted in a pull manufacturing system, which means that parts move through the production system based on end-unit demand, focusing on maintaining a constant flow of components rather than batches of work-in-progress (WIP). With the pull system, work on components does not commence until specifically requested by the next process. JIT techniques aim to keep the materials moving in a continuous flow with no stoppages and no storage. Material movements between operations are minimized by eliminating space between work stations and grouping dissimilar machines into manufacturing cells on the basis of product groups and functioning like an assembly line.

The pull system is implemented by monitoring the consumption of parts at each operation stage and using various types of visible signalling systems (known as *Kanbans*) to authorize production and movement of the part to the using location. The producing cell cannot run the parts until authorized to do so. The signalling mechanism usually involves the use of *Kanban* containers. These containers hold materials or parts for movement from one work centre to another. The capacity of *Kanban* containers tends to vary from two to five units. They are just big enough to permit the production line to operate smoothly despite minor interruptions to individual work centres within the cell. To illustrate how the system works consider three machines forming part of a cell where the parts are first processed by machine A before being further processed on machine B and then machine C. The *Kanbans* are located between the machines. As long as the *Kanban* container is not full, the worker at machine A continues to produce parts, placing them in the *Kanban* container. When the container is full the worker stops producing and recommences when a part has been removed from the container by the worker operating machine B. A similar process applies between the operations of machines B and C. This process can result in idle time within certain locations within the cell, but the JIT philosophy considers that it is more beneficial to absorb short-run idle time rather than add to inventory during these periods. During idle time the workers perform preventive maintenance on the machines.

With a pull system problems arising in any part of the system will immediately halt the production line because work centres at the earlier stages will not receive the pull signal (because the *Kanban* container is full) if a problem arises at a later stage. Alternatively, work centres at a later stage will not have their pull signal answered (because of empty *Kanban* containers) when problems arise with work centres at the earlier stages of the production cycle. Thus attention is drawn immediately to production problems so that appropriate remedial action can be taken. This is deemed to be preferable to the approach adopted in a traditional manufacturing system where large stock levels provide a cushion for production to continue. This can lead to a situation where major problems can remain hidden, or deferred indefinitely, rather than triggering a search for immediate long-term solutions.

In contrast, the traditional manufacturing environment is based on a push manufacturing system. With this system, machines are grouped into work centres based on the similarity of their functional capabilities. Each manufactured part has a designated routing, and the preceding process supplies parts to the subsequent process without any consideration being given to whether the next process is ready to work on the parts or not. Hence the use of the term 'push-through system'.

BATCH SIZES OF ONE

Set-up time is the amount of time required to adjust equipment and to retool for a different product. Long set-up and changeover times make the production of batches with a small

number of units uneconomic. However, the production of large batches leads to substantial throughput delays and the creation of high inventory levels. Throughput delays arise because several lengthy production runs are required to process larger batches through the factory. The JIT philosophy is to reduce and eventually eliminate set-up times. For example, by investing in advanced manufacturing technologies some machine settings can be adjusted automatically instead of manually. Alternatively, some set-up times can be eliminated entirely by redesigning products so that machines do not have to be reset each time a different product has to be made.

If set-up times are approaching zero, this implies that there are no advantages in producing in batches. Therefore the optimal batch size can be one. With a batch size of one, the work can flow smoothly to the next stage without the need for storage and to schedule the next machine to accept this item. In many situations set-up times will not be approaching zero, but by significantly reducing set-up times, small batch sizes will be economical.

JIT PURCHASING ARRANGEMENTS

The JIT philosophy also extends to adopting JIT purchasing techniques, whereby the delivery of materials immediately precedes their use. By arranging with suppliers for more frequent deliveries, stocks can be cut to a minimum. Considerable savings in material handling expenses can be obtained by requiring suppliers to inspect materials before their delivery and guaranteeing their quality. This improved service is obtained by giving more business to fewer suppliers and placing longer-term purchasing orders. Therefore the supplier has an assurance of long-term sales, and can plan to meet this demand.

Companies that have implemented JIT purchasing techniques claim to have substantially reduced their investment in raw materials and work in progress stocks. Other advantages include a substantial saving in factory space, large quantity discounts, savings in time from negotiating with fewer suppliers and a reduction in paperwork arising from issuing blanket long-term orders to a few suppliers rather than individual purchase orders to many suppliers.

JIT AND MANAGEMENT ACCOUNTING

Management accountants in many organizations have been strongly criticized because of their failure to alter the management accounting system to reflect the move from a traditional manufacturing to a just-in-time manufacturing system. Conventional management accounting systems can encourage behaviour that is inconsistent with a just-in-time manufacturing philosophy. Management accounting must support just-in-time manufacturing by monitoring, identifying and communicating to decision-makers any delay, error and waste in the system. Modern management accounting systems are now placing greater emphasis on providing information on supplier reliability, set-up times, throughput cycle times, percentage of deliveries that are on time and defect rates. All of these measures are critical to supporting a just-in-time manufacturing philosophy and are discussed in more detail in the next chapter.

Because JIT manufacturing systems result in the establishment of production cells that are dedicated to the manufacturing of a single product or a family of similar products many of the support activities can be directly traced to the product dedicated cells. Thus, a high proportion of costs can be directly assigned to products. Therefore the benefits from implementing ABC product costing will be lower in JIT organizations.

Summary

Traditional cost control systems emphasize cost containment whereas cost management focuses on cost reduction. Cost management consists of those actions that are taken by managers to reduce costs, some of which are prioritized using information extracted from the accounting system. Other actions, however, are undertaken without the use of accounting information. They involve process improvements, where an opportunity has been identified to perform processes more effectively and efficiently, and which have obvious cost reduction outcomes. Several approaches have been described within this chapter that fall within the cost management area.

Life-cycle costing estimates and accumulates costs over a product's entire life cycle in order to determine whether the profits earned during the manufacturing phase will cover the costs incurred during the pre- and post-manufacturing stages. Approximately 80% of a product's costs are committed during the planning and design stage. At this stage product designers determine the product's design and the production process. In contrast, the majority of costs are incurred at the manufacturing stage, but they have already become locked-in at the planning and design stage and are difficult to alter. Cost management can be most effectively exercised during the planning and design stage and not at the manufacturing stage when the product design and processes have already been determined and costs have been committed.

Target costing is a customer-oriented technique that is widely used by Japanese companies and which has recently been adopted by companies in Europe and the USA. The first stage requires market research to determine the target selling price for a product. Next a standard or desired profit margin is deducted to establish a target cost for the product. The target cost is compared with the predicted actual cost. If the predicted actual cost is above the target cost intensive efforts are made to close the gap. Value engineering and functional analysis are used to drive the predicted actual cost down to the target cost. The major advantage of adopting target costing is that it is deployed during a product's design and planning stage so that it can have a maximum impact in determining the level of the locked-in costs.

In addition to target costing *kaizen costing* is widely used by Japanese organizations as a mechanism for reducing and managing costs. The major difference between target and *kaizen* costing is that target costing is applied during the design stage whereas *kaizen* costing is applied during the manufacturing stage of the product life cycle. With target costing the focus is on the product and cost reductions are achieved primarily through product design. In contrast, *kaizen* costing focuses on the production processes and cost reductions are derived primarily through the increased efficiency of the production process. The aim of *kaizen* costing is to reduce the cost of components and products by a pre-specified amount. A major feature is that workers are given the responsibility to improve processes and reduce costs. Unlike target costing it is not accompanied by a set of techniques or procedures that are automatically applied to achieve the cost reductions.

Activity-based management (ABM) focuses on managing the business on the basis of the activities that make up the organization. It is based on the premise that activities consume costs. Therefore by managing activities costs will be managed in the long term. The goal of ABM is to enable customer needs to be satisfied while making fewer demands on organization resources. Prior to the introduction of ABM most organizations have been unaware of the cost of undertaking the activities that make up the organization. Knowing the cost of activities enables those activities with the highest cost to be highlighted so that they can be prioritized for detailed studies to ascertain whether they can be eliminated or performed more efficiently. To identify and prioritize the potential for cost reduction many organizations have found it useful to classify activities as either value added or non-value added. A value added activity is an activity that customers perceive as adding usefulness to the product or service they purchase whereas a non-value added activity is an activity where there is an opportunity for cost reduction without reducing the product's service potential to the customer. Taking action to reduce or eliminate non-value added activities is

given top priority because by doing so the organization permanently reduces the cost it incurs without reducing the value of the product to the customer.

A business process consists of a collection of activities that are linked together in a coordinated manner to achieve a specific objective. *Business process re-engineering* involves examining business processes and making substantial changes to how the organization currently operates. The aim is to improve the key business processes in an organization by focusing on simplification, cost reduction, improved quality and enhanced customer satisfaction.

A *cost of quality report* indicates the total cost to the organization of producing products or services that do not conform with quality requirements. Quality costs are analysed by four cat-egories for reporting purposes (prevention, appraisal, and internal and external failure costs). The report draws management's attention to the possibility of reducing total quality costs by a wiser allocation of costs among the four quality categories.

Increasing attention is now being given to *value-chain analysis* as a means of increasing customer satisfaction and managing costs more effectively. The value chain is the linked set of value-creating activities all the way from basic raw material sources from component suppliers through to the ultimate end-use product or service delivered to the customer. Understanding how value-chain activities are performed and how they interact with each other creates the conditions to improve customer satisfaction, particularly in terms of cost efficiency, quality and delivery.

Benchmarking involves comparing key activities with world-class best practices by identifying an activity that needs to be improved, finding a non-rival organization that is considered to represent world-class best practice for the activity, and studying how it performs the activity. The objective is to establish how the activity can be improved and ensure that the improvements are implemented.

In recent years many companies have sought to eliminate and/or reduce the costs of non-value added activities by introducing *just-in-time (JIT) systems*. The aims of a JIT system are to produce the required items, at the required quality and in the required quantities, at the precise time they are required. In particular, JIT aims to eliminate waste by minimizing inventories and reducing cycle or throughput times (i.e. the time elapsed from when customers place an order until the time when they receive the desired product or service). Adopting a JIT manufacturing system involves moving from a batch production functional layout to a cellular flow line manufacturing system.

Key Terms and Concepts

activity-based cost management (p. 462)
activity-based management (p. 462)
appraisal costs (p. 467)
batch production functional layout (p. 471)
benchmarking (p. 469)
business process re-engineering (p. 465)
cellular manufacturing (p. 471)
committed costs (p. 456)
costs of non-compliance (p. 467)
costs of non-conformance (p. 467)
costs of quality compliance (p. 467)
costs of quality conformance (p. 467)
cost of quality report (p. 466)
external failure costs (p. 467)
functional analysis (p. 458)
internal failure costs (p. 467)
just-in-time (JIT) production methods (p. 470)
kaizen costing (p. 461)
Kanbans (p. 472)
life-cycle costing (p. 456)
locked-in costs (p. 456)
non-value added activity (p. 464)
prevention costs (p. 467)
product flow line (p. 471)
pull manufacturing system (p. 472)
push manufacturing system (p. 472)
reverse engineering (p. 458)
target costing (p. 456)
tear-down analysis (p. 458)
total quality management (p. 466)
value added activity (p. 464)
value analysis (p. 458)
value-chain analysis (p. 468)
value engineering (p. 458)
zero-defects policy (p. 467)

Recommended Reading

You should refer to Kato (1993) and Tani *et al.* (1994) for a description of target costing in Japanese companies. A more detailed description of activity-based cost management can be found in chapter 8 of Kaplan and Cooper (1998). For a description of the application of value-chain analysis to cost management see Shank and Govindarajan (1992).

Review Problem

Calton Ltd make and sell a single product. The existing product unit specifications are as follows:

Direct material X:	8 sq. metres at £4 per sq. metre
Machine time:	0.6 running hours
Machine cost per gross hour:	£40
Selling price:	£100

Calton Ltd require to fulfil orders for 5000 product units per period. There are no stocks of product units at the beginning or end of the period under review. The stock level of material X remains unchanged throughout the period.

The following additional information affects the costs and revenues:

1. 5% of incoming material from suppliers is scrapped due to poor receipt and storage organization.
2. 4% of material X input to the machine process is wasted due to processing problems.
3. Inspection and storage of material X costs £0.10 pence per sq. metre purchased.
4. Inspection during the production cycle, calibration checks on inspection equipment, vendor rating and other checks cost £25 000 per period.
5. Production quantity is increased to allow for the downgrading of 12.5% of product units at the final inspection stage. Downgraded units are sold as 'second quality' units at a discount of 30% on the standard selling price.
6. Production quantity is increased to allow for returns from customers which are replaced free of charge. Returns are due to specification failure and account for 5% of units initially delivered to customers. Replacement units incur a delivery cost of £8 per unit. 80% of the returns from customers are rectified using 0.2 hours of machine running time per unit and are re-sold as 'third quality' products at a discount of 50% on the standard selling price. The remaining returned units are sold as scrap for £5 per unit.
7. Product liability and other claims by customers is estimated at 3% of sales revenue from standard product sales.
8. Machine idle time is 20% of gross machine hours used (i.e. running hours = 80% of gross hours).
9. Sundry costs of administration, selling and distribution total £60 000 per period.
10. Calton Ltd is aware of the problem of excess costs and currently spends £20 000 per period in efforts to prevent a number of such problems from occurring.

Calton Ltd is planning a quality management programme which will increase its excess cost prevention expenditure from £20 000 to £60 000 per period. It is estimated that this will have the following impact:

1. A reduction in stores losses of material X to 3% of incoming material.
2. A reduction in the downgrading of product units at inspection to 7.5% of units inspected.

3. A reduction in material X losses in process to 2.5% of input to the machine process.
4. A reduction in returns of products from customers to 2.5% of units delivered.
5. A reduction in machine idle time to 12.5% of gross hours used.
6. A reduction in product liability and other claims to 1% of sales revenue from standard product sales.
7. A reduction in inspection, calibration, vendor rating and other checks by 40% of the existing figure.
8. A reduction in sundry administration, selling and distribution costs by 10% of the existing figure.
9. A reduction in machine running time required per product unit to 0.5 hours.

Required:

(a) Prepare summaries showing the calculation of (i) total production units (pre-inspection), (ii) purchases of material X (sq. metres), (iii) gross machine hours. In each case the figures are required for the situation both before and after the implementation of the additional quality management programme, in order that the orders for 5000 product units may be fulfilled. (10 marks)

(b) Prepare profit and loss accounts for Calton Ltd for the period showing the profit earned both before and after the implementation of the additional quality management programme. (10 marks)

(c) Comment on the relevance of a quality management programme and explain the meaning of the terms internal failure costs, external failure costs, appraisal costs and prevention costs giving examples for each, taken where possible from the information in the question. (10 marks)

(Total 30 marks)

ACCA II

Solution to Review Problem

(a) (i) *Total production units (pre-inspection)*

	Existing situation	**Revised situation**
Total sales requirements	5000	5000
Specification losses (5%)	250 (2.5%)	125
	5250	5125
Downgrading at inspection (12.5/87.5 × 5250)	750 (7.5/92.5 × 5125)	416
Total units before inspection (100/87.5 × 5250)	6000 (100/92.5 × 5125)	5541

(ii) *Purchase of material X (m^2)*

Materials required to meet pre-inspection production requirements (6000 × 8 m^2)	48 000 (5541 × 8 m^2)	44 328
Processing losses (4/96 × 48 000)	2 000 (22.5/97.5 × 44 328)	1 137
Input to the process (100/96 × 48 000)	50 000	45 465
Scrapped materials (5/95 × 50 000)	2 632 (3/97 × 45 465)	1 406
Total purchases (100/95 × 50 000)	52 632 (100/97 × 45 465)	46 871

(iii) *Gross machine hours*

Initial requirements (600 × 0.6)	3600 (5541 × 0.5 hrs)	2771
Rectification units (80% × 250 × 0.2 hrs)	40 (80% × 125 × 0.2 hrs)	20
	3640	2791
Idle time (20/80 × 3640)	910 (12.5/87.5 × 2791)	399
Gross machine hrs (100/80 × 3640)	4550 (100/87.5 × 2791)	3190

(b) *Profit and Loss Accounts*

	Existing situation (£)		Revised situation (£)
Sales revenue:			
First quality 5000 × £100	500 000	5000 × £100	500 000
Second quality 750 × £70	52 500	416 × £70	29 120
Third quality 200 × £50	10 000	100 × £50	3 000
Scrap sales 50 × £5	250	25 × £5	125
	562 750		534 245
Costs			
Material X (52 632 × £4)	210 528	46 871 × £4	187 484
Insp/storage costs (52 632 × £0.10)	5 263	46 871 × £0.10	4 687
Machine costs (4550 × £40)	182 000	3190 × £40	127 600
Delivery of replacements (250 × £8)	2 000	125 × £8	1 000
Inspection and other costs	25 000	60% × £25 000	15 000
Product liability (3% × £500 000)	15 000	1% × 500 000	5 000
Sundry fixed costs	60 000	90% × £60 000	54 000
Prevention programme costs	20 000		60 000
	519 791		454 771
Net proft	42 959		79 474

(c) A cost of quality report is a major feature of a quality control programme. The report should indicate the total cost to the organization of producing products that do not conform to quality requirements. The cost of quality report should analyse costs by prevention costs, appraisal costs, internal failure costs and external failure costs. You should refer to Chapter 15 for a description of each of these cost categories.

The cost of quality report can be used as an attention-directing device to make top management aware of how much is being spent on quality-related costs. The report can be used to draw management's attention to the possibility of reducing total quality costs by a wiser allocation of costs among the four quality categories. For example, by spending more on prevention costs, the amount of spending in the internal and external failure categories can be substantially reduced, and therefore total spending can be lowered.

Examples of each of the four cost categories for Calton Ltd are as follows:

Internal failure costs: Incoming materials scrapped due to poor receipt and storage organization, and downgrading products at the final inspection stage.

External failure costs: Free replacement of goods, product liability claims, loss of customer goodwill.

Appraisal costs:	Inspection checks of incoming materials and completed output.
Prevention costs:	Training costs in quality prevention and preventative maintenance.

Questions

15.1

The implementation of budgeting in a world class manufacturing environment may be affected by the impact of (i) a total quality ethos (ii) a just-in-time philosophy and (iii) an activity based focus.

Briefly describe the principles incorporated in EACH of (i) to (iii) and discuss ways in which each may result in changes in the way in which budgets are prepared as compared to a traditional incremental budgeting system. (15 marks)

ACCA

15.2

New techniques are often described as contributing to cost reduction, but when cost reduction is necessary it is not obvious that such new approaches are used in preference to more established approaches. Three examples are:

	new technique	compared with	*established approach*
(a)	benchmarking		interfirm comparison
(b)	activity based budgeting		zero base budgeting
(c)	target costing		continuous cost improvement

You are required, for two of the three newer techniques mentioned above:

- to explain its objectives
- to explain its workings
- to differentiate it from the related approach identified
- to explain how it would contribute to a cost reduction programme. (20 marks)

CIMA

15.3

Kaplan ('Relevance Regained', *Management Accounting*, September 1988) states the view that the 'time-honoured traditions of cost accounting' are 'irrelevant, misleading and wrong'. Variance analysis, product costing and operational control are cited as examples of areas where information provided by management accountants along traditional lines could well fail to meet today's needs of management in industry.

You are required to

(a) state what you consider to be the main requirements for effective operational control and product costing in modern industry; (10 marks)

(b) identify which 'traditional cost accounting' methods in the areas quoted in (a) *may be considered* to be failing to supply the appropriate information to management, and explain why; (9 marks)

(c) recommend changes to the 'traditional cost accounting' methods and information which would serve to meet the problems identified in (b). (6 marks)

(Total 25 marks)

CIMA

15.4

> 'ABC is still at a relatively early stage of its development and its implications for process control may in the final analysis be more important than its product costing implications. It is a good time for every organisation to consider whether or not ABC is appropriate to its particular circumstances.
>
> J Innes & F Mitchell, *Activity Based Costing, A Review with Case Studies*, CIMA, 1990.

You are required:

(a) to contrast the feature of organisations which would benefit from ABC with those which would not; (8 marks)

(b) to explain in what ways ABC may be used to manage costs, and the limitations of these approaches; (11 marks)

(c) to explain and to discuss the use of target costing to control product costs. (6 marks)

(Total 25 marks)

CIMA

15.5

A company is proposing the introduction of an activity-based costing (ABC) system as a basis for much of its management accounting information.

(a) Briefly describe how ABC is different from a traditional absorption approach to costing and explain why it was developed. (8 marks)

(b) Discuss the advantages and limitations of this 'approach based on activities' for management accounting information in the context of:
   (i) preparing plans and budgets
   (ii) monitoring and controlling operations
   (iii) decision-making, for example, product deletion decisions. (12 marks)

(Total 20 marks)

ACCA

15.6

'Japanese companies that have used just-in-time (JIT) for five or more years are reporting close to a 30% increase in labour productivity, a 60% reduction in inventories, a 90% reduction in quality rejection rates, and a 15% reduction in necessary plant space. However, implementing a just-in-time system does not occur overnight. It took Toyota over twenty years to develop its system and realize significant benefits from it.' *Source*: Sumer C. Aggrawal, *Harvard Business Review* (9/85)

Requirements:

(a) Explain how the benefits claimed for JIT in the above quotation are achieved and why it takes so long to achieve those benefits. (15 marks)

(b) Explain how management information systems in general (and management accounting systems in particular) should be developed in order to facilitate and make best use of JIT. (10 marks)

(Total 25 marks)

CIMA

15.7

Within a diversified group, one division, which operates many similar branches in a service industry, has used internal benchmarking and regards it as very useful.

Group central management is now considering the wider use of benchmarking.

Requirement:

(a) Explain the aims, operation, and limitations of internal benchmarking, and explain how external benchmarking differs in these respects. (10 marks)

(b) A multinational group wishes to internally benchmark the production of identical components made in several plants in different countries. Investments have been made with some plants in installing new Advanced Manufacturing Technology (AMT) and supporting this with manufacturing management systems such as Just in Time (JIT) and Total Quality Management (TQM). Preliminary comparisons suggest that the standard cost in plants using new technology is no lower than that in plants using older technology.

Requirement:

Explain possible reasons for the similar standard costs in plants with differing technology. Recommend appropriate benchmarking measures, recognising that total standard costs may not provide the most useful measurement of performance. (10 marks)

(Total 20 marks)

CIMA

15.8

You are Financial Controller of a medium-sized engineering business. This business was family-owned and managed for many years but has recently been acquired by a large group to become its Engineering Division.

The first meeting of the management board with the newly appointed Divisional Managing Director has not gone well.

