



Fundamentals of Cost and Management Accounting

Ninth Edition

SR de Wet



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and Management Accounting**
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Preface to the ninth edition

Welcome to the ninth edition of Fundamentals of Cost and Management Accounting (FCMA). As we emerge from the COVID-19 pandemic, we still endure economic after-effects, such as major supply chain issues and high inflation. Thus, we are reminded of how vital cost and management accounting principles are in navigating through such volatile and complex periods. This textbook provides a solid foundation for cost and management accounting in a dynamic world.

Since the previous edition, several developments have been made in the related fields of accounting and finance. The first significant development is the revised Conceptual Framework for Financial Reporting (March 2018) by the International Accounting Standards Board (IASB), which is now in effect. As prescribed by the revised Conceptual Framework, the updated definitions of an asset and a liability were integrated into the textbook. The second development was the new 2019 Chartered Institute of Management Accountants (CIMA) syllabus. Consideration was given to these changes, specifically to the P1 and P2 learning outcomes, and the new insights were incorporated into the textbook.

The textbook includes additions such as the theory of constraints and throughput accounting, target costing, life cycle costing, and performance evaluation in the not-for-profit and public sectors. Historically, these more advanced concepts in management accounting were excluded but have since become standard concepts in any cost and management accounting course.

The needs of South African universities and emerging South African professionals have been considered as part of this edition. We hope that every cost and management accounting student finds the delivery of the principles and concepts in this textbook easy to grasp and useful in real-world scenarios.

We wish to thank the various academics for their continued support of FCMA through their prescription of the textbook and regular feedback and suggestions to improve it. Although the concepts and principles of cost and management account endure, the articulation and application of some concepts have changed due to the modern digital business ecosystem. We encourage users to provide suggestions for what they would like to see improved, removed, or added to the book.

Finally, I would like to take this opportunity to thank two previous contributing authors, Prof Gideon Els and Ricky van der Walt for their invaluable contribution to FCMA. Undoubtedly, their various contributions to the previous editions have left a lasting impact on the book.

Dr Shaun de Wet

November 2022

Preface to the eighth edition

Welcome to the eight edition of Fundamentals of Cost and Management Accounting (FCMA). The authors are once again very pleased to deliver a book of exceptional quality and insight that speaks to the heart of every South African student. This book has always had the interests of those learning about business and finance in mind and this edition is no exception to that. We have spent countless hours incorporating the latest trends and identifying areas of improvement.

Since the previous edition the higher education sector in South Africa has experienced drastic changes. The #feesmustfall campaign of 2015 has spilled over into 2016 and remains a major milestone for change. Amongst this call for change it has been identified that our education of our young learners remain steeped in tradition, a tradition that has for too long been dictated by a colonial past. No doubt the colonialisation of South Africa has left its mark, but the time has also come for it to be reversed, revised and rectified.

To this end we accepted the decolonisation of the higher education sector as our prime initiative for this edition and set about our task of revising the textbook with this in mind. This has led to some interesting debates, not just amongst ourselves but also with stakeholders and other experts. We acknowledge the contribution of ideas from our fellow colleagues that serve on decolonisation committees and thank them for their meaningful input. With this in mind we have ensured that our motifs remain rooted in African design and that our examples and questions used throughout have been rewritten to reflect a South African perspective.

An interesting side note to this edition is the incorporation of millennial research into how the next generation views learning. Long winded explanations have been converted into more concise descriptions that are to the point. Where needed, we have repackaged information to fit in with a bite sized philosophy of learning. As always, we continue to update errors and omissions (a never ending task!) and strive to improve presentation and layout. Furthermore we have expanded selected chapters, most notably the chapters on Standard Costing, Accounting Flow of Information, Activity-Based Costing (ABC) and expanded the successful introduction of Chapter 17, which highlights more strategic aspects of costing.

It is our wish that every young South African that sets out on the journey of becoming skilled in business and finance will find this textbook useful and filled with relevant information.

The Authors

October 2017

We have started the practice of including the preface to the previous edition in order to track the evolution of the textbook from one edition to the next.

Preface to the seventh edition

Welcome to the seventh edition of Fundamentals of Cost and Management Accounting. Through the effort of three dedicated academic writers we have updated the previous edition to bring it in line with the current trends and latest developments. This journey has been especially meaningful and can probably be most accurately described as four chefs in a kitchen, arguing and debating the merits and shortcomings of each new recipe!

A lot has changed in the accounting and finance landscape since the previous edition was published, the most important being the update of the 2010 Chartered Institute of Management Accountants (CIMA) to the 2015 edition. Along with this update of the content of their syllabus a change in the way that they test prospective candidates has been introduced. Where previously, written examinations were completed at the various levels, testing now consists of computer based objective question tests that cover a broad spectrum of the syllabus, supplemented with three integrated case studies.

The International Accounting Standards Board (IASB) issued new guidance in their International Financial Reporting Standards (IFRS) with regards to presentation and terminology. What was previously known as the Income Statement and Balance Sheet is now described as the Statement of Profit and Loss and the Statement of Financial Position.

In response to the new developments we have set about revising the learning objectives and bringing the textbook in line with the new syllabus and terminology in use. At the end of each chapter you will find review questions with solutions that can be used to guide students learning. We have added numerous review questions to every chapter and where necessary, in-text examples have been expanded to provide more guidance as to how certain calculations were made. A previous shortcoming was the learning curve section in chapter 3, which has now been expanded to include the mathematical formula along with additional practice questions. A new section on Contract Costing was added to chapter 10. As always, grammar and editorial changes were made to text, diagrams and numbering where necessary and the layout and presentation received further attention.

Finally we have introduced a new chapter. We deemed it necessary to leave students at a point where they have a taste of what's to come so that they can see the possibilities of how costing fits into a larger, strategically motivated company. Chapter 17: Costing in the Modern Business Environment provides students with a substantial introduction into the interplay between costing and strategy and is focussed on the themes of how costing supports pricing decisions, what strategies can be used to manage costs and how costing forms part of performance measurement.

We are also excited to announce a further expansion of our online offering to lecturers. From January 2016 the online component to this textbook will include the solutions to the exercises at the back of each chapter, along with 25 multiple choice questions and solutions per chapter. Each chapter will also have a set of comprehensive slides available that can be used in lectures. The online component can be accessed via www.myacademic.co.za.

The quantity of online and printed information has expanded more in the last few years than in the history of mankind. With more and more information available it's almost no wonder that students are reading less and less. This is perhaps the most significant strength of this textbook: A book that gets to the point by communicating in an effective manner.

The Authors

September 2015

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1 The context of costing



LEARNING OUTCOMES

What is the role of accounting information?

What are the different fields of accounting?

What is a cost accounting system and what are the various activities in any cost accounting system?

What is the role of ethical conduct in a management

What is the Chartered Institute of Management Accountants (CIMA)?

See www.cimaglobal.com for more info.

- Explain the importance and relevance of accounting information
- Differentiate between the two fields of accounting
- Explain the difference between financial, cost and management accounting
- Describe the elements of a cost accounting system
- Discuss the importance of ethical conduct in the business environment
- Explain the role of CIMA in the corporate environment
- Explain the benefits of registering as an Associate Chartered Management Accountant and Chartered Global Management Account-

CHAPTER OUTLINE

This chapter introduces cost and management accounting by discussing the context of costing. Costing relies on accounting as a base; therefore, this chapter starts with a discussion of the role of accounting within a business. Accounting information is designed to meet the needs of users of financial information. There is a clear distinction between users that are part of a business or so-called 'internal users' and those users that are outside of the business, called 'external users'.

Internal users consist of management and employees, and the information that they require typically assists with the internal functioning of the business. This functioning can be day-to-day operations or strategic in nature, and the type of information these users require reflects the fact that they are involved in the actual management of the business.

External users consist of the government, revenue services, investors, and creditors. These users are not involved in the operation of a business but nonetheless have a

financial stake in the business. Their purposes can be general in nature, such as government regulatory organization looking for compliance, or it can be more specific such as tax authorities that need to calculate and confirm tax liabilities.

To this end cost and management accounting has evolved over time to satisfy the needs of internal users and accounting has been developed and adapted to satisfy the needs of external users. Both are indispensable for the efficient and effective management of enterprises, but their focus is directed towards either internal or external users.

The remainder of chapter 1 describes the importance of accounting information as well as the economic environment in which accounting information systems are developed and applied.