He commented on the results of the division:

- Sales and profits were well below budget for the month and cumulatively for the year, and the forecast for the rest of the year suggested no improvement.
- Working capital was well over budget.
- Even if budget were achieved the return on capital employed was well below group standards.

He proposed a Total Quality Management (TQM) programme to change attitudes and improve results.

The initial responses of the managers to these comments were:

- The Production Director said there was a limit to what was possible with obsolete machines

and facilities and only a very short-term order book.

- The Sales Director commented that it was impossible to get volume business when deliveries and quality were unreliable and designs out of date.
- The Technical Director said that there was little point in considering product improvements when the factory could not be bothered to update designs and the sales executives were reluctant to discuss new ideas with new potential customers.

You have been asked to prepare reports for the next management board meeting to enable a more constructive discussion.

You are required:

(a) to explain the critical success factors for the implementation of a programme of Total Quality Management. Emphasize the factors that are crucial in changing attitudes from those quoted; (11 marks)

(b) to explain how you would measure quality cost, and how the establishment of a system of measuring quality costs would contribute to a TQM programme. (9 marks)

(Total 20 marks)

CIMA

15.9 Feedback control theory and product quality measurement

(a) In control theory, a 'feedback control' mechanism is one which supplies information to determine whether corrective action should be taken to re-establish control of a system.

You are required to:

(i) illustrate by means of a diagram how the feedback mechanism operates within a control system, adding a commentary describing how the system functions; (9 marks)

(ii) distinguish 'feedforward' from 'feedback' control, giving *two* examples of *each* from within management accounting. (4 marks)

(b) Achievement of a high standard of product quality has become a major issue in modern manufacturing industry.

In support of programmes aimed at achieving acceptable quality standards, some companies have introduced detailed 'quality cost' measurement schemes.

In others, the philosophy has been that no measurement procedures should be devoted especially to the measurement of quality costs: quality cost schemes designed to measure performance in this area are considered to add to administrative burdens; in reality 'quality' should be the expected achievement of the required product specification.

(i) set out a classification of quality costs which would be useful for reporting purposes. Give examples of actual costs which would be represented in each classification; (7 marks)

(ii) discuss the reality of the differences of philosophy expressed in the opening statement. Do they represent fundamental differences or may they be reconciled? (5 marks)

(Total 25 marks)

CIMA

15.10 Traditional and activity-based budget statements and life-cycle costing

The budget for the Production, Planning and Development Department of Obba plc, is currently prepared as part of a traditional budgetary planning and control system. The analysis of costs by expense type for the period ended 30 November 2000 where this system is in use is as follows:

Expense type	Budget %	Actual %
Salaries	60	63
Supplies	6	5
Travel cost	12	12
Technology cost	10	7
Occupancy cost	12	13

The total budget and actual costs for the department for the period ended 30 November 2000 are £1 000 000 and £1 060 000 respectively.

The company now feels that an Activity Based Budgeting approach should be used. A number of activities have been identified for the Production, Planning and Development Department. An investigation has indicated that total budget and actual costs should be attributed to the activities on the following basis:

	Budget %	Actual %
Activities		
1. Routing/scheduling – new products	20	16
2. Routing/scheduling – existing products	40	34
3. Remedial re-routing/scheduling	5	12
4. Special studies – specific orders	10	8
5. Training	10	15
6. Management & administration	15	15

Required:

(a) (i) Prepare *two* budget control statements for the Production Planning and Development Department for the period ended 30 November 2000 which compare budget with actual cost and show variances using
1. a traditional expense based analysis and
2. an activity based analysis. (6 marks)

(ii) Identify and comment on *four* advantages claimed for the use of Activity Based Budgeting over traditional budgeting using the Production Planning and Development example to illustrate your answer. (12 marks)

(iii) Comment on the use of the information provided in the activity based statement which you prepared in (i) in activity based performance measurement and suggest additional information which would assist in such performance measurement. (8 marks)

(b) Other activities have been identified and the budget quantified for the three months ended 31 March 2001 as follows:

Activities	Cost Driver Unit basis	Units of Cost Driver	Cost (£000)
Product design	design hours	8 000	2000 (see note 1)
Purchasing	purchase orders	4 000	200
Production	machine hours	12 000	1500 (see note 2)
Packing	volume (cu.m.)	20 000	400
Distribution	weight (kg)	120 000	600

Note 1: this includes all design costs for new products released this period.

Note 2: this includes a depreciation provision of £300 000 of which £8000 applies to 3 months depreciation on a straight line basis for a new product (NPD). The remainder applies to other products.

New product NPD is included in the above budget. The following additional information applies to NPD:

(i) Estimated total output over the product life cycle: 5000 units (4 years life cycle).

(ii) Product design requirement: 400 design hours

(iii) Output in quarter ended 31 March 2001: 250 units

(iv) Equivalent batch size per purchase order: 50 units

(v) Other product unit data: production time 0.75 machine hours: volume 0.4 cu. metres; weight 3 kg.

Required:

Prepare a unit overhead cost for product NPD using an activity based approach which includes an appropriate share of life cycle costs using the information provided in (b) above. (9 marks)

(Total 35 marks)

ACCA

16

Strategic management accounting

During the late 1980s criticisms of traditional management accounting practices were widely publicized and new approaches were advocated which are more in tune with today's competitive and business environment. In particular, strategic management accounting has been identified as a way forward. However, there is still no comprehensive framework as to what constitutes strategic management accounting. In this chapter we shall examine the elements of strategic management accounting and describe the different contributions that have been made to its development.

One of the elements of strategic management accounting involves the provision of information for the formulation of an organization's strategy and managing strategy implementation. To encourage behaviour that is consistent with an organization's strategy, attention is now being given to developing an integrated framework of performance measurement that can be used to clarify, communicate and manage strategy. In the latter part of this chapter recent developments that seek to incorporate performance measurement within the strategic management process are described.

Some of the issues explored in this chapter relating to strategic management accounting are complex and may not be appropriate for readers pursuing an introductory management accounting course. The sections that relate to the more advanced material are marked with the symbol AR and a vertical red line is used to highlight the section. If you are pursuing an introductory course you may prefer to omit the advanced reading sections.

Learning objectives

After studying this chapter, you should be able to:

- describe the different elements of strategic management accounting;
- describe the balanced scorecard;
- explain each of the four perspectives of the balanced scorecard;
- provide illustrations of performance measures for each of the four perspectives;
- describe the distinguishing features of performance measurement in service organizations.

What is strategic management accounting?

AR For many years **strategic management accounting** has been advocated as a potential area of development that would enhance the future contribution of management accounting. In the late 1980s the UK Chartered Institute of Management Accountants commissioned an investigation to review the current state of development of management accounting. The findings were published in a report entitled *Management Accounting: Evolution not Revolution*, authored by Bromwich and Bhimani

(1989). In the report, and a follow-up report (*Management Accounting: Pathways to Progress*, 1994) Bromwich and Bhimani drew attention to strategic management accounting as an area for future development. Despite the publicity that strategic management accounting has received there is still no comprehensive conceptual framework of what strategic management accounting is (Tomkins and Carr, 1996). For example, Coad (1996) states:

> Strategic management accounting is an emerging field whose boundaries are loose and, as yet, there is no unified view of what it is or how it might develop. The existing literature in the field is both disparate and disjointed (Coad, 1996: 392)

Innes (1998) defines strategic management accounting as the provision of information to support the strategic decisions in organizations. Strategic decisions usually involve the longer-term, have a significant effect on the organization and, although they may have an internal element, they also have an external element. Adopting this definition suggests that the provision of information that supports an organization's major long-term decisions, such as the use of activity-based costing information for product profitability analysis, falls within the domain of strategic management accounting. This view is supported by Cooper and Kaplan (1988) who state that strategic accounting techniques are designed to support the overall competitive strategy of the organization, principally by the power of using information technology to develop more refined product and service costs.

Other writers, however, have adopted definitions that emphasize that strategic management accounting is externally focused. Simmonds (1981, 1982), who first coined the term strategic management accounting, views it as the provision and analysis of management accounting data about a business and its competitors which is of use in the development and monitoring of the strategy of that business. He views profits as emerging not from internal efficiencies but from the firm's competitive partitioning in its market. More recently, Bromwich (1990), a principal advocate of strategic management accounting, has provided the following definition:

> The provision and analysis of financial information on the firm's product markets and competitors' costs and cost structures and the monitoring of the enterprise's strategies and those of its competitors in these markets over a number of periods (Bromwich, 1990: 28).

Because of the lack of consensus on what constitutes strategic management accounting Lord (1996) reviewed the literature and identified several strands that have been used to characterize strategic management accounting. They include:

1. The extension of traditional management accounting's internal focus to include external information about competitors.
2. The relationship between the strategic position chosen by a firm and the expected emphasis on management accounting (i.e. accounting in relation to strategic positioning).
3. Gaining competitive advantage by analysing ways to decrease costs and/or enhance the differentiation of a firm's products, through exploiting linkages in the value chain and optimizing cost drivers.

Let us now examine each of the above characteristics in more detail.

EXTERNAL INFORMATION ABOUT COMPETITORS

Much of the early work relating to strategic management accounting can be attributed to the writings of Simmonds (1981, 1982 and 1986). He argued that management

accounting should be more outward looking and should help the firm evaluate its competitive position relative to the rest of the industry by collecting data on costs and prices, sales volumes and market shares, and cash flows and resources availability for its main competitors. To protect an organization's strategic position and determine strategies to improve its future competitiveness managers require information that indicates by whom, by how much and why they are gaining or being beaten. This information provides advance warning of the need for a change in competitive strategy.

Simmonds also stressed the importance of the learning curve as a means of obtaining strategic advantage by forecasting cost reductions and consequently selling price reductions of competitors. He also drew attention to the importance of early experience with a new product as a means of conferring an unbeatable lead over competitors. The leading competitor should be able to reduce its selling price for the product (through the learning curve effect) which should further increase its volume and market share and eventually force some lagging competitors out of the industry.

An organization may also seek to gain strategic advantage by its pricing policy. Here the management accounting function can assist by attempting to assess each major competitor's cost structure and relate this to their prices. In particular, Simmonds suggests that it may be possible to assess the cost–volume–profit relationship of competitors in order to predict their pricing responses. He states:

> Clearly, competitor reactions can substantially influence the outcome of a price move. Moreover, likely reactions may not be self-evident when each competitor faces a different cost–volume–profit situation. Competitors may not follow a price lead nor even march in perfect step as they each act to defend or build their own positions. For an adequate assessment of the likelihood of competitor price reactions, then, some calculation is needed of the impact of possible price moves on the performance of individual competitors. Such an assessment in turn requires an accounting approach that can depict both competitor cost–volume–profit situations and their financial resources (Simmonds: 1982: 207).

Besides dealing with costs and prices Simmonds focused on volume and market share. By monitoring movements in market share for its major products, an organization can see whether it is gaining or losing position, and an examination of relative market shares will indicate the strength of different competitors. Including market-share details in management accounting reports helps to make management accounting more strategically relevant. Competitor information may be obtained through public, formal sources, such as published reports and the business press, or through informal channels, such as the firm's salesforce, its customers and its suppliers.

Simmonds (1981) also suggested some changes and additions to traditional management accounting reporting systems in order to include the above information. Market share statements could be incorporated into management accounts. In addition, budgets could be routinely presented in a strategic format with columns for Ourselves, Competitor A, Competitor B, etc. According to Ward (1992) very few firms regularly report competitor information.

ACCOUNTING IN RELATION TO STRATEGIC POSITIONING

Various classifications of strategic positions that firms may choose have been identified in the strategic management literature. Porter (1985) suggests that a firm has a choice of three generic strategies in order to achieve sustainable competitive advantage. They are:

- *cost leadership*, whereby an enterprise aims to be the lowest-cost producer within the industry;

- *differentiation*, whereby the enterprise seeks to offer some unique dimension in its products/service that is valued by customers and which can command a premium price;
- *focus*, which involves seeking advantage in a narrow segment of the market either by way of cost leadership or by product differentiation.

Miles and Snow (1978) distinguish between *defenders* and *prospectors*. Defenders operate in relatively stable areas, have limited product lines and employ a mass production routine technology. They compete through making operations efficient through cost, quality and service leadership, and engage in little product/market research. Prospectors compete through new product innovations and market development and are constantly looking for new market opportunities. Hence, they face a more uncertain task environment.

The accounting literature suggests that firms will place more emphasis on particular accounting techniques, depending on which strategic position they adopt. For example, Simons (1987) found that business units that follow a defender strategy tend to place a greater emphasis on the use of financial measures (e.g., short-term budget targets) for compensating financial managers. Prospector firms placed a greater emphasis on forecast data and reduced importance on cost control. Ittner *et al.* (1997) also found that the use of non-financial measures for determining executive's bonuses increases with the extent to which firms follow an innovation-oriented prospector strategy. Shank (1989) stresses the need for management accounting to support a firm's competitive strategies, and illustrates how two different competitive strategies – cost leadership and product differentiation – demand different cost analysis perspectives. For example, carefully engineered product cost standards are likely to be a very important management control tool for a firm that pursues a cost leadership strategy in a mature commodity business. In contrast, carefully engineered manufacturing cost standards are likely to be less important for a firm following a product differentiation strategy in a market-driven, rapidly changing and fast-growing business. A firm pursuing a product differentiation strategy is likely to require more information than a cost leader about new product innovations, design cycle times, research and development expenditures and marketing cost analysis. Exhibit 16.1 illustrates some potential differences in cost management emphasis, depending on the primary strategic thrust of the firm.

GAINING COMPETITIVE ADVANTAGE

Porter (1985) advocated using value-chain analysis (see Chapter 15) to gain competitive advantage. The aim of value chain analysis is to find linkages between value-creating activities which result in lower cost and/or enhanced differentiation. These linkages can be within the firm or between the firm and its suppliers, and customers. The value chain comprises five primary activities and a number of support activities. The primary activities are defined sequentially as inbound logistics, operations, outbound logistics, marketing and sales and services. The secondary activities exist to support the primary activities and include the firm's infrastructure, human resource management, technology and procurement. Costs and assets are assigned to each activity in the value chain. The cost behaviour pattern of each activity depends on a number of causal factors which Porter calls cost drivers. These cost drivers operate in an interactive way and it is management's success in coping with them which determines the cost structure.

Strategic cost analysis also involves identifying the value chain and the operation of cost drivers of competitors in order to understand relative competitiveness. Porter

advocates that organizations should use this information to identify opportunities for cost reduction, either by improving control of the cost drivers or reconfiguring the value chain. The latter involves deciding on those areas of the value chain where the firm has a comparative advantage and those which it should source to suppliers. It is essential that the cost reduction performance of both the organization and its principal competitors is continually monitored if competitive advantage is to be sustained.

EXHIBIT 16.1

Relationship between strategies and cost management emphasis

	Product differentiation	*Cost leadership*
Role of standard costs in assessing performance	Not very important	Very important
Importance of such concepts as flexible budgeting for manufacturing cost control	Moderate to low	High to very high
Perceived importance of meeting budgets	Moderate to low	High to very high
Importance of marketing cost analysis	Critical to success	Often not done at all on a formal basis
Importance of product cost as an input to pricing decisions	Low	High
Importance of competitor cost analysis	Low	High

SOURCE: Shank (1989)

You may be able to remember the illustration in the previous chapter relating to how an American automobile company failed to use the value chain approach to exploit links with suppliers and enhance profitability.[1] The company had made significant internal savings from introducing JIT manufacturing techniques, but, at the same time, price increases from suppliers more than offset these internal cost savings. A value chain perspective revealed that 50% of the firm's costs related to purchases from parts suppliers. As the automobile company reduced its own need for buffer stocks, it placed major new strains on the manufacturing responsiveness of suppliers. The increase in the suppliers' manufacturing costs was greater than the decrease in the automobile company's internal costs. Shank (1989) states:

> For every dollar of manufacturing cost the assembly plants saved by moving towards JIT management concepts, the suppliers' plant spent much more than one dollar extra because of schedule instability arising from the introduction of JIT. Because of its narrow value added perspective, the auto company had ignored the impact of its changes on its suppliers' costs. Management had ignored the idea that JIT involves a partnership with suppliers (Shank, 1989: 51).

OTHER CONTRIBUTIONS TO STRATEGIC MANAGEMENT ACCOUNTING

In this section we shall briefly consider further approaches to strategic management accounting which have not been included within Lord's classification of the literature. Bromwich (1990) has attempted to develop strategic management accounting to consider the benefits which products offer to customers, and how these contribute to sustainable competitive advantage. Bromwich sought to compare the relative cost of product attributes or characteristics with what the customer is willing to pay for them. Products are seen as comprising of a package of attributes which they offer to customers. It is these attributes that actually constitute commodities, and which appeal to customers so that they buy the product. The attributes might include a range of quality elements (such as operating performance variables, reliability and warranty arrangements, physical features – including the degree of finish and trim, and service factors – such as the assurance of supply and after-sales service). A firm's market share depends on the match between the attributes provided by its products and consumers' tastes and on the supply of attributes by competitors. Bromwich argues that it is the product attributes which need to be the subject of appropriate analysis. The purpose of the analysis should be to attribute those costs which are normally treated as product costs to the benefits they provide to the consumer for each of those attributes which are believed to be of strategic importance.

Bromwich concludes that information about a number of demand and cost factors appertaining to attributes possessed by a firm's products and those of its rivals is needed for optimal decision-making. Management accountants can play an important role here in costing the characteristics provided and in monitoring and reporting on these costs regularly. Similarly, they need to be involved in determining the cost of any package of attributes which is being considered for introduction to the market because deciding to provide a product with a particular configuration of attributes or characteristics requires the organization to achieve this at a competitive cost level.

Roslender (1995) has identified target costing as falling within the domain of strategic management accounting. The justification for this is the external focus and that it is a market driven approach to product pricing and cost management. In addition it involves the diffusion of management accounting information throughout the organization and the active involvement of staff from across a broad spectrum of management functions. Their aim is to achieve the target cost which involves identifying, valuing and costing product attributes using functional analysis and examining cost reduction opportunities throughout the entire value chain. For a detailed explanation of target costing you should refer back to Chapter 15.

SURVEYS OF STRATEGIC MANAGEMENT ACCOUNTING PRACTICES

Little research has been undertaken on the extent to which companies use strategic management accounting practices. A notable exception is a survey undertaken by Guilding *et al.* (2000). The survey consisted of a sample of 314 large companies comprising 63 from the UK, 127 from the USA and 124 from New Zealand.

Guilding *et al.* acknowledge the difficulty in identifying what are generally accepted as constituting strategic management accounting practices. Based on a review of the literature they identified twelve strategic management accounting practices. The criteria

that they used for identifying the practices were that they must exhibit one or more of the following characteristics: environmental or marketing orientation; focus on competitors; and long-term, forward-looking orientation. The average usage of the identified practices and their perceived merits are reported in Exhibit 16.2. You will see that attribute costing is one of the twelve identified practices. This practice, based on the views promoted by Bromwich (1990) was described in the previous section. Three of the twelve listed practices; namely quality costing (involving the use of cost of quality reports), life-cycle costing and target costing were described in the previous chapter. Although some of the remaining eight practices have been described in this chapter they can be subject to different interpretations and definitions. The following represent the definitions of these eight terms given to the respondents participating in the survey:

- Competitive position monitoring: The analysis of competitor positions within the industry by assessing and monitoring trends in competitor sales, market share, volume, unit costs and return on sales. This information can provide a basis for the assessment of a competitor's market strategy.
- Strategic pricing: The analysis of strategic factors in the pricing decision process. These factors may include: competitor price reaction; price elasticity; market growth; economies of scale and experience.
- Competitor performance appraisal based on published financial statements: The numerical analysis of a competitor's published statements as part of an assessment of a competitor's key sources of competitive advantage.
- Competitor cost assessment: The provision of regularly updated estimates of a competitor's costs based on, for example, appraisal of facilities, technology, economies of scale. Sources include direct observation, mutual suppliers, mutual customers and ex-employees.
- Strategic costing: The use of cost data based on strategic and marketing information to develop and identify superior strategies that will sustain a competitive advantage.
- Value chain costing: An activity-based costing approach where costs are allocated to activities required to design, procure, produce, market, distribute and service a product or service.
- Brand value monitoring: The financial valuation of a brand through the assessment of brand strength factors such as: leadership; stability; market; internationality; trend; support; and protection combined with historical brand profits.
- Brand value budgeting: The use of brand value as a basis for managerial decisions on allocation of resources to support/enhance a brand position, thus placing attention on management dialogue on brand issues.

It is apparent from Exhibit 16.2 that the three competitor accounting practices and strategic pricing are the most popular strategic management accounting practices. They all have average scores above the mid-point on the seven-point scale for the 'not at all/to a large extent' used measure. You will also see from Exhibit 16.2 that the usage rates for the remaining eight strategic management accounting practices are below the mid-point of the '1–7' measurement scale used thus suggesting that these practices are not widely used by the responding organizations.

In terms of the perceived merit of the twelve practices the rankings shown in Exhibit 16.2 are similar to those reported for the extent of usage. Guilding *et al.* conclude that while usage rates for most of the practices appraised scored relatively lowly, two factors suggest that it would be inappropriate to dismiss their potential. First, for all of the

EXHIBIT 16.2

Usage and perceived merit of strategic management accounting practices

strategic management accounting practices appraised, the perceived merit scores are significantly greater than the usage rate scores. Secondly, for the eight strategic management accounting practices where relatively low usage rates were observed, three (strategic costing, quality costing and value chain costing) scored above the mid-point with respect to perceived merit. These observations suggest that there is a gap between what is needed and what is reported by an accounting system.

Strategic management accounting practice	Average usage score[a]	Ranking	Average perceived merit score[b]	Ranking
Competitive position monitoring	4.99	1	5.73	1
Strategic pricing	4.54	2	5.45	2
Competitor performance appraisal based on published financial statements	4.42	3	5.31	3
Competitor cost assessment	4.07	4	5.27	4
Strategic costing	3.49	5	4.91	5
Quality costing	3.22	6	4.29	6
Target costing	3.12	7	3.94	8
Value chain costing	3.04	8	4.27	7
Brand value monitoring	2.73	9	3.38	11
Life-cycle costing	2.60	10	3.58	9
Attribute costing	2.33	11	3.49	10
Brand value budgeting	2.32	12	3.33	12

Notes

[a]All items scored on a Likert scale where 1 denotes used 'not at all' and 7 denotes used 'to a great extent.'

[b]All items scored on a Likert scale where 1 denotes 'not at all helpful' and 7 denotes 'helpful to a great extent'.