THE NEED FOR RELEVANT ACCOUNTING INFORMATION

Accounting is generally considered to be the process of keeping track of finances and can thus be seen as a specialised system that processes the information of an enterprise. It performs a service function, the main aim of which is to provide relevant information about the enterprise to a wide variety of interested parties. The concept relevant information refers, in this context, to accounting information concerning the enterprise which is required by a particular party for the making of a particular decision. In the modern internationally orientated economic and business world, managers increasingly require more relevant accounting information to make correct and enlightened decisions in the management of their enterprises.

Strong competition is the most important reason for needing more relevant information. South African enterprises find themselves under increasing competitive pressure from similar international organisations. The internationalisation of world economies brings about new opportunities for enterprises. Price, quality, and customer service are increasingly subjected to international pressure. This pressure has increased with the lifting of tariff protection on South African enterprises. The pressure not only impacts on manufacturing and production but also results in the need for more effective local and international marketing and distribution. These issues, together with lower profit margins, emphasise the need for accurate product cost information. Accurate costing information is also an essential element in pricing decisions.

In the new international business environment management increasingly requires relevant and timely accounting information. The changing nature of the economy and the consequent changes in the nature of the information that managers require inevitably influences the ways in which accountants measure costs.

Consequently, not only the traditional cost concepts and procedures are explained in this book, but also the more recent cost concepts and procedures used in contemporary business environments.

THE DIFFERENT FIELDS OF ACCOUNTING

Accounting information has always been important to managers of enterprises. Initially traders only needed relatively uniform information to determine the profitability of an

enterprise. As enterprises grew and became more complex the accounting information required to determine financial results also became more complicated.

With the appearance of companies (corporations) on the economic scene two clear categories of users of information have evolved:

- ☐ those that manage the enterprise; and
- ☐ those that have a financial stake in the enterprise, namely, the owners (shareholders) as well as other interested parties, such as creditors, workers and government.

Consequently, accounting has developed in two streams: the one to provide external users with financial information about the enterprise and the other to meet the requirements of the enterprise's management.

These two streams of accounting are known as:

- ☐ financial accounting; and
- ☐ management accounting.

Financial accounting

The purpose of **financial accounting** is to *provide financial information about the enterprise by means of general-purpose financial reporting mainly for use by interested parties who do not take part in the day-to-day management of the enterprise, in other words parties who are themselves primarily outside the enterprise.*

The objective of general-purpose financial reporting is to provide financial information about the reporting entity that is useful to existing and potential investors, lenders and other creditors in making decisions relating to providing resources to the entity. A complete set of financial statements includes:

- ☐ a statement of financial position (previously called the balance sheet);
- ☐ a statement of profit and loss (previously called the income statement);
- ☐ a statement of cash flows;
- ☐ a description of accounting policies; and
- ☐ notes to the financial statements.

Such general-purpose financial statements essentially provide a report of management's handling of the activities of the enterprise for a limited, already expired period, that is to say the report is a historical one. It is prepared in accordance with certain external standards generally known as International Financial Reporting Standards (IFRS) that is being adopted worldwide as the standard in preparing financial statements and reports. All companies listed on the Johannesburg Stock Exchange (JSE Ltd), for example, have been required to comply with the IFRS requirements since 1 January 2005.

Management accounting

It is important to note that **management accounting** is *the process of identifying, measuring, analysing, interpreting and communicating information in pursuit of an enterprise's goals and thus has to do with planning and control.*

Because internal decision-makers are mainly concerned with the effect of their decisions on the future performance of the enterprise, most management accounting reports are future-orientated reports. Historical data is used only in so far as it is necessary and useful in planning and decision-making.

4 Fundamentals of Cost and Management Accounting

As external criteria do not apply with respect to information provided for internal users, management accounting reports are often subjective in nature. Thus, for example, when preparing a sales budget, the management of an enterprise will be more interested in the subjective estimate of future sales than in an objective report of actual previous sales. Historical data is always taken into consideration in future estimates.

Management itself decides the type and extent of information that is required, *inter alia*:

- ☐ Is the information relevant to the question on hand?
- ☐ Does the information equip management to make better decisions?
- ☐ Is the information timely?
- ☐ Does the information provide all the possible variables?

In contrast to financial accounting reports, which are of a general nature, management accounting reports contain specific information.

The most important differences between financial and management accounting are summarised in Diagram 1.1:

	Financial Accounting	Management Accounting
Users	External: Shareholders, South African Revenue Services (SARS), creditors, investors.	Internal: Managers, decision-makers, budget controllers.
Purpose	Generates general-purpose financial statements and reports.	Generates specific purpose statements and reports.
Timeliness	Report on historical financial events.	Current- and future-orientated reports.
Restrictions	Must conform to standards which are externally imposed, such as IFRS.	Not subject to external standards. Management requires information in a format to meet strategic, operational and planning and controlling needs.
Type of information	Financial (and non-financial) measures.	Financial measures as well as measures on customers, business processes and organisational learning perspectives.
Nature of information	Objective, reliable, consistent and precise information.	Subjective, judgemental, valid, relevant and reasonably accurate information.
Scope	Highly aggregated reports concerning the enterprise.	Disaggregated internal reports for managers and decision-makers.

Diagram 1.1

Both financial and management accountants use historical data but their perspectives differ: financial accountants deal primarily with the reporting of historical costs and income. Management accountants use the same historical information as a starting point for the estimation of future costs and income.

The common ground between financial and management accountants are cost accounting, which embraces the collection and assimilation of current data in order to provide information for:

- ☐ external reporting (financial accountants); and
- ☐ internal planning and control of day-to-day (continuous) activities as well as special decisions (*management accountants*).

THE PLACE AND FUNCTION OF COST ACCOUNTING

Cost accounting is the process of compiling and aggregating the costs of producing certain products, providing certain services or undertaking certain activities. Management depends on cost information and the provision thereof in a format that is the most effective for decision-making is essential.

The sphere of cost accounting developed rapidly when it became necessary to determine the cost of products produced in an increasingly complex manufacturing environment. Hence, various techniques for determining product costs were developed.

Although cost accounting has its origins in the manufacturing environment, cost information is important for all types of activities and organisations. It is relatively easy to measure and determine product costs, but it is usually more difficult to determine the cost of non-manufacturing activities, such as the cost of marketing and general administration.

In modern business environments cost aggregation procedures have evolved to such a level that they can provide information needed even for decisions not traditionally associated with products and services.

Cost accounting is also essential for non-profit organisations. To evaluate their effectiveness, organisations such as government institutions, educational institutions, hospitals and churches must also determine the cost of the products and services that they buy and render.

THE FUNCTION OF MANAGEMENT ACCOUNTING

Management accounting has to do with planning and control decisions.

Planning decisions

Planning decisions set goals for the enterprise and design the actions needed to attain these goals. Typical decisions for which management accounting information is necessary are, *inter alia*:

- ☐ How many units of a given product should be produced in the next budget period?
- ☐ How should a new product be marketed?
- ☐ Should the production facilities be expanded or reduced?
- ☐ Should the production and sale of an existing product continue or cease?
- ☐ How much should be spent on advertising, research and development?
- ☐ What are the enterprise's requirements for short-term and long-term funds?
- ☐ Should a given product be manufactured by the enterprise or is it more economical to purchase it from an outside supplier?

All the above-mentioned planning decisions require estimates of future costs and, in certain cases, future income. Although the planning decisions are based on management's future expectations, historical data provide a good departure point for such future-orientated estimates. Therefore, financial accountants and management accountants use the same databases.

Control decisions

Control decisions entail the comparison of actual results with expected results and the imposition of accountability for deviations from the standards originally set. The control function may require further management decisions to ensure that the planned results are achieved or that the initial planning is amended in the light of the prevailing conditions.

The decisions that must be taken in the control phase are mainly choices between possible alternative actions.