Guilding *et al.* also examined the familiarity of practising accountants with the term 'strategic management accounting'. The responses suggest that there was negligible use of the term in organizations and that practising accountants have a limited appreciation of what the term means. This reinforces Tomkins and Carr's (1996) claim, made in an academic context, that strategic management accounting is ill-defined. ●●●

The balanced scorecard

More recent contributions to strategic management accounting have emphasized the role of management accounting in formulating and supporting the overall competitive strategy of an organization. To encourage behaviour that is consistent with an organization's strategy, attention is now being given to developing an integrated framework of performance measurement that can be used to clarify, communicate and manage strategy implementation. In the remainder of the chapter our focus will be on integrated approaches to performance measurement that are linked to an organization's strategy. These approaches differ from the financial performance measures that have been described in Chapters 11–13. These measures tend to be used primarily as a financial control mechanism whereas the

approaches that are described in the remainder of the chapter attempt to integrate both financial and non-financial measures and incorporate performance measurement within the strategic management process.

Prior to the 1980s management accounting control systems tended to focus mainly on financial measures of performance. The inclusion of only those items that could be expressed in monetary terms motivated managers to focus excessively on cost reduction and ignore other important variables which were necessary to compete in the global competitive environment that emerged during the 1980s. Product quality, delivery, reliability, after-sales service and customer satisfaction became key competitive variables, but none of these were measured by the traditional management accounting performance measurement system.

During the 1980s much greater emphasis was given to incorporating into the management reporting system those non-financial performance measures that provided feedback on the key variables that are required to compete successfully in a global economic environment. However, a proliferation of performance measures emerged. This resulted in confusion when some of the measures conflicted with each other and it was possible to enhance one measure at the expense of another. It was also not clear to managers how the non-financial measures on which they were evaluated contributed to the whole picture of achieving success in financial terms.

The need to link financial and non-financial measures of performance and identify key performance measures led to the emergence of the **balanced scorecard** – a set of measures that gives *top* management a fast but comprehensive view of the organizational unit (i.e. a division/strategic business unit). The balanced scorecard was devised by Kaplan and Norton (1992) and refined in later publications (Kaplan and Norton, 1993, 1996a, 1996b). Therefore the following discussion is a summary of Kaplan and Noton's writings on this topic. They use a diagram similar to the one shown in Figure 16.1 to illustrate how the balanced scorecard links performance measures.

You can see that it allows managers to look at the business from four different perspectives by seeking to provide answers to the following four basic questions:

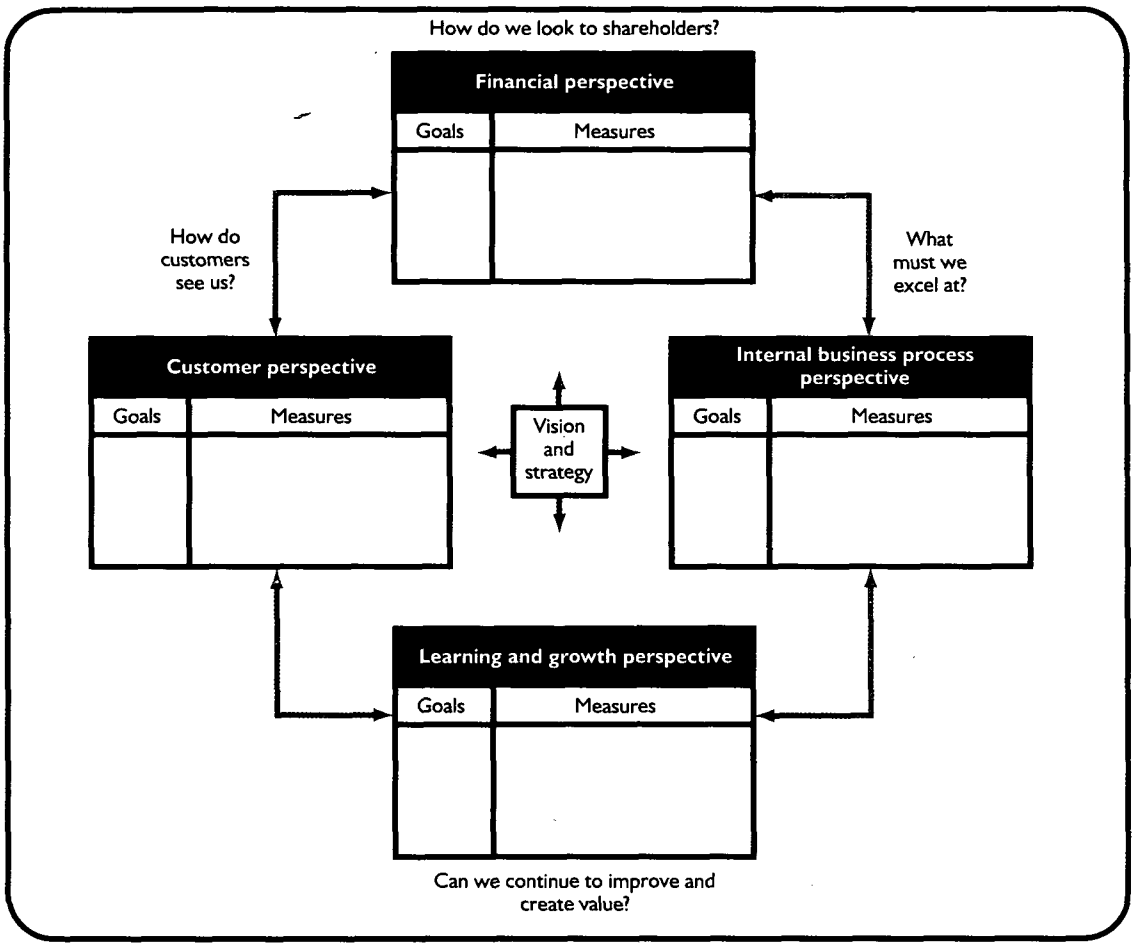
1. How do customers see us? (**customer perspective**)
2. What must we excel at? (**internal business process perspective**)
3. Can we continue to improve and create value? (**learning and growth perspective**)
4. How do we look to shareholders? (**financial perspective**)

The aim of the scorecard is to provide a comprehensive framework for translating a company's strategic objectives into a coherent set of performance measures. In order to minimize information overload the number of measures in each of the boxes in Figure 16.1 is limited. Typically each box ought to comprise three to five measures.

The balanced scorecard is a strategic management system that translates the vision and strategy of an organization into operational objectives for each of four perspectives and then establishes specific performance measures for each of the objectives. Each organization must decide what are its critical performance measures. The choice will vary over time and should be linked to the strategy that the organization is following. Kaplan and Norton assume that casual relationships exist such that measures of organizational learning and growth are the drivers of the measures of the internal business processes. The measures of these processes are in turn the drivers of the measures of the customer perspective, while these measures are the drivers of the financial measures.

As a result of their experiences in implementing the balanced scorecard in organizations Kaplan and Norton became aware of the importance of tying the measures in the balanced scorecard to an organization's strategies. They observed that most companies were not aligning performance measures to their strategies. Instead, they were trying to improve the

FIGURE 16.1 *The balanced scorecard (source: Kaplan and Norton 1996b).*



performance of existing processes (through lower cost, improved quality and shorter customer response times) but they were not identifying the processes that were truly strategic (i.e. those that require exceptional performance) for an organization's strategy to succeed.

Kaplan and Norton's experiences of innovative companies implementing the balanced scorecard indicated that they were using it, not only to clarify and communicate strategy, but also to manage strategy. They conclude that the balanced score-card has evolved from an improved performance measurement system to a core strategic management system. This strategic thrust is reflected in the titles of their later publications – 'Using the balanced scorecard as a strategic management system' (1996a) and *The Balanced Scorecard: Translating Strategy into Action* (1996b).

THE BALANCED SCORECARD AS A STRATEGIC MANAGEMENT SYSTEM

Although many companies have performance measurement systems that incorporate financial and non-financial measures they use them mainly for the feedback and control

of short-term operations. According to Kaplan and Norton the objectives of the balanced scorecard are more than just an *ad hoc* collection of financial and non-financial performance measures; they are derived from a top-down process driven by the mission and strategy of the business unit. In particular, the balanced scorecard should translate a business unit's mission and strategy into a linked set of measures that define both the long-term strategic objectives, as well as the mechanisms for achieving those objectives. The measures incorporate a balance between external measures relating to customers and internal measures relating to critical business processes and innovation and learning. They also incorporate a balance between outcome measures (the results from past efforts) and the measures that drive future performance.

Kaplan and Norton (1996b) describe how innovative companies are using the measurement focus of the scorecard to accomplish the following critical management processes:

1. Clarifying and translating vision and strategy into specific strategic objectives and identifying the critical drivers of the strategic objectives.
2. Communicating and linking strategic objectives and measures. Ideally, once all the employees understand the high level objectives and measures, they should establish local objectives that support the business unit's global strategy.
3. Planning, setting targets, and aligning strategic initiatives. Such targets should be over a 3–5 year period broken down on a yearly basis so that progression targets can be set for assessing the progress that is being made towards achieving the longer-term targets.
4. Enhancing strategic feedback and learning so that managers can monitor and adjust the implementation of their strategy, and, if necessary, make fundamental changes to the strategy itself.

They approach strategy as choosing the market and customer segments the business unit intends to serve, identifying the critical internal processes that the unit must excel at to deliver value to customers in the targeted market segments, and selecting the individual and organizational capabilities required for the internal and financial objectives.

Establishing objectives and performance measures

Having explained the general principles of the balanced scorecard we shall now consider the process of establishing objectives and performance measures in each of the four scorecard perspectives (financial, customer, internal business process, and learning and growth). Throughout this section the generic measures that have been presented by Kaplan and Norton are described. In practice, companies should customize these measures to fit their own specific needs and circumstances.

The financial perspective

In Chapters 11–13 financial performance measures have been extensively discussed. At the strategic business unit level operating profit, return on investment, residual income and economic value added were discussed and such measures should be used for measuring the financial objective of the business unit. Other financial objectives include revenue growth, cost reduction and asset utilization. Typical financial objectives are to increase return on

investment by 20% and/or to increase sales and operating income by 100% over the next five years. Because the financial measures have already been described in earlier chapters we shall concentrate mainly on the remaining three scorecard perspectives.

You should note, however, that some people have argued that by improving the non-financial measures in the scorecard improved financial measures should follow. They argue that financial measures should be de-emphasized on the grounds that by making fundamental improvements in operations the financial measures will take care of themselves. In other words, financial success should be the logical consequence of doing the fundamentals well. Kaplan and Norton reject the view that financial measures are unnecessary on the grounds that improvements in the operational measures are not automatically followed by an improvement in the financial measures. Operational improvements can create excess capacity but this excess capacity will only yield financial benefits if it is eliminated or used to generate additional revenues. The financial measures therefore provide feedback on whether improved operational performance is being translated into improved financial performance. They also summarize the economic consequences of strategy implementation.

The customer perspective

In the customer perspective of the balanced scorecard managers should identify the customer and market segments in which the businesses unit will compete. Target segments may include both existing and potential customers. Managers should then develop performance measures that track the business unit's ability to create satisfied and loyal customers in the targeted segments. The customer perspective typically includes several core or generic objectives and measures that relate to customer loyalty and the outcomes of the strategy in the targeted segments. They include core objectives relating to increasing market share, customer retention, new customer acquisition, customer satisfaction and customer profitability. Possible core measures for these objectives are discussed below.

MARKET SHARE

Market share represents the proportion of sales in a particular market that a business obtains. It can be measured in terms of sales revenues, unit sales volume or number of customers. It is a measure of market penetration. Estimates of total market size can sometimes be derived from public sources such as trade associations and industry groupings. The major contribution of this measure is that it indicates whether the strategy adopted is achieving the expected results in the targeted market segment.

CUSTOMER RETENTION AND LOYALTY

One method of maintaining or increasing market share in targeted customer segments is to ensure that existing customers are retained in those segments. Customer retention can be measured in terms of the average duration of a customer relationship. In addition surveying defecting customers to ascertain where they have taken their business and why they have left can provide valuable feedback on the effectiveness of the firm's strategy. Customer loyalty can be measured by the number of new customers referred by existing customers since this would suggest that a customer must be highly satisfied before recommending a company's products or services to others.

CUSTOMER ACQUISITION

Customer acquisition can be measured by either the number of new customers or the total sales to new customers in the desired market segment. Other measures include the number of new customers expressed as a percentage of prospective inquiries or the ratio of new customers per sales call.

CUSTOMER SATISFACTION

Measuring customer satisfaction typically involves the use of questionnaire surveys and customer response cards. Customer satisfaction can also be measured by examining letters of complaint, feedback from sales representatives and the use of 'mystery shoppers'. The latter normally involves external agencies sampling the service as customers and formally reporting back on their findings. The major limitation of customer satisfaction measures is that they measure attitudes and not actual buying behaviour.

CUSTOMER PROFITABILITY

A company can be very successful in terms of market share, customer retention and acquisition, and customer satisfaction but this may be achieved at the expense of customer profitability. A company does not want just satisfied customers, it also wants profitable customers. The four measures described above relate to the means required to achieve customer profitability but they do not measure the outcome. Customer profitability measures meet this requirement. Profitability should be analysed by different customer segments and unprofitable segments identified. Newly acquired customers may initially be unprofitable and life-cycle profitability analysis should be used for determining whether the focus should be on retention or on abandoning them. For unprofitable existing customers, actions should be taken to try and make them profitable. Such actions might include trying to alter their buying behaviour so that they consume less resources, or price increases. If neither of these strategies is successful they should not be retained.

MEASURING VALUE PROPOSITIONS

Besides describing the core or generic measures relating to the customer perspective Kaplan and Norton focus on the value propositions, which they define as the attributes the supplying companies provide through their products and services to create loyalty and satisfaction in targeted customer segments. The value proposition is the key concept for understanding the drivers of the core measurements of customer satisfaction, acquisition, retention and market share. Although value propositions vary across industries and across different market segments within industries, there are a common set of attributes that establish the value propositions in most industries. These attributes fall into three categories:

1. product/service attributes;
2. customer relationship;
3. image and reputation.

Although individual companies have developed their own ways of measuring attributes along the above three dimensions, Kaplan and Norton point out that in virtually all the

balanced scorecards they have observed three dimensions stand out as particularly important. They are time, quality and price. Let us now consider typical generic measures that companies can use to measure these dimensions.

Many organizations seek to increase customer satisfaction by providing a speedier response to customer requests, ensuring 100% on-time delivery and reducing the time taken to develop and bring new products to market. For these reasons performance measurement systems are starting to place more emphasis on time-based measures, which are now an important competitive variable. Customer lead time, the time taken from when a customer initiates a request for a product or service until the time taken when the product or service is delivered, is a widely used measure for providing feedback on the extent to which lead times are being reduced for meeting target customers' expectations.

Quality is also a key competitive variable. We shall focus on *quality measures* in some detail within the internal business perspective but for the customer perspective the emphasis is on the quality of goods or services delivered to the customer rather than the quality measures within the manufacturing process. Typical quality measures include number of defective units delivered to customers, number of customer complaints, returns by customers and warranty claims. In addition, many companies conduct surveys to measure customer satisfaction in relation to product or service quality.

Irrespective of whether a business unit is pursuing a low cost or a differentiated strategy customers will be concerned about the *price* they are paying for a product or service. To determine how competitive companies are in terms of price, business units should establish a reporting mechanism for comparing the net selling prices of their products or services with those of their competitors. Where sales are dependent on a competitive bidding process, the percentage of bids accepted provides an indication of price competitiveness.

The internal business perspective

In the internal business process perspective, managers identify the critical internal processes for which the organization must excel in implementing its strategy. The internal business process measures should focus on the internal processes that are required to achieve the organization's customer and financial objectives. Kaplan and Norton identify three principal internal business processes. They are:

1. innovation processes;
2. operation processes;
3. post-service sales processes.

INNOVATION PROCESSES

Objectives for the innovation process include increasing the number of new products, decreasing the time to develop new products and identifying new markets and customers. In the innovation process, managers research the needs of customers and then create the products or services that will meet those needs. In particular, companies identify new markets, new customers, and the emerging and latent needs of existing customers. They then design and develop new products and services that enable them to reach these new markets and customers.

Historically, because of difficult measurement problems and the over-emphasis on easily quantifiable financial measures little attention has been given to developing performance measures for product design and development processes. Companies are

becoming increasingly aware that success in developing a continuous stream of innovative products and services can provide a competitive advantage. Research and development has therefore become a more important element in the value chain of most businesses and increasing attention is now being given to specifying objectives and measures for this business process.

Kaplan and Norton highlight some of the innovation measures they have observed in organizations using balanced scorecards. They include:

1. percentage of sales from new products;
2. new product introduction versus competitors'; also new product introduction versus plan;
3. time to develop next generation of the products;
4. number of key items in which the company is first or second to the market;
5. break-even time, being the time from the beginning of product development work until the product has been introduced and has generated enough profit to pay back the investment originally made in its development.

OPERATIONS PROCESS

The operations process starts with the receipt of a customer order and finishes with the delivery of the product or service to the customer. Objectives for the operations process include decreasing process time, increasing process efficiency, improving process quality and decreasing process cost. Historically, the operations process has been the major focus of most of an organization's performance measurement system. The performance and control measures have traditionally relied on financial measures such as standard costs, budgets and variance analysis. The over-emphasis on financial measures, particularly price and efficiency variances sometimes motivated dysfunctional actions. For example, the pursuit of efficiency encouraged the maximum utilization of labour and machines resulting in excessive inventories that were not related to current customer orders.

The emergence of the global competitive environment and the need to make customer satisfaction an overriding priority has resulted in many companies supplementing their financial measures with measures of quality, reliability, delivery and those characteristics of product and service offerings that create value for customers. Companies that can identify the differentiating characteristics of their products and services should incorporate measures of these characteristics in the operation processes component of the balanced scorecard. These developments have created the need to focus on measures relating to achieving excellence in terms of time, quality and cost.

Cycle time measures

Many customers place a high value on short and reliable lead times, measured from the time elapsed from when they place an order until the time when they receive the desired product or service. Traditionally companies met this requirement by holding large inventories of many different products but, as indicated in the previous chapter, this approach is not consistent with being a low-cost supplier. Because of this many companies are adopting just-in-time (JIT) production systems with the aim of achieving both the low-cost and short lead time objectives. Reducing cycle or throughput times is therefore of critical importance for JIT companies.

Delivery performance can focus on cycle time measures and supplier delivery performance. Cycle times can be measured in various ways. Total cycle time measures

the length of time required from the placing of an order by a customer to the delivery of the product or service to the customer. Manufacturing cycle time measures the time it takes from starting and finishing the production process. Cycle times should be measured and monitored and trends observed.

The total manufacturing cycle time consists of the sum of processing time, inspection time, wait time and move time. Only processing time adds value, and the remaining activities are non-value added activities. The aim is to reduce the time spent on non-value added activities and thus minimize manufacturing cycle time. A measure of cycle time that has been adopted is **manufacturing cycle efficiency** (MCE):

$$\text{MCE} = \frac{\text{processing time}}{\text{processing time} + \text{inspection time} + \text{wait time} + \text{move time}}$$

The MCE measure is particularly important for JIT manufacturing companies. With a computerized manufacturing process, it may be possible to report the time taken on each of the above non-value-added activities. This will pinpoint those activities that are causing excessive manufacturing cycle times. At the operational level, cycle times should be measured for each product or product line, and trends reported. The emphasis should be on continuous improvements and a shortening of the cycle times.

Reducing set-up times enables manufacturing lot sizes to be reduced, thus leading to shorter manufacturing cycles and greater flexibility. Set-up times should therefore also be measured at the operational level for each process and monitored over time. Modern manufacturing techniques also advocate preventive maintenance to ensure that machines are working effectively at all times, so that quality problems and late deliveries do not occur. A useful measure of machine downtime is the number of lost machine hours in each manufacturing cell. However, downtime when a machine is not needed is not relevant. The focus should be on downtime when a machine is needed but is not ready. In addition, bottleneck operations should be monitored. The aim is to obtain 100% utilization of equipment where bottleneck occurs.

Although JIT production processes and MCE measures were initially developed for manufacturing operations, they are also applicable to service companies. For example, many customers are forced to queue to receive a service. Companies that can eliminate waiting time for a service will find it easier to attract customers. The time taken to process mortgage and loan applications by financial institutions can take a considerable time period involving a considerable amount of non-value added waiting time. Thus, reducing the time to process the applications enhances customer satisfaction and creates the potential for increasing sales revenues.

Quality measures

Besides time, **quality measures** should also be included in the measures relating to operating processes. Most organizations now have established quality programmes and use all, or some of the following process quality measurements:

- process parts-per-million (PPM) defect rates
- yields (ratio of good items produced to good items entering the process)
- first-pass yields
- waste
- scrap
- rework
- returns
- percentages of processes under statistical process control.

In many companies suppliers also have a significant influence on the ability of a company to achieve its time, quality and cost objectives. Performance measures relating to suppliers' performance include the frequency of defects, the number of late deliveries and price trends.

Cost measurement

Kaplan and Norton recommend that activity-based costing should be used to produce cost measures of the important internal business processes. These costs, together with measurements relating time and quality should be monitored over time and/or benchmarked with a view to continuous improvement or process re-engineering.

The above measures represent generic measures but aspects of quality, time and cost measurement are likely to be included as critical performance measures in any organization's internal business perspective within its balanced scorecard.

POST-SALES SERVICE PROCESSES

This final category relating to the internal business process perspective includes warranty and repair activities, treatment of defects and returns and the process and administration of customer payments. Increasing quality, increasing efficiency and decreasing process time are also objectives that apply to the post-sales service. In addition, excellent community relations is an important strategic objective for ensuring continuing community support to operate manufacturing facilities in companies where environmental factors are involved. For such companies appropriate environmental measures, such as those relating to the safe disposal of waste and by-products, should be established.

Kaplan and Norton suggest that companies attempting to meet their target customers' expectations for superior post-sales service can measure their performance by applying some of the time, quality and cost measurements that have been suggested for the operating processes. For example, cycle time from customer request to the ultimate resolution of the problem can measure the speed of response to failures. Activity-cost measurement can be used to measure the cost of the resources used for the post-sale service processes. Also first-pass yields can measure what percentage of customer requests are handled with a single service call, rather than requiring multiple calls to resolve the problem. These time, quality and cost measurements can also be applied to companies with extensive sales on credit. The aim should be to reduce the length of time between project completion and the final cash payment by the customer.