The place and function of financial accounting, management accounting and cost accounting are shown in Diagram 1.2:

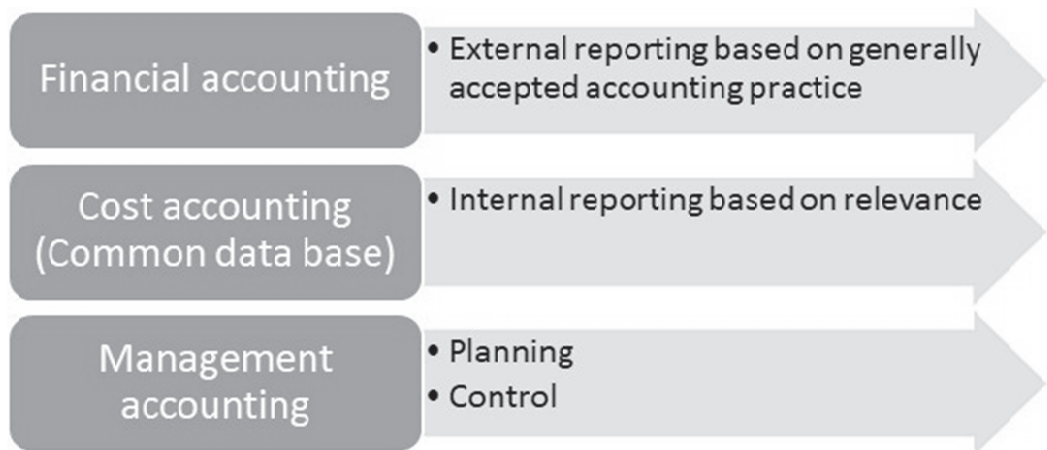


Diagram 1.2

COST ACCOUNTING SYSTEMS

A cost accounting system is a set of systematic processes and procedures that are used to measure, record and report on cost accounting data. There are five distinct activities in any cost accounting system:

- ☐ Cost determination
- ☐ Cost recording
- ☐ Cost analysis
- ☐ Cost management
- ☐ Cost reporting.

Cost determination

In this activity, data is collected to determine the costs of a specific product or activity. Before this can be done information (i.e., hours worked, material used, and units produced) must be obtained from the different departments in the enterprise.

Cost recording

Most cost accounting systems are an integral part of the enterprise's double-entry accounting system. The cost accounting system is part of the basic accounting system that accumulates accounting information for the use in both management and financial accounting. The information for the recording of labour and material costs is obtained from various source documents such as wage sheets and supplier's invoices.

Cost analysis

A cost accounting system can provide a large amount of information but in order for it to be useful and meaningful, the information must be analysed by people who have a thorough knowledge of the cost accounting methods in use.

Cost management

The cost accountant uses **cost analysis** to *make meaningful recommendations concerning cost management (for example, savings on costs)*. The cost accountant thus fulfils a strategic role in the allocation of scarce resources within the organisation. To provide management with meaningful information accountants must collect, analyse and report costing information in a different manner from the traditional ways. Therefore, **cost management** can be defined as *the preparation of information in report format for the requirement of management to effectively manage the enterprise*. The various techniques used for this will be discussed later in this book.

Cost reporting

Reporting is the process by which relevant information is given to the decision-makers. Internal cost reports are usually very detailed. **Relevant information** refers to *accounting information concerning the enterprise which is required by a particular manager or management team for the making of a specific decision*.

The cost accounting system must provide relevant and necessary information timeously to those who require it.

ETHICAL CONDUCT

Most enterprises in South Africa are driven by a profit motive, which, if successful, contributes towards the growth of the country. Millions of transactions are passed daily through the books of all enterprises in South Africa.

Although some actions are clearly ethical (for example, working a full day in exchange for a full day's pay), and others are clearly unethical (for example, fraudulent deals or pumping contaminated waste into rivers), managers and accountants occasionally take actions that do not support the attainment of organisational goals mainly due to the set of inappropriate performance measures. Some examples are:

- ☐ If performance is measured by return on assets (net profit/total assets), managers may be reluctant to replace inefficient equipment with new equipment because the resulting increase in the denominator will reduce return on investment.
- ☐ Keeping redundant or obsolete inventory in the books to avoid recording smaller profits or even losses.
- ☐ Purchasing supplies from a relative or friend rather than going through a transparent tender process.

- ☐ Allocating some costs of contract X to contract Y to avoid an unfavourable performance report on contract X.
- ☐ Basing a budget on an overly optimistic sales forecast.

To make employees more aware of situations involving ethical behaviour and to provide a reference point of resisting pressures to engage in actions of questionable ethical standards of conduct normally existing for the employees of enterprises. Careers may be affected when individuals are found to be involved in unethical behaviour. The careers of people who fail to point out unethical behaviour may also be affected, especially if they have a responsibility for measurement and reporting.

Professional institutions normally prescribe standards of ethical conduct. The ethical standards of the Association of Accountants and Financial Professionals in Business (IMA®) in the United States of America is a good example of the ethical code for management accountants. A shortened version of the IMA® Statement of Ethical Professional Practice is as follows:

I. COMPETENCE

Each member has a responsibility to:

- ☐ Maintain an appropriate level of professional expertise by continually developing knowledge and skills.
- ☐ Perform professional duties in accordance with relevant laws, regulations, and technical standards.
- ☐ Provide decision support information and recommendations that are accurate, clear, concise, and timely.
- ☐ Recognise and communicate professional limitations or other constraints that would preclude responsible judgement or successful performance of an activity.

II. CONFIDENTIALITY

Each member has a responsibility to:

- ☐ Keep information confidential except when disclosure is authorised or legally required.
- ☐ Inform all relevant parties regarding appropriate use of confidential information. Monitor subordinates' activities to ensure compliance.
- ☐ Refrain from using confidential information for unethical or illegal advantage.

III. INTEGRITY

Each member has a responsibility to:

- ☐ Mitigate actual conflicts of interest, regularly communicate with business associates to avoid apparent conflicts of interest. Advise all parties of any potential conflicts.
- ☐ Refrain from engaging in any conduct that would prejudice carrying out duties ethically.
- ☐ Abstain from engaging in or supporting any activity that might discredit the profession.

IV. CREDIBILITY

Each member has a responsibility to:

- ☐ Communicate information fairly and objectively.
- ☐ Disclose all relevant information that could reasonably be expected to influence an intended user's understanding of the reports, analyses, or recommendations.
- ☐ Disclose delays or deficiencies in information, timeliness, processing, or internal controls in conformance with organisation policy and/or applicable law.

Source: The Association of Accountants and Financial Professionals in Business
[<https://www.imanet.org/-/media/b6fbbeb74d964e6c9fe654c48456e61f.ashx>]
Accessed: 13 October 2017

The CIMA follows a principle-based approach to ethics, which provides a framework for assessing if the finance professional complies with fundamental principles. A summary of its approach is presented as follows:

Conceptual framework approach

The Code establishes a conceptual framework that requires a professional accountant to identify, evaluate, and address threats to compliance with the fundamental principles. The conceptual framework approach assists professional accountants in complying with the ethical requirements of this Code and meeting their responsibility to act in the public interest.

Fundamental principles

CIMA's Code of Ethics is made up of five fundamental principles:

- ☐ Integrity: being straightforward, honest and truthful in all professional and business relationships. You should not be associated with any information that you believe contains a materially false or misleading statement, or which is misleading by omission.
- ☐ Objectivity: not allowing bias, conflict of interest or the influence of other people to override your professional judgment.
- ☐ Professional competence and due care: an ongoing commitment to your level of professional knowledge and skill. Base this on current developments in practice, legislation and techniques. Those working under your authority must also have the appropriate training and supervision.
- ☐ Confidentiality: you should not disclose professional information unless you have specific permission or a legal or professional duty to do so.
- ☐ Professional behaviour: comply with relevant laws and regulations. You must also avoid any action that could negatively affect the reputation of the profession.

The code explains these principles, and gives examples of their use for professional accountants in practice (Part B) and professional accountants in business (Part C).

Threats

The code identifies five categories of common threats to the five principles:

- ☐ Self-interest threat: commonly called a "conflict of interest" which may inappropriately influence judgment or behaviour.
- ☐ Self-review threat: when you are required to evaluate the results of a previous judgment or service.
- ☐ Advocacy threat: arising if promoting a position or opinion to the point that your subsequent objectivity is compromised.
- ☐ Familiarity threat: when you become so sympathetic to the interests of others as a result of a close relationship that your professional judgment becomes compromised.
- ☐ Intimidation threat: when you are deterred from acting.

Safeguards

Our code has a "threats and safeguards" approach to resolving ethical issues. This means that if you think there is a threat, you should assess whether the threat is significant. Then, take action to remove or mitigate it. Employing institutions often have safeguards: whistle-blowing or grievance procedures. Safeguards are also created by the profession, legislation or regulation.