The learning and growth perspective

The fourth and final perspective on the balanced scorecard identifies the infrastructure that the business must build to create long-term growth and improvement. This perspective stresses the importance of investing for the future in areas other than investing in assets and new product research and development (which is included in the innovation process of the internal business perspective). Organizations must also invest in their infrastructure (people, systems and organizational procedures) to provide the capabilities that enable the accomplishment of the other three perspectives' objectives. Based upon their experiences of building balanced scorecards across a wide variety of organizations Kaplan and Norton have identified the following three principal categories, or enablers, for the learning and growth objectives:

1. employee capabilities;
2. information system capabilities;
3. motivation, empowerment and alignment.

They point out that although they have found that many companies have made excellent progress on specific measures for their financial, customer, innovation and operating processes virtually no effort has been devoted to measuring the outcomes relating to the above three categories. As companies implement management processes based on the balanced scorecard framework more creative and customized measures relating to the learning and growth perspective are expected to emerge.

EMPLOYEE CAPABILITIES

Kaplan and Norton observed that most companies use three common core measurement outcomes – employee satisfaction, employee retention and employee productivity. Within this core, the employee satisfaction objective is generally considered to be the driver of the other two measures. Satisfied employees are normally a pre-condition for increasing customer satisfaction. Many companies periodically measure employee satisfaction using surveys. Typically, they are requested to specify on a scale, ranging from dissatisfied to highly satisfied, their score for a list of questions that seek to measure employee satisfaction. For example, questions may relate to involvement in decisions and active encouragement to be creative and to use one's initiative. An aggregate index is constructed which can be analysed on a departmental or divisional basis.

Employee retention can be measured by the annual percentage of key staff that leave and many different methods can be used to measure employee productivity. A generic measure of employee productivity that can be applied throughout the organization and compared with different divisions is the sales revenue per employee.

INFORMATION SYSTEM CAPABILITIES

For employees to be effective in today's competitive environment they need excellent information on customers, internal processes and the financial consequences of their decisions. Measures of strategic information availability suggested by Kaplan and Norton include percentage of processes with real time quality, cycle time and cost feedback available and the percentage of customer-facing employees having on-line information about customers. These measures seek to provide an indication of the availability of internal process information to front-line employees.

MOTIVATION, EMPOWERMENT AND ALIGNMENT

The number of suggested improvements per employee is proposed as a measure relating to having motivated and empowered employees. The performance drivers for individual and organizational alignment focus on whether departments and individuals have their goals aligned with the company objectives articulated in the balanced scorecard. A suggested outcome measure is the percentage of employees with personal goals aligned to the balanced scorecard and the percentage of employees who achieve personal goals.

Performance measurement in service organizations

Although Kaplan and Norton illustrate how the balanced scorecard can be applied in both the manufacturing and service sectors most of the performance measurement literature relates to the manufacturing sector. To remedy this deficiency this section focuses on performance measurement in the service sector. Based on their research into the management accounting practices of a range of companies in several different service industries Fitzgerald *et al.* (1989) identified four unique characteristics distinguishing service companies from manufacturing organizations. First, most services are intangible. Fitzgerald *et al.* state:

> In travelling on a particular airline the customer will be influenced by the comfort of the seat, the meals served, the attitudes and confidence of the cabin staff, the boarding process and so on. This makes managing and controlling the operation complex because it is difficult to establish exactly what an individual customer is buying; is it the journey or the treatment? (Fitzgerald *et al.*, 1989: 2)

Secondly, service outputs vary from day to day, since services tend to be provided by individuals whose performance is subject to variability that significantly affects the service quality the customer receives. Thirdly, the production and consumption of many services are inseparable such as in taking a rail journey. Fourthly, services are perishable and cannot be stored. Fitzgerald *et al.* illustrate this characteristic with a hotel, which contains a fixed number of rooms. If a room is unoccupied, the sales opportunity is lost for ever and the resource is wasted.

With regard to the control of the intangible aspects, the authors found that companies used the following methods to measure performance:

1. *Measures of satisfaction after the service.* The most common method was the monitoring and analysis of letters of complaint, but some companies interviewed samples of customers or used questionnaires to ascertain the customers' perception of service quality.
2. *Measures during the service.* An approach used by some companies was for management to make unannounced visits, with the aim of observing the quality of service offered. Another mechanism was the use of 'mystery shoppers', where staff employed by external agencies were sent out to sample the service as customers and formally report back on their findings.
3. *Tangibles as surrogates for intangibles.* The researchers observed that some firms used internal measures of tangible aspects of the service as indicators of how the customers might perceive the service. Some companies measured waiting times and the conditions of the waiting environment as surrogates of customers' satisfaction with the service.

Fitzgerald *et al.* also draw attention to the importance of relating the performance measures to the corporate and marketing strategies of the organizations. For example, if the delivery of high quality service is seen to be a key strategic variable then quality measures should be the dominant performance measures. On the other hand, if a low cost of the service relative to competitors is seen as the key strategic variable then strict adherence to budgets will be a key feature of the control system. There is also a greater danger in service organizations of focusing excessively on financial performance measures, which can be easily quantified, thus placing an undue emphasis on maximizing short-term performance, even if this conflicts with maximizing long-term performance. Consequently, it is more important in service organizations that a range of non-financial performance indicators be developed providing better predictors for the attainment of long-term profitability goals.

EXHIBIT 16.3

Performance measures for service organizations

DIMENSIONS OF PERFORMANCE MEASUREMENT

Fitzgerald *et al.* (1991) advocate the measurement of service business performance across six dimensions. They propose that managers of every service organization need to develop their own set of performance measures

	Dimensions of performance	*Types of measures*
Results	Competitiveness	Relative market share and position Sales growth Measures of the customer base
	Financial performance	Profitability Liquidity Capital structure Market ratios
Determinants	Quality of service	Reliability Responsiveness Aesthetics/appearance Cleanliness/tidiness Comfort Friendliness Communication Courtesy Competence Access Availability Security
	Flexibility	Volume flexibility Delivery speed flexibility Specification flexibility
	Resource utilization	Productivity Efficiency
	Innovation	Performance of the innovation process Performance of individual innovations

SOURCE: Fitzgerald *et al.*, 1991

across the six dimensions to monitor the continued relevance of their competitive strategy. Exhibit 16.3 shows the six dimensions with examples of types of performance measures for each dimension. You should note that the dimensions fall into two conceptually different categories. Competitiveness and financial performance reflect the success of the chosen strategy (i.e. ends or results). The remaining four dimensions (quality, flexibility, resource utilization and innovation) are the drivers or determinants that determine competitive success. Fitzgerald *et al.* conclude that the design of a balanced range of performance measures should be dependent upon the company's service type, competitive environment and chosen strategy.

Moon and Fitzgerald (1996) point out the similarities between the Fitzgerald *et al.* framework and the balanced scorecard. Both frameworks emphasize the need to link performance measures to corporate strategy, include external (customer type) as well as internal measures, include non-financial as well as financial measures and make explicit the trade-offs between the various measures of performance. In addition, both frameworks distinguish between 'results' of actions taken and the 'drivers' or 'determinants' of future performance. The balanced scorecard complements 'financial measures with operational measures on customer satisfaction, internal processes, and the organization's innovation and improvement activities that are the drivers of future financial performance' (Kaplan and Norton, 1992). The Fitzgerald *et al.* framework specifies that measures of financial performance and competitiveness are the 'results' of actions previously taken and reflect the success of the chosen strategy. The remaining four dimensions (quality, flexibility, resource utilization and innovation) are the factors or drivers that determine competitive success, either now or in the future. The objective of both approaches is to ensure that a balanced set of performance measures is used so that no dimension is overly stressed to the detriment of another.

Summary

For many years strategic management accounting has been advocated as a potential area of development that would enhance the future contribution of management accounting. Despite the publicity that strategic management accounting has received there is still no comprehensive conceptual framework of what strategic management accounting is. Because of the lack of consensus on what constitutes strategic management accounting the elements that have been identified in the literature to characterize strategic management accounting have been described. Three elements were identified:

1. The extension of traditional management accounting's internal focus to include external information about competitors;
2. The relationship between the strategic position chosen by a firm and the expected emphasis on management accounting.
3. Gaining competitive advantage by analysing ways to decrease costs and/or enhance the differentiation of a firm's products, through exploiting linkages in the value chain and optimizing cost drivers.

Despite many papers on the subject Lord (1996) observes that there still seems to be a paucity of examples of strategic management accounting actually being used. In a study of a New Zealand cycle manufacturer she concluded that although some form of strategic management accounting was evident, and influential in this firm, the management accountants played little or no part in the process.

A broader view of strategic management accounting is that it is the provision of information to support senior management to achieve, and sustain, a strategic (i.e. commanding) position in the market place relative to competitors (Roslender 1996). Adopting a broader view of strategic management accounting encompasses activity-based costing, target costing and the cost management approaches described in the previous chapter.

Recent developments in performance evaluation have sought to integrate financial and non-financial measures and assist in clarifying, communicating and managing strategy. The balanced scorecard attempts to meet these requirements. It allows managers to look at the business from four different perspectives by seeking to provide answers to the following four basic questions:

1. How do customers see us? (customer perspective)
2. What must we excel at? (internal business process perspective)
3. Can we continue to improve and create value? (learning and growth perspective)
4. How do we look to shareholders? (financial perspective)

The aim of the scorecard is to provide a comprehensive framework for translating a company's strategic objectives into a coherent set of performance measures. Organizations should articulate the major goals for each of the four perspectives and then translate these goals into specific performance measures. Each organization must decide what are its critical performance measures. The choice will vary over time and should be linked to the strategy that the organization is following.

Note

1 This illustration has been derived from Shank (1989).

Key Terms and Concepts

balanced scorecard (p. 493)
brand value budgeting (p. 491)
brand value monitoring (p. 491)
competitive position monitoring (p. 491)

competitor cost assessment (p. 491)
competitor performance appraisal (p. 491)
cost measures (p. 501)
customer perspective (p. 493)
cycle time measures (p. 499)
financial perspective (p. 493)
internal business process perspective (p. 493)
learning and growth perspective (p. 493)
learning curve (p. 487)
manufacturing cycle efficiency (MCE) (p. 500)
quality measures (p. 500)
strategic costing (p. 491)
strategic management accounting (p. 485)
strategic pricing (p. 491)
target costing (p. 490)
time-based measures (p. 498)
value-chain analysis (p. 488)
value-chain costing (p. 491)
value propositions (p. 497)

Recommended Reading

For a more detailed discussion of the elements of strategic management accounting you should refer to the articles by Lord (1996) or Roslender (1995 and 1996). The balanced scorecard was designed by Kaplan and Norton and in their writings they describe its development and the experiences of companies that have implemented it. This chapter has summarized Kaplan and Norton's writings but for a more detailed description of their work you should refer to the book they have written on the balance scorecard – *The Balance Scorecard: Translating Strategy into Action* (1996b). For a broader description of performance measurement linked to strategy you should refer to Simons (1999).

Review Problem

BS Ltd provides consultancy services to small and medium sized businesses. Three types of consultants are employed offering administrative, data processing and marketing advice respectively. The consultants work partly on the client's premises and partly in BS Ltd premises, where chargeable development work in relation to each client contract will be undertaken. Consultants spend some time negotiating with potential clients attempting to secure contracts from them. BS Ltd has recently implemented a policy change which allows for a number of follow-up (remedial) hours at the client's premises after completion of the contract in order to eliminate any problems which have arisen in the initial stages of operation of the system. Contract negotiation and remedial work hours are not charged directly to each client. BS Ltd carries out consultancy for new systems and also to offer advice on existing systems which a client may have introduced before BS Ltd became involved. BS Ltd has a policy of retaining its consultancy staff at a level of 60 consultants on an ongoing basis.

Additional information for the year ended 30 April is as follows:

(i) BS Ltd invoices clients £75 per chargeable consultant hour.
(ii) Consultant salaries are budgeted at an average per consultant of £30 000 per annum. Actual salaries include a bonus for hours in excess of budget paid for at the budgeted average rate per hour.
(iii) Sundry operating costs (other than consultant salaries) were budgeted at £3 500 000. Actual was £4 100 000.
(iv) BS Ltd capital employed (start year) was £6 500 000.
(v) Table 1 shows an analysis of sundry budgeted and actual quantitative data.

Required:

(a) (i) Prepare an analysis of actual consultancy hours for the year ended 30 April which shows the increase or decrease from the standard/allowed non-chargeable hours. This increase or decrease should be analysed to show the extent to which

it may be shown to be attributable to a change from standard in:
1. standard chargeable hours; 2. remedial advice hours; 3. contract negotiation hours; 4. other non-chargeable hours. (13 marks)

(ii) Calculate the total value of each of 1 to 4 in (a) above in terms of chargeable client income per hour. (4 marks)

(b) BS Ltd measure business performance in a number of ways. For each of the undernoted measures, comment on the performance of BS Ltd using quantitative data from the question and your answer to (a) to assist in illustrating your answer:

(i) Financial performance
(ii) Competitive performance
(iii) Quality of service
(iv) Flexibility
(v) Resource utilisation
(vi) Innovation. (18 marks)

(Total 35 marks)

Table 1: BS Ltd Sundry statistics for year ended 30 April

	Budget	Actual
Number of consultants:		
Administration	30	23
Data processing	12	20
Marketing	18	17
Consultants hours analysis:		
contract negotiation hours	4 800	9 240
remedial advice hours	2 400	7 920
other non-chargeable hours	12 000	22 440
general development work hours (chargeable)	12 000	6 600
customer premises contract hours	88 800	85 800
Gross hours	120 000	132 000
Chargeable hours analysis:		
new systems	70%	60%
existing systems advice	30%	40%
Number of clients enquiries received:		
new systems	450	600
existing systems advice	400	360
Number of client contracts worked on:		
new systems	180	210
existing systems advice	300	288
Number of client complaints	5	20
Contracts requiring remedial advice	48	75

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Solution to Review Problem

(a)

	Original budget based on 120 000 gross hours	Standard hours based on actual gross hours	Actual hours	Variance (hours)	Variance (£) at £75 per hour
Gross hours	120 000	132 000	132 000		
Contract negotiation	4 800 (4%)	5 280 (4%)	9 240 (7%)	3 960A	297 000A
Remedial advice	2 400 (2%)	2 640 (2%)	7 920 (6%)	5 280A	396 000A
Other non-chargeable	12 000 (10%)	13 200 (10%)	22 440 (17%)	9 240A	693 000A
Chargeable hours	100 800 (84%)	110 880 (84%)	92 400 (70%)	18 480A	1 386 000A

There was a capacity gain over budget of 10 080 (110 880 – 100 800) hours at a client value of £756 000 (10 080 hours at £75) but because all of this was not converted into actual chargeable hours there was a net fall in chargeable hours compared with the original budget of 8400 (100 800 – 92 400) hours at a client value of £630 000.

(b) *Financial performance*

Profit statement and financial ratios for year ending 30 April

	Budget (£000)	Actual (£000)
Revenue from client contracts (chargeable hours × £75)	7560	6930
Costs:		
Consultant salaries	1800	1980
Sundry operating costs	3500	4100
	5300	6080
Net profit	2260	850
Capital employed	6500	6500
Financial ratios:		
Net profit: Turnover	29.9%	12.3%
Turnover: Capital employed	1.16 times	1.07 times
Net profit: Capital employed	34.8%	13.1%

The above figures indicate a poor financial performance for the year. The statement in (a) indicates an increase in gross hours from 120 000 to 132 000 hours providing the potential for 110 880 chargeable hours compared with the budget of 100 800 hours. This should have increased fee income by £756 000 (10 080 × £75). However, of the potential 110 880 hours there were only 92 400 chargeable hours resulting in a shortfall of 18 480 hours at a lost fee income of £1 386 000. The difference between these two monetary figures of £630 000 represents the difference between budgeted and actual revenues.

Competitiveness

Competitiveness should be measured in terms of market share and sales growth. Sales are less than budget but the offer of free remedial advice to clients presumably represents the allocation of staff time to improve longer term competitiveness even though this has had an adverse impact on short-term profit.

Competitiveness may also be measured in terms of the relative success/failure in obtaining business from clients. The data shows that the budgeted uptake from clients is 40% for new systems and 75% for existing systems compared with actuals of 35% and 80% respectively. For new systems worked on there is a 16.7% increase compared with the budget whereas for existing systems advice actual is 4% less than budget.

Quality

The data indicate that client complaints were four times the budgeted level and that the number of clients requiring remedial advice was 75 compared with a budgeted level of 48. These items should be investigated.

Flexibility

Flexibility relates to the responsiveness to customer enquires. For BS Ltd this relates to its ability to cope with changes in volume, delivery speed and the employment of staff who are able to meet changing customer demands. The company has retained 60 consultants in order to increase its flexibility in meeting demand. The data given show a change in the mix of consultancy specialists that may reflect an attempt to respond to changes in the marketing mix. The ratio of new systems to existing systems advice has changed and this may indicate a flexible response to market demands.

Resource utilization

The budget was based on chargeable hours of 84% of gross hours but the actual percentage was 70% (see part (a)). There was an increased level of remedial advice (6% of gross hours compared with 2% in the budget) and this may represent an investment with the aim of stimulating future demand.

Innovation

Innovation relates to the ability of the organization to provide new and better quality services. The company has established an innovative feature by allowing free remedial advice after completion of a contract. In the short term this is adversely affecting financial performance but it may have a beneficial long-term impact. The answer to part (a) indicates that remedial advice exceeded the adjusted budget by 5280 hours. This should be investigated to establish whether or not this was a deliberate policy decision.

Other points

Only budgeted data were given in the question. Ideally, external benchmarks ought to be established and the trend monitored over several periods rather than focusing only on a single period.

Questions

16.1

Management accounting practice has traditionally focused on techniques to assist organisational decision-making and cost control. In concentrating on the internal environment, the management accounting function has been criticised for not addressing the needs of senior management to enable effective strategic planning. In particular, the criticism has focused on inadequate provision of information which analyses the organisation's exposure to environmental change and its progress towards the achievement of corporate objectives.

Requirement:

Explain how Strategic Management Accounting can provide information which meets the requirements of senior managers in seeking to realise corporate objectives. (20 marks)

CIMA

16.2

The introduction of improved quality into products has been a strategy applied by many organisations to obtain competitive advantage. Some organisations believe it is necessary to improve levels of product quality if competitive advantage is to be preserved or strengthened.

Requirement:

Discuss how a management accountant can assist an organisation to achieve competitive advantage by measuring the increase in added value from improvement in its product quality.

(20 marks)
CIMA

16.3

Research on Performance Measurement in Service Businesses, reported in *Management Accounting*, found that 'performance measurement often focuses on easily quantifiable aspects such as cost and productivity whilst neglecting other dimensions which are important to competitive success'.

You are required:

(a) to explain what 'other dimensions' you think are important measures of performance; (8 marks)

(b) to describe what changes would be required to traditional information systems to deal with these 'other dimensions'. (9 marks)

(Total 17 marks)
CIMA

16.4 Performance measurement in non-profit organizations

(a) The absence of the profit measure in Not for Profit (NFP) organisations causes problems for the measurement of their efficiency and effectiveness.

You are required to explain:

(i) why the absence of the profit measure should be a cause of the problems referred to; (9 marks)

(ii) how these problems extend to activities within business entities which have a profit motive. Support your answer with examples. (4 marks)

(b) A public health clinic is the subject of a scheme to measure its efficiency and effectiveness. Amongst a number of factors, the 'quality of care provided' has been included as an aspect of the clinic's service to be measured. Three features of 'quality of care provided' have been listed:

Clinic's adherence to appointment times
Patients' ability to contact the clinic and make appointments without difficulty
The provision of a comprehensive patient health monitoring programme.

You are required to:

(i) suggest a set of quantitative measures which can be used to identify the effective level of achievement of each of the features listed; (9 marks)

(ii) indicate how these measures could be combined into a single 'quality of care' measure. (3 marks)

(Total 25 marks)
CIMA

16.5

Thomas Sheridan, writing in *Management Accounting* in February 1989, pointed out that Japanese companies have a different approach to cost information with 'the emphasis – based on physical measures', and 'the use of non-financial indices, particularly at shop floor level'. He argues that their approach is much more relevant to modern conditions than traditional cost and management accounting practices.

You are required

(a) to explain what is meant by 'physical measures' and 'non-financial indices'; (3 marks)

(b) to give *three* examples of non-financial indices that might be prepared, with a brief note of what information each index would provide. (5 marks)

(c) What existing cost and management accounting practices do you consider inappropriate in modern conditions? (9 marks)

(Total 17 marks)
CIMA

16.6

The 'Balanced Scorecard' approach aims to provide information to management to assist strategic policy formulation and achievement. It emphasises the need to provide the user with a set of information which addresses all relevant areas of performance in an objective and unbiased fashion.

Requirements

(i) Discuss in general terms the main types of information which would be required by a manager to implement this approach to measuring performance;
and

(ii) comment on three specific examples of performance measures which could be used in a company in a service industry, for example a firm of consultants. (10 marks)

CIMA

16.7 Design and discussion of key performance indicators for DIY outlets and regional companies

Duit plc has recently acquired Ucando Ltd which is a regional builders' merchants/DIY company with three outlets all within a radius of 40 miles. Duit plc is building up its national coverage of outlets. Duit plc has set up regional companies each with its own board of directors responsible to the main board situated in London.

It is expected that eventually each regional company will have between 10 and 20 outlets under its control. A regional company will take over control of the three Ucando Ltd outlets. Each outlet will have its own manager, and new ones have just been appointed to the three Ucando Ltd outlets.

The outlets' managers will be allowed to hire and fire whatever staff they need and the introduction of a head count budget is being considered by Head Office. Each outlet manager is responsible for his own sales policy, pricing, store layout, advertising, the general running of the outlet and the purchasing of goods for resale, subject to the recommendations below. Duit plc's policy is that all outlet managers have to apply to the regional board for all items of capital expenditure greater than £500, while the regional board can sanction up to £100 000 per capital expenditure project.

The outlets will vary in size of operations, and this will determine the number of trade sales representatives employed per outlet. There will be a minimum of one trade sales representative per outlet under the direction of the outlet manager. Each manager and representative will be entitled to a company car.

Outlet sales are made to both retail and trade on either cash or credit terms. Debtor and cash control is the responsibility of regional office. Cash received is banked locally, and immediately credited to the Head Office account. Credit sales invoices are raised by the outlet with a copy sent to regional office. Within each outlet it is possible to identify the sales origin, e.g. timber yard, saw mill, building supplies, kitchen furniture, etc.