Source: The Chartered Institute of Management Accountants

[<https://www.cimaglobal.com/Documents/Ethics/CIMA%20Code%20of%20Ethics.pdf>]

Accessed 13 October 2017

THE CHARTERED INSTITUTE OF MANAGEMENT ACCOUNTANTS (CIMA)

The Chartered Institute of Management Accountants (CIMA) and the South African branch of the Institute influence the professional environment of management accountants in South Africa. **CIMA** *is a professional management accounting institute that promotes the professionalism and competence of management accountants.* CIMA awards the **ACMA**, **GCMA** (Accredited Chartered Management Accountant, Global Chartered Management Accountant) designation to all students who comply with the requirements.

Management accountants possessing an ACMA are in high demand by all industries and are often given greater responsibilities and rewarded with higher compensation than those who do not possess this qualification. The ACMA qualification enjoys international status, as it is a popular qualification in most countries of the world.

Just as the Association of Accountants and Financial Professionals in Business (IMA®) has a statement of ethical professional practice, so does CIMA.

THE AIM OF THIS BOOK

In this book only internal reporting (management accounting) and cost accounting as a database for management accounting are covered.

In recent years the difference between cost and management accounting has become somewhat vague. It is not always possible to draw a dividing line between the two facets and in many cases where a distinction is made it is merely one of relative emphasis.

Cost accounting emphasises *the assimilation and evaluation of cost data.* **Management accounting** emphasises *the use of cost data in internal planning, control and decision-making.*

Different meanings can be attached to the term *cost data*. Consequently, this book emphasises the three primary uses of cost data, namely;

- ☐ the allocation of costs between cost of sales and finished goods inventory for the calculation of profit;
- ☐ cost data for long- and short-term decisions: and
- ☐ cost data for planning and control decisions.

Because there is a close relationship between the assimilation, evaluation and use of cost data, attention is given to all these aspects.

Although this book concentrates on the business enterprise, many of the concepts and techniques discussed are also applicable to non-profit-orientated business enterprises. Moreover, one of the most important developments in recent years has been the application of cost accounting and management accounting techniques and concepts to the management of non-profit-orientated organisations.

In modern practice, most enterprises process their financial data by means of computers. However, the discussion of topics in this book is presented using a manual data processing system so that the basic concepts, analysis and use of financial information may be explained and illustrated.

SUMMARY

Accounting is an information system of which the main function is to provide relevant information to a wide variety of interested parties. Accounting has developed into two streams, namely, financial accounting, which provides external users with financial information, and management accounting, which meets the internal users' requirements.

Management accounting is the process of identifying, measuring, analysing, interpreting and communicating information in pursuit of an enterprise's goals and thus, has to do with planning and control decisions.

The distinctive activities in any cost accounting system are cost determination, cost recording, cost analysis, cost management and cost reporting.

Standards of conduct normally exist for employees of enterprises and professional institutions. A shortened version of The Standards of Ethical Conduct of Practitioners of Management Accounting and Financial Management was briefly discussed. CIMA promotes the professionalism and competence of management accountants.

PERSPECTIVES ON COSTING

Knowledge

You should know:

- ☐ the key terms and concepts presented at the end of this chapter;
- ☐ that accounting is a specialised information system with the purpose to provide relevant information about the enterprise to a wide variety of interested parties;
- ☐ that the purpose of financial accounting is to provide financial information about the enterprise by means of financial statements mainly for the use of parties who are primarily outside the enterprise;
- ☐ that the purpose of management accounting is to provide special-purpose reports about the enterprise for planning and control purposes and for decision-makers within the enterprise;
- ☐ that cost accounting is the process of calculating the cost of producing products, providing services or the undertaking of projects or activities;
- ☐ the five distinctive activities of a cost accounting system namely, data collection, cost recording, cost analysis, cost management and cost reporting;
- ☐ the scope of ethical conduct which includes professional competency, integrity, confidentiality of information and to communicate information fairly and objectively; and
- ☐ that the Chartered Institute of Management Accountants (CIMA) and the South African branch thereof, influence the professional environment of management accountants in South Africa.