Timber for resale is supplied to an outlet on request from stocks held at regional office or direct from the ports where Duit (Timber Importers) Ltd has further stocks. Duit Kitchens Ltd provides kitchen furniture that the outlets sell. Duit plc also has a small factory making windows, doors and frames which are sold through the outlets. When purchasing other products for resale, the outlet is requested to use suppliers with which Head Office has negotiated discount buying arrangements. All invoices for outlet purchases and overheads are passed by the respective outlet manager before being paid by regional office. In existing Duit outlets a perpetual inventory system is used, with a complete physical check once a year.

Information concerning last year's actual results for one of Ucando Ltd's outlets situated at Birport is given below:

Birport DIY outlet
Trading and profit and loss account
for year to 31 March

	(£)	(£)
Sales (1)		1 543 000
Less Cost of sales		1 095 530
Prime gross margin (29%)		447 470
Less:		
Wages (2)	87 400	
Salaries (3)	45 000	
Depreciation:		
equipment (4)	9 100	
buildings	3 500	
vehicles (3 cars)	6 500	
Vehicle running expenses	6 170	
Leasing of delivery lorry	6 510	
Lorry running expenses	3 100	
Energy costs	9 350	
Telephone/stationery	9 180	
Travel and entertaining	3 490	
Commission on sales	7 770	
Bad debts written off	9 440	
Advertising	25 160	
Repairs	6 000	
Rates, insurance	13 420	
Sundry expenses	10 580	

Delivery expenses	7400	269070
	Net profit (11.56%)	£178400

Position at 31 March

	(£)
Debtors	100900
Stock	512000

Notes:

(1) Sales can be identified by till code–cash/credit, trade/retail, timber, kitchen furniture, frames, heavy building supplies, light building supplies, sawmill etc.
(2) Workforce distributed as follows: timber yard (3), sawmill (1), sales (7), general duties (1), administration (3).
(3) Paid to sales representatives (2), assistant manager, manager.
(4) Equipment used in sales area, sawmill, yard.

Requirements:

(a) Describe a cost centre, a profit centre and an investment centre and discuss the problems of and benefits from using them for management accounting purposes. (7 marks)
(b) Suggest key performance indicators which can be used either individually or jointly by each member of the management team for the regional outlet network, i.e. those in the regional office, the outlets and their departments, in a responsibility reporting system for their evaluation purposes. (6 marks)
(c) Justify the key performance indicators that you have suggested in (b) incorporating, where appropriate, reference to whether the individuals or entities are being treated as cost, profit or investment centres. (6 marks)
(d) Design a pro forma monthly report without figures which can be used by both the outlet manager for his management and control needs and by the regional board to evaluate the outlet. The report can include two or more sections if you wish. Provide a brief explanation for the format chosen. (6 marks)

Note: The manufacturing companies and the importing company report direct to the main board. (Total 25 marks)

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16.8 Financial and non-financial performance measures

Scotia Health Consultants Ltd provides advice to clients in medical, dietary and fitness matters by offering consultation with specialist staff.

The budget information for the year ended 31 May is as follows:

(i) Quantitative data as per Appendix.
(ii) Clients are charged a fee per consultation at the rate of: medical £75; dietary £50 and fitness £50.
(iii) Health foods are recommended and provided only to dietary clients at an average cost to the company of £10 per consultation. Clients are charged for such health foods at cost plus 100% mark-up.
(iv) Each customer enquiry incurs a variable cost of £3, whether or not it is converted into a consultation.
(v) Consultants are *each* paid a fixed annual salary as follows: medical £40000; dietary £28000; fitness £25000.
(vi) Sundry other fixed cost: £300000.

Actual results for the year to 31 May incorporate the following additional information:

(i) Quantitative data as per Appendix.
(ii) A reduction of 10% in health food costs to the company per consultation was achieved through a rationalisation of the range of foods made available.
(iii) Medical salary costs were altered through dispensing with the services of two full-time consultants and sub-contracting outside specialists as required. A total of 1900 consultations were sub-contracted to outside specialists who were paid £50 per consultation.
(iv) Fitness costs were increased by £80000 through the hire of equipment to allow sophisticated cardio-vascular testing of clients.
(v) New computer software has been installed to provide detailed records and scheduling of all client enquiries and consultations. This software has an annual operating cost (including depreciation) of £50000.

Required:

(a) Prepare a statement showing the financial results for the year to 31 May in tabular format. This should show:

(i) the budget and actual gross margin for each type of consultation and for the company
(ii) the actual net profit for the company
(iii) the budget and actual margin (£) per consultation for each type of consultation.

(Expenditure for each expense heading should be shown in (i) and (ii) as relevant.) (15 marks)

(b) Suggest ways in which each of the undernoted performance measures (1 to 5) could be used to supplement the financial results calculated in (a). You should include relevant quantitative analysis from the Appendix below for each performance measure:

1. Competitiveness; 2 Flexibility; 3. Resource utilisation; 4. Quality; 5. Innovation.

(20 marks)

(Total 35 marks)

Appendix

Statistics relating to the year ended 31 May

	Budget	Actual
Total client enquiries:		
new business	50 000	80 000
repeat business	30 000	20 000
Number of client consultations:		
new business	15 000	20 000
repeat business	12 000	10 000
Mix of client consultations:		
medical	6 000	5 500 (note 1)
dietary	12 000	10 000
fitness	9 000	14 500
Number of consultants employed:		
medical	6	4 (note 1)
dietary	12	12
fitness	9	12
Number of client complaints:	270	600

Note 1: Client consultations *includes* those carried out by outside specialists. There are now 4 full-time consultants carrying out the remainder of client consultations.

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Appendices

Appendix A: Present value factors

The table gives the present value of a single payment received *n* years in the future discounted at *x*% per year. For example, with a discount rate of 7% a single payment of £1 in six years time has a present value of £0.6663 or 66.63p.

Years	1%	2%	3%	4%	5%	6%	7%	8%	9%	10%
1	0.9901	0.9804	0.9709	0.9615	0.9524	0.9434	0.9346	0.9259	0.9174	0.9091
2	0.9803	0.9612	0.9426	0.9426	0.9070	0.8900	0.8734	0.8573	0.8417	0.8264
3	0.9706	0.9423	0.9151	0.8890	0.8638	0.8396	0.8163	0.7938	0.7722	0.7513
4	0.9610	0.9238	0.8885	0.8548	0.8227	0.7921	0.7629	0.7350	0.7084	0.6830
5	0.9515	0.9057	0.8626	0.8219	0.7835	0.7473	0.7130	0.6806	0.6499	0.6209
6	0.9420	0.8880	0.8375	0.7903	0.7462	0.7050	0.6663	0.6302	0.5963	0.5645
7	0.9327	0.8706	0.8131	0.7599	0.7107	0.6651	0.6227	0.5835	0.5470	0.5132
8	0.9235	0.8535	0.7894	0.7307	0.6768	0.6274	0.5820	0.5403	0.5019	0.4665
9	0.9143	0.8368	0.7664	0.7026	0.6446	0.5919	0.5439	0.5002	0.4604	0.4241
10	0.9053	0.8203	0.7441	0.6756	0.6139	0.5584	0.5083	0.4632	0.4224	0.3855
11	0.8963	0.8043	0.7224	0.6496	0.5847	0.5268	0.4751	0.4289	0.3875	0.3505
12	0.8874	0.7885	0.7014	0.6246	0.5568	0.4970	0.4440	0.3971	0.3555	0.3186
13	0.8787	0.7730	0.6810	0.6006	0.5303	0.4688	0.4150	0.3677	0.3262	0.2897
14	0.8700	0.7579	0.6611	0.5775	0.5051	0.4423	0.3878	0.3405	0.2992	0.2633
15	0.8613	0.7430	0.6419	0.5553	0.4810	0.4173	0.3624	0.3152	0.2745	0.2394
16	0.8528	0.7284	0.6232	0.5339	0.4581	0.3936	0.3387	0.2919	0.2519	0.2176
17	0.8444	0.7142	0.6050	0.5134	0.4363	0.3714	0.3166	0.2703	0.2311	0.1978
18	0.8360	0.7002	0.5874	0.4936	0.4155	0.3503	0.2959	0.2502	0.2120	0.1799
19	0.8277	0.6864	0.5703	0.4746	0.3957	0.3305	0.2765	0.2317	0.1945	0.1635
20	0.8195	0.6730	0.5537	0.4564	0.3769	0.3118	0.2584	0.2145	0.1784	0.1486
21	0.8114	0.6598	0.5375	0.4388	0.3589	0.2942	0.2415	0.1987	0.1637	0.1351
22	0.8034	0.6468	0.5219	0.4220	0.3418	0.2775	0.2257	0.1839	0.1502	0.1228
23	0.7954	0.6342	0.5067	0.4057	0.3256	0.2618	0.2109	0.1703	0.1378	0.1117
24	0.7876	0.6217	0.4919	0.3901	0.3101	0.2470	0.1971	0.1577	0.1264	0.1015
25	0.7798	0.6095	0.4776	0.3751	0.2953	0.2330	0.1842	0.1460	0.1160	0.0923
26	0.7720	0.5976	0.4637	0.3607	0.2812	0.2198	0.1722	0.1352	0.1064	0.0839
27	0.7644	0.5859	0.4502	0.3468	0.2678	0.2074	0.1609	0.1252	0.0976	0.0763
28	0.7568	0.5744	0.4371	0.3335	0.2551	0.1956	0.1504	0.1159	0.0895	0.0693
29	0.7493	0.5631	0.4243	0.3207	0.2429	0.1846	0.1406	0.1073	0.0822	0.0630
30	0.7419	0.5521	0.4120	0.3083	0.2314	0.1741	0.1314	0.0094	0.0754	0.0573
35	0.7059	0.5000	0.3554	0.2534	0.1813	0.1301	0.0937	0.0676	0.0490	0.0356
40	0.6717	0.4529	0.3066	0.2083	0.1420	0.0972	0.0668	0.0460	0.0318	0.0221
45	0.6391	0.4102	0.2644	0.1712	0.1113	0.0727	0.0476	0.0313	0.0207	0.0137
50	0.6080	0.3715	0.2281	0.1407	0.0872	0.0543	0.0339	0.0213	0.0134	0.0085

11%	12%	13%	14%	15%	16%	17%	18%	19%	20%	Years
0.9009	0.8929	0.8850	0.8772	0.8696	0.8621	0.8547	0.8475	0.8403	0.8333	1
0.8116	0.7972	0.7831	0.7695	0.7561	0.7432	0.7305	0.7182	0.7062	0.6944	2
0.7312	0.7118	0.6931	0.6750	0.6575	0.6407	0.6244	0.6086	0.5934	0.5787	3
0.6587	0.6355	0.6133	0.5921	0.5718	0.5523	0.5337	0.5158	0.4987	0.4823	4
0.5935	0.5674	0.5428	0.5194	0.4972	0.4761	0.4561	0.4371	0.4190	0.4019	5
0.5346	0.5066	0.4803	0.4556	0.4323	0.4104	0.3898	0.3704	0.3521	0.3349	6
0.4817	0.4523	0.4251	0.3996	0.3759	0.3538	0.3332	0.3139	0.2959	0.2791	7
0.4339	0.4039	0.3762	0.3506	0.3269	0.3050	0.2848	0.2660	0.2487	0.2326	8
0.3909	0.3606	0.3329	0.3075	0.2843	0.2630	0.2434	0.2255	0.2090	0.1938	9
0.3522	0.3220	0.2946	0.2697	0.2472	0.2267	0.2080	0.1911	0.1756	0.1615	10
0.3173	0.2875	0.2607	0.2366	0.2149	0.1954	0.1778	0.1619	0.1476	0.1346	11
0.2858	0.2567	0.2307	0.2076	0.1869	0.1685	0.1520	0.1372	0.1240	0.1122	12
0.2575	0.2292	0.2042	0.1821	0.1625	0.1452	0.1299	0.1163	0.1042	0.0935	13
0.2320	0.2046	0.1807	0.1597	0.1413	0.1252	0.1110	0.0985	0.0876	0.0779	14
0.2090	0.1827	0.1599	0.1401	0.1229	0.1079	0.0949	0.0835	0.0736	0.0649	15
0.1883	0.1631	0.1415	0.1229	0.1069	0.0930	0.0811	0.0708	0.0618	0.0541	16
0.1696	0.1456	0.1252	0.1078	0.0929	0.0802	0.0693	0.0600	0.0520	0.0451	17
0.1528	0.1300	0.1108	0.0946	0.0808	0.0691	0.0592	0.0508	0.0437	0.0376	18
0.1377	0.1161	0.0981	0.0829	0.0703	0.0596	0.0506	0.0431	0.0367	0.0313	19
0.1240	0.1037	0.0868	0.0728	0.0611	0.0514	0.0433	0.0365	0.0308	0.0261	20
0.1117	0.0926	0.0768	0.0638	0.0531	0.0443	0.0370	0.0309	0.0259	0.0217	21
0.1007	0.0826	0.0680	0.0560	0.0462	0.0382	0.0316	0.0262	0.0218	0.0181	22
0.0907	0.0738	0.0601	0.0491	0.0402	0.0329	0.0270	0.0222	0.0183	0.0151	23
0.0817	0.0659	0.0532	0.0431	0.0349	0.0284	0.0231	0.0188	0.0154	0.0126	24
0.0736	0.0588	0.0471	0.0378	0.0304	0.0245	0.0197	0.0160	0.0129	0.0105	25
0.0663	0.0525	0.0417	0.0331	0.0264	0.0211	0.0169	0.0135	0.0109	0.0087	26
0.0597	0.0469	0.0369	0.0291	0.0230	0.0182	0.0144	0.0115	0.0091	0.0073	27
0.0538	0.0419	0.0326	0.0255	0.0200	0.0157	0.0123	0.0097	0.0077	0.0061	28
0.0485	0.0374	0.0289	0.0224	0.0174	0.0135	0.0105	0.0082	0.0064	0.0051	29
0.0437	0.0334	0.0256	0.0196	0.0151	0.0116	0.0090	0.0070	0.0054	0.0042	30
0.0259	0.0189	0.0139	0.0102	0.0075	0.0055	0.0041	0.0030	0.0023	0.0017	35
0.0154	0.0107	0.0075	0.0053	0.0037	0.0026	0.0019	0.0013	0.0010	0.0007	40
0.0091	0.0061	0.0041	0.0027	0.0019	0.0013	0.0009	0.0006	0.0004	0.0003	45
0.0054	0.0035	0.0022	0.0014	0.0009	0.0006	0.0004	0.0003	0.0002	0.0001	50

Years	21%	22%	23%	24%	25%	26%	27%	28%	29%	30%
1	0.8264	0.8197	0.8130	0.8065	0.8000	0.7937	0.7874	0.7813	0.7752	0.7692
2	0.6830	0.6719	0.6610	0.6504	0.6400	0.6299	0.6200	0.6104	0.6009	0.5917
3	0.5645	0.5507	0.5374	0.5245	0.5120	0.4999	0.4882	0.4768	0.4658	0.4552
4	0.4665	0.4514	0.4369	0.4230	0.4096	0.3968	0.3844	0.3725	0.3611	0.3501
5	0.3855	0.3700	0.3552	0.3411	0.3277	0.3149	0.3027	0.2910	0.2799	0.2693
6	0.3186	0.3033	0.2888	0.2751	0.2621	0.2499	0.2383	0.2274	0.2170	0.2072
7	0.2633	0.2486	0.2348	0.2218	0.2097	0.1983	0.1877	0.1776	0.1682	0.1594
8	0.2176	0.2038	0.1909	0.1789	0.1678	0.1574	0.1478	0.1388	0.1304	0.1226
9	0.1799	0.1670	0.1552	0.1443	0.1342	0.1249	0.1164	0.1084	0.1011	0.0943
10	0.1486	0.1369	0.1262	0.1164	0.1074	0.0992	0.0916	0.0847	0.0784	0.0725
11	0.1228	0.1122	0.1026	0.0938	0.0859	0.0787	0.0721	0.0662	0.0607	0.0558
12	0.1015	0.0920	0.0834	0.0757	0.0687	0.0625	0.0568	0.0517	0.0471	0.0429
13	0.0839	0.0754	0.0678	0.0610	0.0550	0.0496	0.0447	0.0404	0.0365	0.0330
14	0.0693	0.0618	0.0551	0.0492	0.0440	0.0393	0.0352	0.0316	0.0283	0.0254
15	0.0573	0.0507	0.0448	0.0397	0.0352	0.0312	0.0277	0.0247	0.0219	0.0195
16	0.0474	0.0415	0.0364	0.0320	0.0281	0.0248	0.0218	0.0193	0.0170	0.0150
17	0.0391	0.0340	0.0296	0.0258	0.0225	0.0197	0.0172	0.0150	0.0132	0.0116
18	0.0323	0.0279	0.0241	0.0208	0.0180	0.0156	0.0135	0.0118	0.0102	0.0089
19	0.0267	0.0229	0.0196	0.0168	0.0144	0.0124	0.0107	0.0092	0.0079	0.0068
20	0.0221	0.0187	0.0159	0.0135	0.0115	0.0098	0.0084	0.0072	0.0061	0.0053
21	0.0183	0.0154	0.0129	0.0109	0.0092	0.0078	0.0066	0.0056	0.0048	0.0040
22	0.0151	0.0126	0.0105	0.0088	0.0074	0.0062	0.0052	0.0044	0.0037	0.0031
23	0.0125	0.0103	0.0086	0.0071	0.0059	0.0049	0.0041	0.0034	0.0029	0.0024
24	0.0103	0.0085	0.0070	0.0057	0.0047	0.0039	0.0032	0.0027	0.0022	0.0018
25	0.0085	0.0069	0.0057	0.0046	0.0038	0.0031	0.0025	0.0021	0.0017	0.0014
26	0.0070	0.0057	0.0046	0.0037	0.0030	0.0025	0.0020	0.0016	0.0013	0.0011
27	0.0058	0.0047	0.0037	0.0030	0.0024	0.0019	0.0016	0.0013	0.0010	0.0008
28	0.0048	0.0038	0.0030	0.0024	0.0019	0.0015	0.0012	0.0010	0.0008	0.0006
29	0.0040	0.0031	0.0025	0.0020	0.0015	0.0012	0.0010	0.0008	0.0006	0.0005
30	0.0033	0.0026	0.0020	0.0016	0.0012	0.0010	0.0008	0.0006	0.0005	0.0004
35	0.0013	0.0009	0.0007	0.0005	0.0004	0.0003	0.0002	0.0002	0.0001	0.0001
40	0.0005	0.0004	0.0003	0.0002	0.0001	0.0001	0.0001	0.0001		
45	0.0002	0.0001	0.0001	0.0001						
50	0.0001									

31%	32%	33%	34%	35%	36%	37%	38%	39%	40%	Years
0.7634	0.7576	0.7519	0.7463	0.7407	0.7353	0.7299	0.7246	0.7194	0.7143	1
0.5827	0.5739	0.5653	0.5569	0.5487	0.5407	0.5328	0.5251	0.5176	0.5102	2
0.4448	0.4348	0.4251	0.4156	0.4064	0.3975	0.3889	0.3805	0.3724	0.3644	3
0.3396	0.3294	0.3196	0.3102	0.3011	0.2923	0.2839	0.2757	0.2679	0.2603	4
0.2592	0.2495	0.2403	0.2315	0.2230	0.2149	0.2072	0.1998	0.1927	0.1859	5
0.1979	0.1890	0.1807	0.1727	0.1652	0.1580	0.1512	0.1448	0.1386	0.1328	6
0.1510	0.1432	0.1358	0.1289	0.1224	0.1162	0.1104	0.1049	0.0997	0.0949	7
0.1153	0.1085	0.1021	0.0962	0.0906	0.0854	0.0806	0.0760	0.0718	0.0678	8
0.0880	0.0822	0.0768	0.0718	0.0671	0.0628	0.0588	0.0551	0.0516	0.0484	9
0.0672	0.0623	0.0577	0.0536	0.0497	0.0462	0.0429	0.0399	0.0371	0.0346	10
0.0513	0.0472	0.0434	0.0400	0.0368	0.0340	0.0313	0.0289	0.0267	0.0247	11
0.0392	0.0357	0.0326	0.0298	0.0273	0.0250	0.0229	0.0210	0.0192	0.0176	12
0.0299	0.0271	0.0245	0.0223	0.0202	0.0184	0.0167	0.0152	0.0138	0.0126	13
0.0228	0.0205	0.0185	0.0166	0.0150	0.0135	0.0122	0.0110	0.0099	0.0090	14
0.0174	0.0155	0.0139	0.0124	0.0111	0.0099	0.0089	0.0080	0.0072	0.0064	15
0.0133	0.0118	0.0104	0.0093	0.0082	0.0073	0.0065	0.0058	0.0051	0.0046	16
0.0101	0.0089	0.0078	0.0069	0.0061	0.0054	0.0047	0.0042	0.0037	0.0033	17
0.0077	0.0068	0.0059	0.0052	0.0045	0.0039	0.0035	0.0030	0.0027	0.0023	18
0.0059	0.0051	0.0044	0.0038	0.0033	0.0029	0.0025	0.0022	0.0019	0.0017	19
0.0045	0.0039	0.0033	0.0029	0.0025	0.0021	0.0018	0.0016	0.0014	0.0012	20
0.0034	0.0029	0.0025	0.0021	0.0018	0.0016	0.0013	0.0012	0.0010	0.0009	21
0.0026	0.0022	0.0019	0.0016	0.0014	0.0012	0.0010	0.0008	0.0007	0.0006	22
0.0020	0.0017	0.0014	0.0012	0.0010	0.0008	0.0007	0.0006	0.0005	0.0004	23
0.0015	0.0013	0.0011	0.0009	0.0007	0.0006	0.0005	0.0004	0.0004	0.0003	24
0.0012	0.0010	0.0008	0.0007	0.0006	0.0005	0.0004	0.0003	0.0003	0.0002	25
0.0009	0.0007	0.0006	0.0005	0.0004	0.0003	0.0003	0.0002	0.0002	0.0002	26
0.0007	0.0006	0.0005	0.0004	0.0003	0.0002	0.0002	0.0002	0.0001	0.0001	27
0.0005	0.0004	0.0003	0.0003	0.0002	0.0002	0.0001	0.0001	0.0001	0.0001	28
0.0004	0.0003	0.0003	0.0002	0.0002	0.0001	0.0001	0.0001	0.0001	0.0001	29
0.0003	0.0002	0.0002	0.0002	0.0001	0.0001	0.0001	0.0001	0.0001		30
0.0001	0.0001									35

Appendix B: Cumulative present value factors

The table gives the present value of n annual payments of £1 received for the next n years with a constant discount of x% per year.

For example, with a discount rate of 7% and with six annual payments of £1, the present value is £4.767.

Years 0 to:	1%	2%	3%	4%	5%	6%	7%	8%	9%	10%
1	0.990	0.980	0.971	0.962	0.952	0.943	0.935	0.926	0.917	0.909
2	1.970	1.942	1.913	1.886	1.859	1.833	1.808	1.783	1.759	1.736
3	2.941	2.884	2.829	2.775	2.723	2.673	2.624	2.577	2.531	2.487
4	3.902	3.808	3.717	3.630	3.546	3.465	3.387	3.312	3.240	3.170
5	4.853	4.713	4.580	4.452	4.329	4.212	4.100	3.993	3.890	3.791
6	5.795	5.601	5.417	5.242	5.076	4.917	4.767	4.623	4.486	4.355
7	6.728	6.472	6.230	6.002	5.786	5.582	5.389	5.206	5.033	4.868
8	7.652	7.325	7.020	6.733	6.463	6.210	5.971	5.747	5.535	5.335
9	8.566	8.162	7.786	7.435	7.108	6.802	6.515	6.247	5.995	5.759
10	9.471	8.983	8.530	8.111	7.722	7.360	7.024	6.710	6.418	6.145
11	10.368	9.787	9.253	8.760	8.306	7.887	7.499	7.139	6.805	6.495
12	11.255	10.575	9.954	9.385	8.863	8.384	7.943	7.536	7.161	6.814
13	12.134	11.348	10.635	9.086	9.394	8.853	8.358	7.904	7.487	7.103
14	13.004	12.106	11.296	10.563	9.899	9.295	8.745	8.244	7.786	7.367
15	13.865	12.849	11.938	11.118	10.380	9.712	9.108	8.559	8.061	7.606
16	14.718	13.578	12.561	11.652	10.838	10.106	9.447	8.851	8.313	7.824
17	15.562	14.292	13.166	12.166	11.274	10.477	9.763	9.122	8.544	8.022
18	16.398	14.992	13.754	12.659	11.690	10.828	10.059	9.372	8.756	8.201
19	17.226	15.678	14.324	13.134	12.085	11.185	10.336	9.604	8.950	8.365
20	18.046	16.351	14.877	13.590	12.462	11.470	10.594	9.818	9.129	8.514
21	18.857	17.011	15.415	14.029	12.821	11.764	10.836	10.017	9.292	8.649
22	19.660	17.658	15.937	14.451	13.163	12.042	11.061	10.201	9.442	8.772
23	20.456	18.292	16.444	14.857	13.489	12.303	11.272	10.371	9.580	8.883
24	21.243	18.914	16.939	15.247	13.799	12.550	11.469	10.529	9.707	8.985
25	22.023	19.523	17.413	15.622	14.094	12.783	11.654	10.675	9.823	9.077
26	22.795	20.121	17.877	15.983	13.375	13.003	11.826	10.810	9.929	9.161
27	23.560	20.707	18.327	16.330	14.643	13.211	11.987	10.935	10.027	9.237
28	24.316	21.281	18.764	16.663	13.898	13.406	12.137	11.051	10.116	9.307
29	25.066	21.844	19.188	16.984	15.141	13.591	12.278	11.158	10.198	9.370
30	25.808	22.396	19.600	17.292	15.372	13.765	12.409	11.258	10.274	9.427
35	29.409	24.999	21.487	18.665	16.374	14.498	12.948	11.655	10.567	9.644
40	32.835	27.355	23.115	19.793	17.159	15.046	13.332	11.925	10.757	9.779
45	36.095	29.490	24.519	20.720	17.774	15.456	13.606	12.108	10.881	9.863
50	39.196	31.424	25.730	21.482	18.256	15.762	13.801	12.233	10.962	9.915

11%	12%	13%	14%	15%	16%	17%	18%	19%	20%	Years 0 to:
0.901	0.893	0.885	0.877	0.870	0.862	0.855	0.847	0.840	0.833	1
1.713	1.690	1.668	1.647	1.626	1.605	1.585	1.566	1.547	1.528	2
2.444	2.402	2.361	2.322	2.283	2.246	2.210	2.174	2.140	2.106	3
3.102	3.037	2.974	2.914	2.855	2.798	2.743	2.690	2.639	2.589	4
3.696	3.605	3.517	3.433	3.352	3.274	3.199	3.127	3.058	2.991	5
4.231	4.111	3.998	3.889	3.784	3.685	3.589	3.498	3.410	3.326	6
4.712	4.564	4.423	4.288	4.160	4.039	3.922	3.812	3.706	3.605	7
5.146	4.968	4.799	4.639	4.487	4.344	4.207	4.078	3.954	3.837	8
5.537	5.328	5.132	4.946	4.772	4.607	4.451	4.303	4.163	4.031	9
5.889	5.650	5.426	5.216	5.019	4.833	4.659	4.494	4.339	4.192	10
6.207	5.938	5.687	5.453	5.234	5.029	4.836	4.656	4.486	4.327	11
6.492	6.194	5.918	5.660	5.421	5.197	4.988	4.793	4.611	4.439	12
6.750	6.424	6.122	5.842	5.583	5.342	5.118	4.910	4.715	4.533	13
6.982	6.628	6.302	6.002	5.724	5.468	5.229	5.008	4.802	4.611	14
7.191	6.811	6.462	6.142	5.847	5.575	5.324	5.092	4.876	4.675	15
7.379	6.974	6.604	6.265	5.954	5.668	5.405	5.162	4.938	4.730	16
7.549	7.120	6.729	6.373	6.047	5.749	5.475	5.222	4.990	4.775	17
7.702	7.250	6.840	6.467	6.128	5.818	5.534	5.273	5.033	4.812	18
7.839	7.366	6.938	6.550	6.198	5.877	5.584	5.316	5.070	4.843	19
7.963	7.469	7.025	6.623	6.259	5.929	5.628	5.353	5.101	4.870	20
8.075	7.562	7.102	6.687	6.312	5.973	5.665	5.384	5.127	4.891	21
8.176	7.645	7.170	6.743	6.359	6.011	5.696	5.410	5.149	4.909	22
8.266	7.718	7.230	6.792	6.399	6.044	5.723	5.432	5.167	4.925	23
8.348	7.784	7.283	6.835	6.434	6.073	5.746	5.451	5.182	4.937	24
8.422	7.843	7.330	6.873	6.464	6.097	5.766	5.467	5.195	4.948	25
8.488	7.896	7.372	6.906	6.491	6.118	5.783	5.480	5.206	4.956	26
8.548	7.943	7.409	6.935	6.514	6.136	5.798	5.492	5.215	4.964	27
8.602	7.984	7.441	6.961	6.534	6.152	5.810	5.502	5.223	4.970	28
8.650	8.022	7.470	6.983	6.551	6.166	5.820	5.510	5.229	4.975	29
8.694	8.055	7.496	7.003	6.566	6.177	5.829	5.517	5.235	4.979	30
8.855	8.176	7.586	7.070	6.617	6.215	5.858	5.539	5.251	4.992	35
8.951	8.244	7.634	7.105	6.642	6.233	5.871	5.548	5.258	4.997	40
9.008	8.283	7.661	7.123	6.654	6.242	5.877	5.552	5.261	4.999	45
9.042	8.304	7.675	7.133	6.661	6.246	5.880	5.554	5.262	4.999	50

Years 0 to:	21%	22%	23%	24%	25%	26%	27%	28%	29%	30%
1	0.826	0.820	0.813	0.806	0.800	0.794	0.787	0.781	0.775	0.769
2	1.509	1.492	1.474	1.457	1.440	1.424	1.407	1.392	1.376	1.361
3	2.074	2.042	2.011	1.981	1.952	1.923	1.896	1.868	1.842	1.816
4	2.540	2.494	2.448	2.404	2.362	2.320	2.280	2.241	2.203	2.166
5	2.926	2.864	2.803	2.745	2.689	2.635	2.583	2.532	2.483	2.436
6	3.245	3.167	3.092	3.020	2.951	2.885	2.821	2.759	2.700	2.643
7	3.508	3.416	3.327	3.242	3.161	3.083	3.009	2.937	2.868	2.802
8	3.726	3.619	3.518	3.421	3.329	3.241	3.156	3.076	2.999	2.925
9	3.905	3.786	3.673	3.566	3.463	3.366	3.273	3.184	3.100	3.019
10	4.054	3.923	3.799	3.682	3.571	3.465	3.364	3.269	3.178	3.092
11	4.177	4.035	3.902	3.776	3.656	3.543	3.437	3.335	3.239	3.147
12	5.278	4.127	3.985	3.851	3.725	3.606	3.493	3.387	3.286	3.190
13	4.362	4.203	4.053	3.912	3.780	3.656	3.538	3.427	3.322	3.223
14	4.432	4.265	4.108	3.962	3.824	3.695	3.573	3.459	3.351	3.249
15	4.489	4.315	4.153	4.001	3.859	3.726	3.601	3.483	3.373	3.268
16	4.536	4.357	4.189	4.033	3.887	3.751	3.623	3.503	3.390	3.283
17	4.576	4.391	4.219	4.059	3.910	3.771	3.640	3.518	3.403	3.295
18	4.608	4.419	4.243	4.080	3.928	3.786	3.654	3.529	3.413	3.304
19	4.635	4.442	4.263	4.097	3.942	3.799	3.664	3.539	3.421	3.311
20	4.657	4.460	4.279	4.110	3.954	3.808	3.673	3.546	3.427	3.316
21	4.675	4.476	3.292	4.121	3.963	3.816	3.679	3.551	3.432	3.320
22	4.690	4.488	4.302	4.130	3.970	3.822	3.684	3.556	3.436	3.323
23	4.703	4.499	4.311	4.137	3.976	3.827	3.689	3.559	3.438	3.325
24	4.713	4.507	4.318	4.143	3.981	3.831	3.692	3.562	3.441	3.327
25	4.721	4.514	4.323	4.147	3.985	3.834	3.694	3.564	3.442	3.329
26	4.728	4.520	4.328	4.151	3.988	3.837	3.696	3.566	3.444	3.330
27	4.734	4.524	4.332	4.154	3.990	3.839	3.698	3.567	3.445	3.331
28	4.739	4.528	4.335	4.157	3.992	3.840	3.699	3.568	3.446	3.331
29	4.743	4.531	4.337	4.159	3.994	3.841	3.700	3.569	3.446	3.332
30	4.746	4.534	4.339	4.160	3.995	3.842	3.701	3.569	3.447	3.332
35	4.756	4.541	4.345	4.164	3.998	3.845	3.703	3.571	3.448	3.333
40	4.760	4.544	4.347	4.166	3.999	3.846	3.703	3.571	3.488	3.333
45	4.761									
50	4.762	4.545	4.348	4.167	4.000	3.846	3.704	3.571	3.448	3.333

31%	32%	33%	34%	35%	36%	37%	38%	39%	40%	Years 0 to:
0.763	0.758	0.752	0.746	0.741	0.735	0.730	0.725	0.719	0.714	1
1.346	1.331	1.317	1.303	1.289	1.276	1.263	1.250	1.237	1.224	2
1.791	1.766	1.742	1.719	1.696	1.673	1.652	1.630	1.609	1.589	3
2.130	2.096	2.062	2.029	1.997	1.966	1.935	1.906	1.877	1.849	4
2.390	2.345	2.302	2.260	2.220	2.181	2.143	2.106	2.070	2.035	5
2.588	2.534	2.483	2.433	2.385	2.339	2.294	2.251	2.209	2.168	6
2.739	2.677	2.619	2.562	2.508	2.455	2.404	2.355	2.308	2.263	7
2.854	2.786	2.721	2.658	2.598	2.540	2.485	2.432	2.380	2.331	8
2.942	2.868	2.798	2.730	2.665	2.603	2.544	2.487	2.432	2.379	9
3.009	2.930	2.855	2.784	2.715	2.649	2.587	2.527	2.469	2.414	10
3.060	2.978	2.899	2.824	2.752	2.683	2.618	2.555	2.496	2.438	11
3.100	2.013	2.931	2.853	2.779	2.708	2.641	2.576	2.515	2.456	12
3.129	3.040	2.956	2.876	2.799	2.727	2.658	2.592	2.529	2.469	13
3.152	3.061	2.974	2.982	2.814	2.740	2.670	2.603	2.539	2.478	14
3.170	3.076	2.988	2.905	2.825	2.750	2.679	2.611	2.546	2.484	15
3.183	3.088	2.999	2.914	2.834	2.757	2.685	2.616	2.551	2.489	16
3.193	3.097	3.007	2.921	2.840	2.763	2.690	2.621	2.555	2.492	17
3.201	3.104	3.012	2.926	2.844	2.767	2.693	2.624	2.557	2.494	18
3.207	3.109	3.017	2.930	2.848	2.770	2.696	2.626	2.559	2.496	19
3.211	3.113	3.020	2.933	2.850	2.772	2.698	2.627	2.561	2.497	20
3.215	3.116	3.023	2.935	2.852	2.773	2.699	2.629	2.562	2.498	21
3.217	3.118	3.025	2.936	2.853	2.775	2.700	2.629	2.562	2.438	22
3.219	3.120	3.026	2.938	2.854	2.775	2.701	2.630	2.563	2.499	23
3.221	3.121	3.027	2.939	2.855	2.776	2.701	2.630	2.563	2.499	24
3.222	3.122	3.028	2.939	2.856	2.777	2.702	2.631	2.563	2.499	25
3.223	3.123	3.028	2.940	2.856	2.777	2.702	2.631	2.564	2.500	26
3.224	3.123	3.029	2.940	2.856	2.777	2.702	2.631			27
3.224	3.124	3.029	2.940	2.857	2.777	2.702	2.631			28
3.225	3.124	3.030	2.941	2.857	2.777	2.702	2.631			29
3.225	3.124	3.030	2.941	2.857	2.778	2.702	2.631			30
3.226	3.125									35
3.226										40
3.226	3.125	3.030	2.941	2.857	2.778	2.703	2.632	2.564	2.500	45
3.226	3.125	3.030	2.941	2.857	2.778	2.703	2.632	2.564	2.500	50

Case study problems

Case 1 HARDHAT LTD
Stan Brignall, Aston Business School

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Case 5 SHERIDAN CARPET COMPANY 1167
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Peter Nordgaard and Carsten Rohde, Copenhagen Business School

Additional cases, together with teaching notes, are available from the dedicated website for this book (see Preface for details relating to how they can be accessed).

CASE 1
HARDHAT LTD

Stan Brignall, Aston Business School, Aston University

Hardhat Limited's Budget Committee, which has members drawn from all the major functions in the business, is meeting to consider the projected income statement for 2000/2001, which is composed of the ten months' actuals to the end of January 2001 and estimates for the last two months of the financial year:

Hardhat Ltd: Projected Income Statement 2000/2001

	(£000s)	(£000s)
Sales (100 000 units)	10 000	
Cost of goods sold	6 000	
Gross profit		4 000
Selling expenses	1 500	
Administrative expenses	1 000	
		2 500
Net profit before tax		£1 500

After some discussion of information principally supplied by the Finance Director, John Perks, the Committee agrees the following changes for the 2001/2002 budget:

30% increase in number of units sold
20% increase in unit cost of materials
5% increase in direct labour cost per unit
10% increase in variable indirect cost per unit
5% increase in indirect fixed costs
8% increase in selling expenses, arising solely from increased volume
6% increase in administrative expenses, reflecting anticipated higher salary and other costs rather than any effects of the expected increased sales volume.

The increase in sales volume is meant to be a significant step towards an ambitious target market share which was included in the latest review of Hardhat's strategic plan at the insistence of the marketing manager, Keith Boskin. Despite the change in volume, inventory quantities are expected to change little next year because of planned efficiency gains in the supply and handling of materials and despatch of finished goods.

The composition of the production cost of a unit of finished product in 2000/2001 for materials, direct labour and production overhead was in the ratio of 3 : 2 : 1 respectively. In 2000/2001 £40 000 of the production overhead was fixed. No changes in production methods or credit policies are anticipated for 2001/2002.

The managing director, Steve Hartley, has set a target profit before tax for 2001/2002 of £2 000 000, and the Budget Committee are now debating what this might imply for the unit selling price, on the basis of the information they have assembled so far. The consensus appears to be that the profit target is very tough, but that presumably this is what Steve and the Chairman, Lord Haretop, believe the City expects.

Keith Boskin is worried that the imposition of the short-term target profit will jeopardize the staged attainment of his long-run market share. 'I'm concerned that, in order to meet the profit (target imposed by Steve Hartley) we'll have to drastically put up

our price. If that happens we *might* hit the profit, but it'll ruin my plans for damaging the prospects of Farfetched Co., who have been trying to take market share from us for some while now via heavy marketing expenditure – I think they're getting desperate because our cost structure and product quality are better than theirs! If we can just keep squeezing them for another year or two we might force them out of the market, or get them to agree to a takeover on reasonable terms. Then we'd effectively have the market to ourselves.' Dick Whittington, Keith's deputy, asked 'rather than putting up the price, could we work out how many units we'd have to sell at the old price to meet the profit target? Then we could check to see whether it would be within the plant's capacity.'

Mark Catchall, the production manager, intervened at this point, saying 'we can make up to 150 000 units a year with the present plant, but could we sustain that capacity output for long? I doubt it. We might have to invest in extra capacity, which is a whole new ball game. Besides, I don't really believe we can sell an extra 30 000 units next year, never mind 50 000 units, especially at an enhanced price. I suspect we will only manage to sell an extra 20 000 units *at best*, and perhaps only 10 000: what would that do for our profits, John?' John replied that he didn't know, but would investigate the various suggestions and come back to the next meeting in a week's time with some figures.

As he walked back to his office, John privately mused that perhaps the MD and Chairman wanted to boost short-term profits to make it easier to raise the finance to take over Farfetched Co., in which case it wouldn't hurt to give some thought as to the best source of finance for such a deal.

Required

Write a report to the Board of Hardhat Ltd setting-out the financial effects of the various proposals and make recommendations as to what price Hardhat should charge next year and in the longer run.

Your report and presentation should cover:

(a) the sales price needed to earn the target profit, using the information compiled by the budget committee;

(b) the number of units that would have to be sold at the old price to meet the target profit, and whether this seems feasible;

(c) what the profit would be if the sales price calculated in (a) were adopted, but sales volume only rose by 10%, or at best 20%;

(d) any other factors you think should be taken into account when making decisions about the price to be charged next year, such as any change in risk involved in the cost–volume–profit structure you propose; the link between short- and long-run prices; and the interactions between acquisitions policy, financing decisions and pricing decisions.

CASE 2
LYNCH PRINTERS

© *Peter Clarke, University College Dublin*

Dermot Lynch is the owner and managing director of a small printing business which carries his name. The company undertakes each printing job according to special instructions received from the customer. The type of printing orders include cards, invitations, small books and even occasional trade magazines. The nature of the printing

business virtually ensures that there is no closing stock of finished goods on hand at the end of any accounting period. Work is done according to customer orders received or not at all. Sales and purchase invoices were paid on delivery so that the working capital investment in the company was virtually negligible.

According to the financial results for 20x1, the accounting year just ended, Lynch Printers had returned a net loss for the first time in its history. The loss was not of alarming proportions but Lynch wondered what had gone wrong and what he could do about it. Logic suggested that his problems were due to either low prices or excessive costs but this puzzled Lynch since each job was priced to include all costs to which a satisfactory profit margin was added. Moreover costs did not appear to have increased compared with previous years.

Lynch Printers has developed over the years a good reputation in the trade for quality work and reliability of delivery. Lynch passionately believed that these two factors were crucial in determining the success of his business. Quotation price was very much of secondary importance. Over the years his customers had continually insisted on good quality work and adherence to agreed delivery dates. For guarantees on these two issues the customer was willing to pay any price within reasonable bounds.

Lynch Printers use a system recommended by his trade association to quote a price for each printing job. When the customer specifies the type of work required, Lynch establishes an estimated cost for the job which includes direct and indirect expenses. A fixed percentage (10%) is added to total cost for profit and the final figure is given to the customer as a quotation. The quotation price as far as Lynch is concerned, is 'not negotiable'. Thus there are no special prices for any jobs. It's a take it or leave it situation as far as Lynch is concerned. If accepted by the customer it becomes a fixed price so that any cost overruns are absorbed by the printers and are not passed on to customers. This quotation system has been in operation for several years and Lynch prided himself on his estimating ability. Moreover it was a rare occurrence for a customer not to accept the quoted price. Admittedly, the absence of other printing firms in the locality meant that potential customers were placed at a slight disadvantage when dealing with Lynch.

The production process in Lynch Printers was relatively simple. Initially Lynch consulted his production manager about the feasibility of the order including the size and styles of type to be used. Once agreement was reached and the order confirmed by the customer Lynch issued a production order, which included printing instructions, and the material was sent to the composing room, where it was set in type. A galley proof was printed and sent to the copy editor who checked it against the original material. Any errors were marked on the proof which was then sent to the customer for approval. When returned by the customer the appropriate corrections were made and the order was then sent to the pressroom for production. Copies were then printed, bound and packaged for delivery to the customer.

The direct expenses of the business consisted of the cost of paper used and actual labour hours worked on each printing job. All other expenses were classified as overhead. Lynch Printers currently employ six individuals in the production process. They work a maximum of 35 hours per week, 48 weeks per year with four weeks holiday entitlements. The annual average cost of this typesetting and printing labour is €18,200 inclusive of employer's pension and social welfare contributions. Because of space limitations no more than six typesetters may be employed at any one time. The company has recently introduced the practice of 'flexitime' which has improved work practices enormously and has eliminated the necessity for overtime. For example if an employee takes Monday morning off he will work late some other evening, at no additional cost, to make up lost time.

For quotation purposes the total number of labour hours required in typesetting and printing for each job is estimated by Lynch and is priced at actual cost of labour work to be performed. To this computed labour cost a predetermined percentage is added to cover

EXHIBIT 1

Profit and Loss Account for year ended 31 December, 20x1

	€	€
Sales		226 900
Direct costs:		
Cost of paper consumed	22 000	
Wages (directly charged out)	90 720	
Overheads:		
Consumables (not directly chargeable)	4 400	
Wages (not directly chargeable)	18 480	
General production overheads, administration and delivery	72 240	207 840
Net Profit		19 060

production overhead costs, including non-chargeable labour hours and also administration and delivery costs.

The other direct cost is that of paper. It is fairly easy to estimate the amount of paper required for each job since the customer specifies the size of the paper required, e.g. A4 size. In addition the quality of paper to be used is agreed in advance with the customer. Lynch personally discusses such requirements with each customer and offers advice. They normally accept his recommendation and are ultimately more than pleased with the completed product. To the estimated cost of paper used is added a predetermined percentage to cover 'consumables' such as ink and other minor costs incidental to the production process.

The predetermined percentages to recover both production overhead and consumables are always set equivalent to the actual percentage relationships between corresponding costs incurred during the previous financial year. In effect last year's actual cost performance becomes the budget for the following year. While this basis may compound any inefficiencies within the production process it has the advantage of considerably simplifying the accounting calculations. A summary of the actual results for 20x1 which formed the basis for 20x2 estimates is provided in Exhibit 1.

Comparing the 20x1 profit performance with the loss incurred in 20x2, Lynch was even more puzzled especially since there were no cost increases over the two years. He knew, however, that in 20x2 business had fallen – measured in terms of chargeable labour hours. In 20x1, 90% of the labour hours worked were charged to specific jobs. However, in 20x2 only 75% of hours worked represented chargeable hours. Even though the volume of trade had dropped no one had been laid off since good typesetters and printers were difficult to recruit and volume might improve in following years.

The actual general production overheads including administration and delivery costs amounted to €72 240 in 20x2. Lynch was not surprised that they were the same as the previous year since they were predominantly fixed in nature. The cost of paper consumed during 20x2 amounted to €19 000. At least it was less than last year, Lynch consoled himself, as was the €3500 incurred on consumables.

As always it was necessary to obtain reliable data on what had actually happened during the year in order to analyse the situation, Lynch thought to himself. Once obtained, he

could begin to draw conclusions and implications. Even at this preliminary stage Lynch anticipated that this whole basis of pricing policy might be in need of revision for 20x3.

Requirement

(1) What were the recovery rates used in 20x2 for both consumables and production overhead? Use these rates and other actual data to calculate actual sales for 20x2.

(2) What was the amount of the loss for 20x2? Explain how the loss has arisen. Comment critically on Lynch's pricing system.

(3) Prepare a statement comparing actual performance in 20x2 from budget. What information content do these variances have? Justify your choice of budget figures.

CASE 3
HIGH STREET REPRODUCTION FURNITURE LTD

Jayne Ducker, Antony Head, Rona O'Brien (Sheffield Hallam University) and Sue Richardson (University of Bradford Management Centre)

This is an extract from Ducker, H., Head, A., McDonnell, B., O'Brien, R. and Richardson, S. (1998), *A Creative Approach to Management Accounting: Case Studies in Management Accounting and Control*, Sheffield Hallam University Press, ISBN 0 86339 791 3.

Introduction

High Street Reproduction Furniture is a small, but rather exclusive, producer of reproduction bedroom furniture. Turnover last year was just over £1 million and the business continues to provide a steady profit margin. It is a private limited company owned by John Carpenter and his wife Eleanor and it has been trading for 25 years. John, who is a fully qualified cabinet maker, started in the trade immediately after leaving school. He has little formal training in management, but has much hands-on experience gained from running his business.

Past and recent history of the company

The company originally operated from small, cold and draughty premises in the back streets of Sheffield and in the early years its only employee was Fred. Because of the cold working conditions, John always wore a 'flat' cap (a woven cap with a peak, traditionally worn by the men of Yorkshire) whilst he worked alongside Fred, a habit that seems to have stuck and has become somewhat of a trademark for John. According to John, 'In those days I had to think on my feet and we tended to exist from one job to the next, on a wing and a prayer you might say?' As a consequence of this, whenever John has a major problem at work which needs resolving, he tends to put his cap on to help him think things through. The employees always know the 'chips are down' when they see John walking about in his cap.

The business grew steadily in the early years and about ten years ago John was able to move from the original site to a high street location in Sheffield, which provides a small showroom area, a workshop, staff room and storage. However, the product range has remained fairly constant and consists of three pieces of bedroom furniture, namely, a wardrobe, a chest of drawers and a dressing table. These are sold directly to customers either as separate items or as a bedroom suite.

The furniture is hand-made to a very high standard, authentically reproducing the Baxendale style which was popular in the late nineteenth century. This requires a high degree of skill in the construction and finishing stages of the production process. Although most of John's time these days is spent in managing the business, he still keeps a watchful eye on activities and likes to help out if the men are over-stretched.

The furniture is made from mahogany supplied by Sheffield Timber Company, which imports high quality seasoned timber from South America. Although John could buy mahogany more cheaply elsewhere, he has dealt with this company for a long time and has confidence that the quality will be consistently good. The grain and colour of the wood is extremely important and, because the fronts of the furniture must match in grain and colour for each piece or suite of furniture, the company expects to have a high level of off-cuts and waste.

The unique finish to the furniture is produced through a highly-skilled hand-waxing process, using beeswax mixed to a special recipe created especially for High Street Reproduction Furniture by Charlesworth Specialist Waxes, who make and supply this recipe exclusively to the company. Mahogany and beeswax are the two main materials used to make the finished products.

Twelve people are now employed full time in the production process: ten are highly skilled cabinet makers and two are young apprentices. All the cabinet makers have been with the company for a long time and Fred is now the workshop supervisor. Fred is a bit set in his ways but, according to John, 'He does a damned good job and he is a very good craftsman.'

Careful delivery of the furniture to the customer is very important and John is proud of the fact that the company receives very few complaints of furniture damaged in transit. The company sub-contracts this part of its activities to a well established company in the city of Sheffield. This company has always been reliable and has provided a high class service to customers carefully protecting the furniture in transit, setting the piece in its position for the customer and asking them to check it over. If the customer is not satisfied with the furniture, then it is returned to the workshop immediately. Of course, High Street Reproduction Furniture pay a premium price for this service, but it has proved of benefit to both the company and the customer, since problems can be resolved immediately.

The specialised nature of the production process and the specialised delivery service results in high product costs. However, John has found that the company's products attract the type of customer who is willing to pay a premium price.

In the past year the company has invested £100 000 in the refurbishment of the offices and showroom and in the extension of the workshop and storage area to meet increasing demand for the company's products. This was funded by a five year loan from the company's bank. John believes that the increase in demand is mainly due to the showing of a television documentary of Sheffield which featured High Street Reproduction Furniture. The company appeared in a very favourable light as part of the new face of Sheffield emerging from the aftermath of the shrinking steel industry and the programme was given prime-time national coverage. In order to capitalise upon this free publicity, John also launched a national advertising campaign, using the documentary as a marketing ploy. However, the increased demand is putting pressure on the workforce and the lead time (the time between the customer ordering the furniture and the expected delivery date) is increasing.

Iris has been responsible for the paperwork ever since John started the business. Initially she worked part time whilst her children were young but has worked full time for the last five years. She has had the help of Cecil, who is a qualified accountant, for the last twelve months. Cecil spends two days each month on the company premises, assisting with costings and accounts.

Although, according to John, 'Iris has always done a great job of sorting us out', John feels that the company is getting too busy for her to cope. He has asked Cecil's advice and Cecil has suggested that it is probably time to employ a full time management accountant, even though this will mean a reduction in his own services for the company.

Two months ago

John took Cecil's advice and contacted Sheffield Hallam University to advertise the post on the undergraduate careers board. He felt that the post would suit a new graduate and that he could offer a fair salary whilst not placing too large a burden on the company's overheads. A number of students expressed an interest and John interviewed three of these. He selected Mary, who is due to start with the company as soon as her final exams are completed.

Last week

Mary arrived at High Street Reproduction Furniture and settled in nicely. Wisely, John involved Iris in the selection process and the two seem to be getting on well together.

John received a profit statement from Cecil for the previous six months' trading which itemised the performance of the company's three products. This is attached as Exhibit 1. John was appalled to see that the dressing tables had made a loss. He has called a meeting for next week with Mary, Iris and Fred to discuss the situation. It could not be before then, as John had important appointments for the rest of the week. First, he had to visit the beeswax suppliers who are located in the Scottish Highlands, in order to renegotiate a contract for beeswax for the coming year; second, Sheffield Timber had telephoned and asked for an urgent meeting.

John warned Mary, Iris and Fred that at next week's meeting he also wishes to discuss another matter with them. This concerns a potential new venture for the company. Much to his amazement, knowledge of the company has reached the American market through the screening of the television programme. One particular company has approached John with an enquiry for fifty chests for export to America. High Street Reproduction Furniture has never supplied bulk orders before and this customer is only willing to pay 70 per cent of the normal selling price.

He has briefly discussed the problems with Mary who, being keen and enthusiastic in her first job, wishes to anticipate John's information needs before the meeting takes place. She has been working overtime (after Iris has left for the

EXHIBIT 1

Cecil's Profit Statement for the last six months' trading

	Wardrobes (£000)	Dressing Tables (£000)	Chests (£000)	Total
Sales revenue	340	200	300	840
Direct materials	100	96	90	286
Direct labour	63	48	53	164
Variable workshop overheads	17	16	15	48
Apportioned fixed workshop overheads	60	70	68	198
Total manufacturing costs	240	230	226	696
Gross profit (loss)	100	(30)	74	144
Selling & distribution costs				80
Net profit				64

EXHIBIT 2

Mary's Initial Information Gathering

Profit statement:
Numbers of each product sold in the period covered by the statement:

Wardrobes	200
Dressing tables	160
Chests of drawers	200

Selling and distribution costs includes delivery costs to the customer

Amount paid to delivery contractor for last six months	£19 600
Average delivery cost per product	£35 each

Dressing tables:
Six months ago John made the decision to buy in the mirror section of the dressing tables from a local firm at a cost of £200 each. Mary has found the original estimate of the cost if the company were to continue making the mirror section in house, which was used for comparison with the sub-contract price. This is shown below:

	(£)
Direct materials	120
Direct labour	40
Variable overheads	20
Fixed overheads	40
Total	220

In order to ensure that the timber used to frame the mirror section matched the main body of the dressing table, it was agreed that the supplying firm would buy their timber from the same supplier, i.e. Sheffield Timber Company. The mirror sections were delivered to High Street Reproduction Furniture in an unfinished state and were hand-waxed by the company's own craftsmen. Control over the quality of the mirror sections has been problematic.

The American Enquiry

Mary has obtained the following information:

Delivery charges	
(50 chests to the dockside)	3 vans @ £300 each
Average lead time:	
for the last six months	12 weeks
for the six months prior to that	8 weeks
Average overtime:	
last week	6 hours per man
for the last six months	1 hour per man per week
Stocks of mahogany	3250 square metres

Average usage of mahogany per product:	
Wardrobes	10 square metres
Dressing tables (excluding mirror)	4 square metres
Mirror section	1 square metre
Chests of drawers	5 square metres

day) to produce the information which is attached in Exhibit 2. She hopes to impress John at the meeting by being well prepared, but has only managed to obtain the raw data by the date of the meeting.

The meeting

It is obvious to everyone (except Mary) that John is worried. He makes a strange sight in his cleanly cut business suit and his flat cap! Mary is puzzled but she dares not to comment.

The first item on the agenda is the loss-making situation of the dressing tables. John comments, 'I am appalled to find that the dressing tables are making a loss of £30 000. I can't understand it as it has never happened before. It looks as though we shall have to stop making them and concentrate on the other products, unless any of you can offer an alternative solution'.

Iris says that, given Cecil's figures, she has to agree with John about the dressing tables. Fred comments that he hasn't had time to look at the figures as he has been 'snowed under' with work. Mary decides to keep her data to herself at this stage and offers to go away and 'work on some numbers'.

The second item is the potential new venture. John passes copies of the American enquiry to all those present. 'I intimated to you all last week that we might discuss this today. Do you have any views on whether we should accept it or not?'

Iris and Fred have discussed this item before the meeting. Fred tells John that the order is totally impossible, given that the workshop is getting very overstretched, and Iris agrees with him, adding, 'How on earth do they expect us to make a profit at only 70 per cent of the normal selling price?' Mary interrupts at this stage, having gained a little more confidence, and suggests to John that the enquiry might be worth looking into. She promises to provide further information by the end of the week. John decides that they should meet again on Friday, when Mary will have more information for them and hopefully Fred will have had time to give the issues greater consideration.

As they leave the meeting, Fred comments to Iris, 'There's something else worrying him besides what he's telling us. I wonder what it can be?'

Question 1

Mary has decided to restate Cecil's original profit statement by using the additional information she has collected and by employing a marginal costing approach.

Required:

(a) Prepare a new profit statement for Mary which clearly identifies both the contribution made by each product over the last six months and the overall profit.

(b) Prepare a profit statement which shows the potential situation if John stops production of the dressing tables and demand for the other products remains the same as that of the past six months. Assume that supplies of mahogany are unlimited.

(c) What other issues should John consider before making the decision to stop producing dressing tables?

(d) Prepare a statement which identifies the contribution which the dressing tables would have made in the last six months, had the mirror section not been sub-contracted out. Suggest other issues which might affect John's decision to make the mirror sections in house once again.

Question 2

Utilising theoretical models and illustrating your answer with reference to the case study materials, discuss the decision situation regarding the American enquiry. Your discussion should also be supported by financial information which Mary would be likely to produce.

Question 3

Mary has suggested to John that the company would benefit from a management information system to aid him in planning and controlling the activities of the business and to assist in organisational decision making. Join is not sure what Mary means.

Required:

(a) Illustrate the types of planning and controlling activities that are likely to take place at High Street Reproduction Furniture Limited.

(b) Describe the types of information which might be useful.

(c) Suggest the likely sources of this information.

Question 4

At the urgent meeting last week, the Sheffield Timber Company informed John that supplies of mahogany from South America were in jeopardy. There had been a serious forest fire and much of the seasoned stock ready for export at the premises of the South American exporter had been wiped out. Sheffield Timber envisaged that there would be no more supplies of the type used by High Street Reproduction Furniture for the next six months. After that date, it seems that supplies can be restored to normal.

Required:

(a) Provide a production schedule which would maximise profits on the stocks of mahogany held by High Street Reproduction Furniture Limited and identify the forecast profit figure based on this production schedule.

You should assume that forecast demand from the normal customer base will be 10 per cent higher than the last six months' figures and that the decision on the American enquiry is still unresolved. You should also assume that the mirror section of the dressing table will have to be produced by High Street Reproduction Furniture, since the current supplier does not hold any stock of the mahogany.

(b) Identify other issues which John would need to take account of, if this production schedule is undertaken.

(c) Compare the predicted profit in (a) above with the profit which John might have expected in the second half of the year, if the predicted demand for all three products had been met, the American contract had not been taken on and the mirror section of the dressing table had been produced by High Street Reproduction Furniture Limited. Comment on your findings.

CASE 4
FLEET LTD

Lin Fitzgerald, University of Warwick Business School

Background

Fleet operates a chain of high street retail outlets selling clothing and household items. In 1995 this company was heading for a financial loss and was deemed to have lost strategic direction. The business formula that had proved successful in the 1980s and early 1990s was no longer proving effective. A new chief executive was appointed to turn the company around. He put into effect a threefold strategy. Firstly he removed levels in the hierarchy, secondly he decentralized the organization and thirdly he focused on the core competencies or skills of the business. These core skills were identified as essentially buying and selling, and from this analysis the philosophy of outsourcing was developed. The argument put forward was that the core activities have to be world class and that the organization must strive to achieve this. You also need world class support, i.e. non-core activities, but this is difficult, if not impossible to achieve in-house. This is because you need to use people who are working in the forefront, or the core, of that industry, and by definition your people are not in the forefront because it is a non-core activity.

The corporate philosophy and its outsourcing implication was thus evolved in this organization with anything that was not buying and selling becoming a potential candidate for outsourcing. For example distribution has been outsourced and has been reduced in size from 250 staff to three; quality control, packaging, and design activities have followed a similar pattern. Security and cleaning are currently in the process of being outsourced.

Detail

Outsourcing was thus the overall philosophy of the company but they would not do it just for the sake of it, they still needed to be shown that, if a particular activity was outsourced, improvements would result. In relation to IT the feeling of senior management was that IT was performing reasonably well in an operational sense but not really delivering its potential for the business. The IT department are based miles away from the business, off-site and are hard to manage. They had been fully centralized and told by the previous chief executive that they were going to be the hub and key to the smooth running of the company. Arrangements for the setting up of projects with the IT department were fairly informal and projects were tending to overrun budgets.

Fleet decided to explore the possibility of outsourcing all of its IT needs. The process involved the selection of a shortlist of vendors which the company felt to be capable of handling such a contract. The company provided a brief to these four who were invited to provide an initial response. The selected vendor, Results Ltd., was the one that was felt to best understand the philosophy and objectives of the company, especially in the area of development. Further detailed negotiations were carried out with Results Ltd. Most of the details of the company's performance requirements in IT had been defined in detail over the past three years, especially the key requirements of their stores and for buying and merchandising.

The proposal from Results is for a three year initial contract at a fixed price of £250 000 per year. The initial response of the IT department to the possibility of outsourcing was negative. They expressed concern over the recent large investment the company had made in replacing all its computer systems, £100 million had been spent only last year, they expected this equipment would service the company for another three years. Obviously there was deep concern over job security. Currently the IT department has ten staff earning,

on average, £30 000 per year. The vendor had agreed to take on eight of these staff maintaining the terms and conditions they held with Fleet. Of the remaining two staff one, Charles Smith, was eager to take early retirement and the other was to be retained within Fleet, at a salary of £30 000 to assist with management of the contract. A contract manager would have to be appointed by Fleet – this would be a new appointment, the company did not currently have anyone with those skills in-house – at an estimated salary of £50 000.

Additional information provided by the finance director

- If Charles Smith retired two years early the company would have to pay an extra £20 000 lump sum into the pension scheme.
- The building housing the IT department was on a three year lease and the company was committed to an annual rental of £10 000 per year for that period. This building could be sublet if IT were outsourced generating £4 000 in the first year, £8 000 in the second and £10 000 in the final year of the lease.
- Current forecasts of consumables in the IT department are £5000, £6000 and £7000 over the next three years.
- The resale value of the IT equipment bought last year is £30 000.
- Annual overheads for the IT department are £27 000 per year. 60% of the overhead varies with staff numbers, the remaining 40% is a share of central overhead charges.

Required

You have been appointed as a consultant to prepare a report analysing the outsourcing proposal, including both the financial and non-financial effects, and give your recommendations.

Your report should include the following:

1. an incremental costing analysis;
2. the effects on reported profits;
3. discussion of other factors that need to be taken into account before a decision is made;
4. recommendations with reasons;
5. an executive summary.

CASE 5
SHERIDAN CARPET COMPANY

Professor James S. Reece (University of Michigan)

This case is reprinted from *Accounting: Text and Cases*, Anthony and Reece, 7th edition, 1983 and *Cases in Cost Management*, Shank J.K., 1996, South Western Publishing Company, by permission of Professor James S. Reece. The case was originally set in the 1980s.

Sheridan Carpet Company produced high-grade carpeting materials for use in automobiles and recreational vans. Sheridan's products were sold to finishers, who cut and bound the material so as to fit perfectly in the passenger compartment or cargo area (e.g. automobile trunk) of a specific model of automobile or van. Some of these finishers were

captive operations of major automobile assembly divisions, particularly those that assembled the 'top of the line' cars that included high-grade carpeting. Other finishers concentrated on the replacement and van customizing markets.

Late in 2000, the marketing manager and chief accountant of Sheridan met to decide on the list price for carpet number 104. It was industry practice to announce prices just prior to the January–June and July–December 'seasons'. Over the years, companies in the industry had adhered to their announced prices throughout a six-month season unless significant unexpected changes in costs occurred. Sales of carpet 104 were not affected by seasonal factors during the two six-month seasons.

Sheridan was the largest company in its segment of the automobile carpet industry. Its 1999 sales had been over $40 million. Sheridan's salespersons were on a salary basis, and each one sold the entire product line. Most of Sheridan's competitors were smaller than Sheridan. Accordingly, they usually awaited Sheridan's price announcement before setting their own selling prices.

Carpet 104 had an especially dense nap. As a result, making it required a special machine, and it was produced in a department whose equipment could not be used to produce Sheridan's other carpets. Effective 1 January 2000, Sheridan had raised its price on this carpet from $3.90 to $5.20 per square yard. This had been done in order to bring 104's margin up to that of the other carpets in the line. Although Sheridan was financially sound, it expected a large funds need in the next few years for equipment replacement and plant expansion. The 2000 price increase was one of several decisions made in order to provide funds for these plans.

Sheridan's competitors, however, had held their 2000 prices at $3.90 on carpets competitive with 104. As shown in Exhibit 1, which includes estimates of industry volume on these carpets, Sheridan's price increase had apparently resulted in a loss of market share. The marketing manager, Mel Walters, estimated that the industry would sell about 630 000 square yards of these carpets in the first half of 2001. Walters was sure Sheridan could sell 150 000 yards if it dropped the price of 104 back to $3.90. But if Sheridan held its price at $5.20, Walters feared a further erosion in Sheridan's share. However, because some customers felt that 104 was superior to competitive products, Walters felt that Sheridan could sell at least 65 000 yards at the $5.20

During their discussion, Walters and the chief accountant, Terry Rosen, identified two other aspects of the pricing decision. Rosen wondered whether competitors would announce a further price decrease if Sheridan dropped back to

EXHIBIT 1

Carpet 104: Prices and production, 1998–2000

Selling Season*	Production volume (square yards) Industry total	Sheridan Carpet	Price (per square yard) Most competitors	Sheridan Carpet
1998-1	549 000	192 000	$5.20	$5.20
1998-2	517 500	181 000	5.20	5.20
1999-1	387 000	135 500	3.90	3.90
1999-2	427 500	149 500	3.90	3.90
2000-1	450 000	135 000	3.90	5.20
2000-2	562 500	112 500	3.90	5.20

*199x-1 means the first 6 months of 199x; 199x-2 means the second six months of 199x.

EXHIBIT 2

Estimated cost of carpet 104 at various production volumes. First six months of 2001

$3.90. Walters felt it was unlikely that competitors would price below $3.90, because none of them was more efficient than Sheridan, and there were rumours that several of them were in poor financial condition. Rosen's other concern was whether a decision relating to carpet 104 would have any impact on the sales of Sheridan's other carpets. Walters was convinced that since 104 was a specialized item, there was no interdependence between its sales and those of other carpets in the line.

	Volume (square yards)					
Costs/sq. yd.	65 000	87 500	110 000	150 000	185 000	220 000
Raw materials	$0.520	$0.520	$0.520	$0.520	$0.520	$0.520
Materials spoilage	0.052	0.051	0.049	0.049	0.051	0.052
Direct labour	1.026	0.989	0.979	0.962	0.975	0.997
Department overhead:						
Direct*	0.142	0.136	0.131	0.130	0.130	0.130
Indirect (A)	1.200	0.891	0.709	0.520	0.422	0.355
General overhead (B)	0.308	0.297	0.294	0.289	0.293	0.299
Factory cost	3.248	2.884	2.682	2.470	2.391	2.353
Selling and administrative (C)	2.111	1.875	1.743	1.606	1.554	1.529
Total cost	$5.359	$4.759	$4.425	$4.076	$3.945	$3.882

* Materials handlers, supplies, repairs, power, fringe benefits.
(A) Supervision, equipment depreciation, heat and light.
(B) 30 per cent of direct labour.
(C) 65 per cent of factory cost.

Exhibit 2 contains cost estimates that Rosen has prepared for various volumes of 104. These estimates represented Rosen's best guesses as to costs during the first six months of 2001, based on past cost experience and anticipated inflation.

Questions

1. Assuming no intermediate prices are to be considered, should Sheridan price 104 at $3.90 or $5.20?
2. If Sheridan's competitors hold their prices at $3.90, how many square yards of 104 would Sheridan need to sell at a price of $5.20 in order to earn the same profit as selling 150 000 square yards at a price of $3.90?
3. What additional information would you wish to have before making this pricing decision? (Despite the absence of this information, still answer Question 1!)
4. With hindsight, was the decision to raise the price in January of 2000 a good one?

CASE 6
ANJO LTD

Lin Fitzgerald, Warwick Business School and Anne Deakin, Centaur Metals

Background

Anjo Ltd was established in 1986 by two brothers, Andrew and Jonathan Bright. They saw a market for providing accessories in the home to accommodate the new era of home entertainment, such as television cabinets, record stands, hi-fi cabinets, tape cassette racks and more recently video and CD racks.

Andrew and Jonathan have retired from the business and Andrew's son, Michael, now runs the business. Michael introduced the use of regular management team meetings in an effort to ensure shared aims and objectives by improved information flows. In addition he introduced the current system of standard marginal costing and budgeting, and agreed with the accountant that for internal reporting stock was to be valued at standard marginal cost. Quarterly meetings for the management team are held where the variances arising between actual results and budgeted results are reviewed and any problems or new ideas can be explored. Michael is becoming concerned that in recent meetings the various managers seem to have become more defensive about their own position and are not considering the company as a whole.

The five members of the management team are:

The Management Accountant
The Production Manager
The Buying Manager
The Sales Manager
The Chairman of the Company, (Michael)

One of the products that Anjo currently produces is a CD rack. It produces these to two specifications aiming at different markets; a veneered version which is sold through a catalogue, and a deluxe version which is sold through High Street furniture shops. The latter is currently one of the company's best sellers and the company is keen to maintain market share in this product.

Production process

Most of the products are made from bought in components which are assembled by the production department. Production and sales of the CD storage racks have shown consistent growth over the past few years with the deluxe version becoming more popular in recent times. The CD storage racks consist of an outer shell fitted with an inner plastic coated rack. The production processes are the same for both versions of the storage rack. They are distinguished by the materials used for the outer casing. Ash veneered chipboard is used for the catalogue version and mahogany for the deluxe version. Both products use the same type of plastic rack insert. The company has a commitment to local suppliers and currently all purchases of ash veneer, mahogany and plastic racks are bought locally.

Budgeting system

Michael, along with the accountant introduced the system of standard marginal costing so that budgets may be prepared and variance analysis readily carried out. At the start of the budget period the Accountant sends a memo to each department detailing the planning

parameters for the period. Departments respond with their outline proposals. There follows a period of negotiation after which the finally agreed departmental proposals are circularized and Michael receives a copy of the full Master Budget.

Progress against budget is discussed at the quarterly management meetings. In preparation for these meetings the Accountant compares the actual results for the period with the planned budget and produces a variance analysis statement. Departmental managers receive details of the variances relating to their own departments and are invited to provide explanations at the management meeting for any variances that may have arisen. A full copy of the variance report is sent to Michael who also attends the quarter end meetings. In recent meetings the Accountant has begun to feel that each department holds him/her responsible for their shortcomings and is anxious to ensure that no blame is placed on the accounting role.

Further information

EXHIBIT 1

Budgeted sales and standard cost information for the CD racks

Budgeted sales and production
Budget information for the quarter to 30 April 2000

	Veneered	Wood
Sales units	1300	1500
Sales price	£75	£200
Production units	1300	1500

There are no stocks held at the beginning of the period.

Standard costs per unit
Ash veneered chipboard CD rack

	£
Veneered chipboard (0.5 sheet @ £30.00 per sheet)	15.00
Rack insert	5.00
Labour (3 hours @ £4.00 per hour)	12.00
Packaging (1 kilo @ £7.50)	7.50
Variable overheads	9.00
Total variable cost	48.50

Mahogany CD rack

	£
Wood (9 feet @ £5.00 per foot)	45.00
Rack insert	5.00
Labour (5 hours @ £4.00 per hour)	20.00
Packaging (1 kilo @ £7.50)	7.50
Variable overheads	15.00
Total variable cost	92.50

Additional information
Variable costs
Variable costs are charged on a labour hour basis.

Fixed costs
Fixed costs for the quarter are expected to be £35 000.

Stocks
There are no opening stocks.

EXHIBIT 2

Actual results for the quarter to 30 April 2000

Sales and production

	Veneered	Wood
Sales units	1000	1700
Sales price	£70	£210
Production units	1000	1700

Raw materials used

Veneer	700 sheets @ £28.00 per sheet
Wood	15 500 feet @ £6.50 per foot
Racks	2700 @ £3.00 per rack
Packaging	2800 kilos @ £7.60 per kilo

Labour
12 000 hours @ £5.00 per hour.

Variable costs
Variable costs for the quarter £36 000.

Fixed costs
Fixed costs for the quarter £40 000.

Required

1. Using the information provided produce a variance analysis statement reconciling the budgeted profit figure to the actual profit figure for the quarter. All relevant variances should be calculated.
2. Prepare a presentation to your seminar group based on the budget and actual results for the quarter. Your presentation should be conducted as a Board meeting. Each member of the group should assume the role of one of the members of the management team. Your seminar leader will provide additional notes for individual members of the team. The chairperson must control the meeting and invite the accountant to present the variance analysis reconciling actual profit with budgeted profit. Comments need to be invited from other members of the management team to explain the variances – there may well be some conflict – and questions invited from the rest of the Board members, i.e. the other groups in the room.
3. *After* the presentation meeting you are required to produce a summary of key points from the meeting and to include explanations for the variances produced and Agreed Action points. This summary should be on one side of A4 and given to your seminar tutor within 24 hours of the meeting.

CASE 7
AIRPORT COMPLEX[1]

Peter Nordgaard and Carsten Rohde, Copenhagen Business School

Background

Airport Complex was founded in Northern Europe in the late 1940s, and at the time it primarily served as a domestic airport. During the 1970s, flights to foreign destinations became an ever more vital activity for the airport. Today, the airport functions as a hub for a large portion of Nordic air traffic. The fact that the airport is a hub means that a great deal (approximately 35–40 per cent) of the airport's passengers only touch down at the airport to catch another plane to a new destination. The airport remained state property until the mid-1990s when the airport was transformed into a private company, though the state held on to a substantial ownership share. Naturally, this generated an increased focus on the airport's financial performance, which, however, boosted healthy profit margins. This also constituted the background for the continued extension of the airport, which today has placed itself as an airport entering the medium-size class of Nordic airports. The profit margins of the airport (see Exhibit 1) have suffered a decline over the past few years due to a combination of deteriorating income as a result of a fall in domestic traffic and costs that have not decreased correspondingly. At the same time, tax-free sales were abolished in 1999. This has contributed heavily to the decline in revenue.

Investors have consequently requested that the airport commit itself more to a focus on the overall profitability measured against the invested capital. Accordingly, the management has now decided that the efficiency of the airport should be subject to assessment. An

[1] This case is written by Peter Nordgaard, part-time lecturer, and Carsten Rohde, associate professor, Copenhagen Business School. Airport Complex is a fictitious case, and the information in the case is thus constructed on the basis of the authors' knowledge about and interest in European airports. The case has been simplified for teaching purposes, and thus it cannot serve as a basis for comparison with specific airports.

EXHIBIT 1

Key figure development: Airport Complex

airport is characterized by the fact that almost all costs are capacity costs. This is partly due to significant investment in buildings, runways and technology, but also to the large staff which handles the administration, operation and maintenance of the airport. The management suspects that the costs are not

(All amounts in 1000 Euro)	(budget) 1995	1996	1997	1998	1999
Turnover	203 800	207 876	214 112	222 677	218 223
Pre-tax profit	61 140	61 751	61 751	62 492	60 118
Assets	680 000	748 000	782 000	802 400	816 000
Profit margin	30%	30%	29%	28%	28%
Return on investments (ROI)	9%	8%	8%	8%	7%

sufficiently adjusted to the income. In particular, the management finds it difficult to get an overview of how the various business areas utilize the airport's resources and services and thus contribute to the bottomline of the airport.

Business areas

The revenue of Airport Complex derives from five different areas; take-off duties from air traffic, passenger fees, rental income from property, licensing income from the airport's shopping centre and sundry income related to provision of services in the airport. Each of the five business areas is briefly outlined in the following discussion.

Take-off duties

Every time an aircraft departs from the airport, the airline pays a take-off duty. The duty is calculated on the basis of the type and weight of the aircraft. The income is related to the airline's use of the airport's control of the air space, runways, technical equipment such as runway lights, meteorological equipment, facilities on the gate for cleaning the aircraft, changing the air in the aircraft, fuelling, de-icing, etc. After the aircraft has landed, it is guided to a gate. If the pilot does not know the airport, airport personnel will guide the aircraft to its gate. There are two types of gates: gates served by a building, i.e. the gate is connected to one of the airport's terminals allowing passengers to leave the aircraft and enter the terminal directly, and remote gates where the aircraft is parked somewhere else in the airport area from where passengers are subsequently transported by buses to one of the airport terminals. Airlines are in broad consent that building-served gates service passengers far better than remote gates. Still, prices for building-served and remote gates are currently not differentiated, though the management has discussed this question. In addition to the take-off duties, a stopover duty is also payable depending on how long the aircraft stays in the gate. The first hour, however, is free.

Passenger fees

Take-off and stopover duties are complemented by a passenger fee per passenger on the aircraft. These three sources of income are collectively referred to as traffic income. Passenger fees depend solely on the number of passengers. The passengers' points of departure and final destination are thus not relevant to the calculation of the fee. In principle, passenger fees relate to the passengers' use of the airport area and services. This

covers for instance buildings, transport to the terminal, service information, luggage handling and passenger areas in the airport. A differentiation on the prices for domestic passengers and those travelling to destinations abroad was previously in force, but EU competition rules have now put an end to this differentiation. It has been discussed whether there should be different passenger fees for passengers who merely touch down at the airport, but never leave the aircraft (transit passengers) as opposed to passengers who only land at the airport in order to get on a new plane (transfer passengers), as these passengers do not use the airport's landside areas. Every year, the relation between take-off duties and passenger duties is also discussed, as there are occasional imbalances in the case of small aircraft with many passengers and large aircraft with few passengers.

Rental income

Parts of the airport buildings are let out to airlines, travel agencies and shops. This revenue is collectively referred to as rental income. Prices are fixed as per square metre and vary with the use of the rented premises and its location within the airport area. Besides yielding a reasonable profit margin, rental income must in principle cover wear and tear, maintenance, use of common facilities such as toilets, lifts, etc.

Services

In connection with renting of buildings, supplementary services such as cleaning, security guard surveillance of rooms and shops, access to canteens and to the airport's computer network are also offered. This income is collectively referred to as income from provision of services and is of course related to the airport's costs in connection with these services. In recent years, this income has seen a rapid increase as a result of the airport seizing ever more opportunities for expanding the range of its services offered to the airport's customers.

Licensing income

Finally, the airport generates income from licensing agreements entered into with shops and agencies that rent premises in the airport. In addition to rent for the premises, a duty is payable for running a shop within the airport's area. The licensing agreements are based on the payment of a certain share of the turnover of shops and agencies to the airport. This income is collectively referred to as licensing income. In return, the airport takes on costs for decoration and marketing of the shopping centre such as signs, brochures, campaigns and information staff. Campaigns are budgeted separately, though there is no connection between the budgeting of campaigns and that of licensing agreements. The revenue of Airport Complex is shown in Exhibit 2.

Organization

The organization of Airport Complex is a result of a continuous development of the company. Originally, everything was collected under the traffic department, as there were no other business activities. As other commercial activities and letting out of premises were developed, the business area was isolated. Immediately after this separation, the need for a distinct building department was recognized, and the new department was established. In connection with the transfer from a state enterprise to a private undertaking, the administrative activities were collected under their own organizational area. Figure 1 shows the organization plan of Airport Complex.

EXHIBIT 2

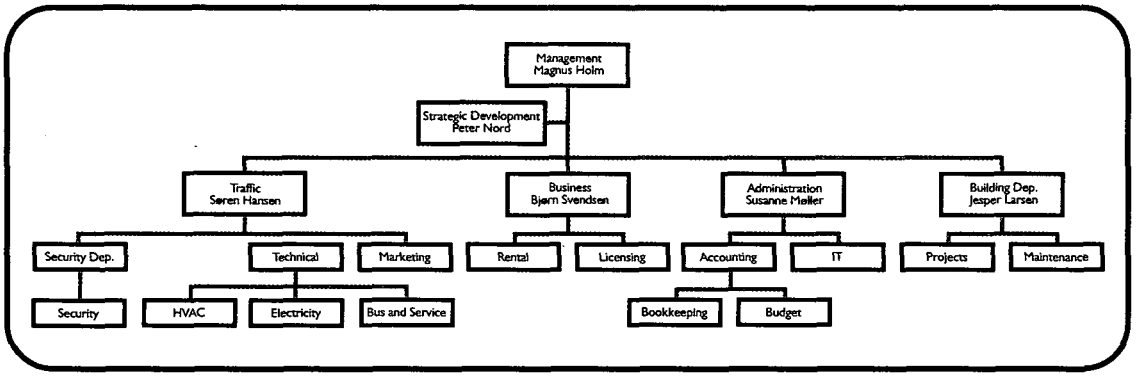
Revenue of Airport Complex

Financial management

The accounting department handles the company's financial control. The bookkeeping department takes care of the day-to-day invoicing and bookkeeping of the company's transactions and of the company's financial accounting and tax

All amounts in 1000 Euro	1995 (budget)	1996	1997	1998	1999
Aeronautical revenue	73 368	78 993	83 504	89 071	93 836
Non-aeronautical revenue	38 722	41 575	44 964	46 762	52 374
Revenue from provision of services	4 076	8 315	8 564	11 134	17 458
Licensing revenue	87 634	78 993	77 080	75 710	54 556
Total revenue	203 800	207 876	214 112	222 677	218 223

Figure 1 *Organization of Airport Complex A/S.*



accounting. The budget department is in charge of the co-ordination of budgets, whereas part budgets are prepared in the individual departments, which subsequently report their budget to the budget department. The budgets are entered into the airport's financial control system, which at the same time ensures that the individual department is only able to view its own budgets. Subsequently, the total budget is subject to approval first by the management and then by the board. The exact budgeting is of course very different from one department to the other, depending on the functions of each department and the people responsible for the budget of the department. Nevertheless, some general comments can be made on the airport's budget procedure. Staff budgets are normally prepared on the basis of a combination of price and amount per staff category. The remaining costs are predominantly provided for in the budget as a fixed amount. Depreciation is not allocated to the individual departments, but is estimated as a total amount by the budget department. The budget for traffic income is based on a forecast of the number of different types of aircraft. For each type of plane, the average weight and the average number of passengers are calculated and subsequently multiplied by the current take-off and passenger fees and the number of planes of that type. Rental income is estimated on the basis of the number of square metres relative to the average rent per square metre. Different prices per square metre are used depending on the type of building, use and location. The buildings may typically be divided into terminal buildings, office buildings, workshops, hangars, and

warehouses. The income from provision of services is estimated on the basis of expected sales measured as an amount, and finally, the licensing income is estimated as expected turnover per shop type multiplied by the licence percentage.

Outline of departments

Strategic development

The department is situated in the administrative office building. It was established three years ago with the task of supporting the management and the board in their work with strategic development of the airport. The department employs 4–5 people who make analyses of the operation of the airport and perform benchmarking analysis of the company compared to other airports. The department typically works on 3–4 projects at a time. Examples of projects are:

- the profitability of future extension projects;
- analyses of traffic statistics and forecasts of future traffic development;
- strategies for the information structure in the airport, including the future extension of the network and the number of services implemented in the network.

Traffic department

The traffic department has the overall responsibility for the development of the airport's traffic activities. The department handles traffic-related security and co-ordination with the aviation authorities, which are in charge of the actual control of the airspace, i.e. permission to take off and land. The traffic department is also the most wage consuming department since a major part of the airport staff is employed here.

Technical departments

The complicated technical structure of the airport such as traffic and passenger co-ordination systems, bridges from airport buildings to the aircraft, runway lights, etc. is handled by the technical department. The department has three sub-departments: electricity, HVAC, and buses and service. The department takes care of these same functions for the rest of the airport.

Electricity department

The electricity department employs 125 employees on an annual basis. The department is divided between five area managers, each responsible for specific parts of the airport. However, the department seeks to maintain a certain degree of job rotation to ensure that the employees acquire a high level of knowledge within all job functions in the department. Apart from vehicles, the department is responsible for a great deal of technical equipment, cranes, lifts, etc. The tasks in the department vary from mounting and repairing of control and marking equipment in connection with the runways, to maintenance of the airport's technical equipment and more ordinary electricity work in connection with the airport buildings. Work in connection with the airport buildings is co-ordinated by the building department, apart from work in connection with the airport's rented property, which is co-ordinated by the rental department. The electricity department is naturally also involved in the implementation of the airport's network, which is performed on the basis of requirements from the IT department.

HVAC department

The HVAC department employs approximately 150 people annually, and the department is divided on the basis of geographical areas in the airport. The division is as follows: airside undeveloped areas, airside developed areas, terminals, and finally, other landside buildings.

Each area has its own head of department. Like the electricity department, the HVAC department has at its disposal a large amount of technical equipment used in its daily work. The major part of the tasks of the department is co-ordinated with the building department.

Bus and service department

The bus and service department is responsible for transporting the passengers to the terminals and for servicing the runways and other outdoor areas. The service primarily consists of maintenance of the green areas of the airport and of snow removal, and the service department employs 25 people. The bus department employs approximately 50 chauffeurs who are responsible mainly for transporting the passengers to and from the aircraft, but who sometimes also function as guides for aircraft whose pilots do not know the airport.

Marketing department

The marketing department is in charge of conducting negotiations with both airlines that already use the airport and airlines that wish to use the airport in the future. This applies to passenger traffic as well as freight traffic. The department employs six people on average.

Security department

Traditionally, airports are always associated with large security risks. Therefore, security is an important work area. The security department is thus responsible for monitoring the security in the airport. The main tasks of the security department are outdoor area surveillance, indoor security check of passengers and screening of luggage, and security service in connection with the airport's own premises and rented premises. This includes security checking of all passengers and screening of luggage. If the airport uses external artisans in connection with the activities of the building department or the technical department, these will be constantly monitored by a security guard. Furthermore, the security personnel are responsible for security surveillance of rented premises.

On an annual basis, the area surveillance function employs 30 people who always work together in teams of two. Each team has at its disposal a cross-country vehicle, which enables them to turn out quickly to any place in the airport. They communicate with the central security function on a current basis via the internal communication system, which also includes GPS surveillance of all vehicles. The system has just recently been fully implemented and is controlled by the IT department. Apart from a meeting room in the terminal building, the department has at its disposal three smaller buildings located in opposite parts of the airport. There are always three teams working at the same time and their activities are co-ordinated by the central security service, which is manned by the security manager in charge and an assistant. The indoor security check function is manned in relation to the expected number of passengers during the day and employs approximately 70 people on an annual basis. The airport is divided into a landside and an airside area. The airside area can only be accessed through the security lock with a valid ticket and after screening of hand luggage and scanning of the passenger. The landside area, on the other hand, is accessible to everybody. There are three security locks in the airport that are manned according to the expected passenger flow during the day. Each lock is manned by three security employees who are in constant radio contact with the security manager in charge. Apart from this, two to three security employees are constantly patrolling the airside of the airport as well as the landside terminal areas. Moreover, both the indoor and the outdoor security personnel also function as security service in connection with the rented premises in the airport. The most cost-intensive item in the security department is therefore staff costs and staff-related costs such as uniforms and security courses. Furthermore, the department has at its disposal considerable assets such as cars, and security equipment such as scanners, X-ray equipment, etc.

Business department

The main activities in the business department are renting of areas as well as buildings and licensing agreements with retailers, restaurants, car hire firms, etc. The eight employees in the rental department administer the rental agreements and are responsible for finding suitable premises for this purpose. Extensions, renovation and maintenance of the rented premises are co-ordinated with the technical department and the building department.

The 12 employees in the licensing department draw up agreements on how to carry on business in the airport areas, including agreements on the turnover-related fees to be paid for this. The promotion of the shopping centre is planned and carried out by the business department. The extension of the shopping centre is co-ordinated with the project department.

Administrative department

This department handles the overall day-to-day administration in connection with invoicing, bookkeeping and cash. Furthermore, the IT department, which is part of the administrative department, is responsible for the airport's network which is used by the airport's own departments as well as other users of the airport. This applies to both networks for administrative use, for traffic monitoring and for signboards in the airport. Moreover, access to the airport's network and support in this connection are let out. The administrative department employs 120 people on an annual basis of which approximately half are employed in the IT department.

Building department

The project department is responsible for the continuous extension of the airport, i.e. the strategic planning in collaboration with the management as well as the actual project management. Approximately 20 people are employed on an annual basis to perform these tasks. The operative part is placed with the maintenance department, which is responsible for the continuous maintenance of both the airport area and the buildings, and which employs approximately 80 people. Exemptions are HVAC and technical appliances, which are the responsibility of the technical department under the traffic unit.

Requirements

1. Comment on the financial management of Airport Complex.
2. Discuss the problems and opportunities connected with assessing the profitability of the different services offered by the airport to the airlines and their customers. You are, among other things, asked to consider whether you would recommend the use of Full Cost, Activity Based Costing or Contribution Margin Concept to the company and state the reasons for your recommendation.
3. Draw up a reasoned suggestion for how an assessment of the productivity of selected departments can be organized, including an indication of the financial and non-financial measures that can be used.
4. Discuss the methods used by Airport Complex for budgeting revenue and costs and give reasoned suggestions for improvements.

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