Skills

You should be able to:

- ☐ explain the difference between financial and management accounting;
- ☐ explain the purpose of financial accounting;
- ☐ explain the purpose of management accounting;
- ☐ correctly define cost accounting;
- ☐ list the five distinctive activities of a cost accounting system; and
- ☐ explain ethical conduct.

KEY TERMS AND CONCEPTS

CIMA	10	Cost management	7
CMA	10	Financial accounting	3
Cost accounting	5	Management accounting	3
Cost analysis	7	Relevant information	2

EXERCISES

- 1.1** Describe the differences between financial and management accounting.
- 1.2** Discuss the role of the cost accountant.
- 1.3** Discuss the activities of a cost accounting system.
- 1.4** Discuss in detail the ethical conduct of the management accountant.

2 Cost classification and terminology



LEARNING OUTCOMES

What is cost and how does it relate to objects?

How do costs move through a business?

What are the different ways in which costs can be classified?

- Define the concept of cost
- Explain 'cost objects'
- Costing flow through a business
- Nature of cost classification
- Time classification
- Functional classification
- Behavioural classification

CHAPTER OUTLINE

This chapter begins by discussing the concept of cost and how it is defined in the context of management accounting. Within a business or similar enterprise costs will not stand in isolation but will rather be attributable to cost objects. These cost objects are typically chosen by management as it is necessary to measure the costs associated with certain cost objects to assist management in making financial and other decisions. Cost objects depend on the context in which the business operates, therefore if the business manufactures, for example, a motor vehicle, then every motor vehicle will be a cost object. Processes can also be identified as a cost object such as the process of applying the paint to the motor vehicle that is being manufactured.

The concept and definition of cost is specific to the field of management accounting and is different to the accounting concept of expense. The accounting concept of expense allows for all outflows of money or other resources to be recognised as an expense against profit, in the Statement of Profit or Loss. If the benefit associated with a particular expense will only be received in the future, then the expense is classified as an asset in the Statement of Financial Position. Avoidable and unavoidable outflows are still classified as expenses. In contrast, the costs associated with a particular cost object will only consist of the normal expenses and if there are any unavoidable expenses these will also be considered part of the cost. Any avoidable expenses that are not normally required in the manufacturing process will not form part of the cost of a cost object.

The remaining part of the chapter explains how costs, once allocated to a cost object, can be classified in a variety of ways that assists with various types of financial decisions. Costs can be classified according to their nature which identifies which costs are part of manufacturing costs and which are not. The rest make up the commercial costs of a business. More relevant to accounting is the time classification which allocates costs either to a product or a period. Product costs are allocated to products which are recognised as an expense when the product is sold. Period costs are allocated to the period as opposed to a product. Costs can also be classified according to the function they serve in the manufacturing process, being either material, or labour, or manufacturing overheads. Finally, costs can be classified according to the different ways in which they behave depending on the activity levels of a business.

THE CONCEPT OF COST

Nowadays, there is surely no term used more than that of cost, but the concept has different meanings for everyone. Some speak about the cost of living, the cost of transport, the cost of food, health costs and other activities that cause cost to occur. Within the field of finance, the concepts of cost and expenses are synonymous, but in management accounting in particular, they have different meanings.

Expenses *relate to value offered where it has not yet been determined whether the expenses will be applied effectively. As soon as the expenses are applied effectively, we can speak of cost.* If the expenses are not applied effectively, the expenses are wastage (loss). Wastage is the difference between the total expenditure and the effective expenditure. Thus, wastage suggests an economic rather than a technical concept.

Expenses must be applied as effectively as possible to obtain certain resources, in other words, the minimum expense must be applied to obtain the best possible advantage. The effectiveness must be measured economically and not technically. In a manufacturing environment certain materials are used in the production process, and it will be an expense to purchase the material. If under normal circumstances 80% of the material is used successfully and 20% is discarded, this discarded portion cannot be regarded as wastage as it is part of the normal manufacturing process. Should more than the normal 20% be discarded this additional portion will be an avoidable wastage and considered to be a loss.

Therefore, it can be said that wastage is a loss but that all losses cannot be regarded as wastage. **Wastage** is thus *all expenses that were not necessary for producing a product or delivering a service.* Wastage may have different causes, for example, ineffective administration, working methods, marketing, and distribution of expensive production resources.

Costs are expenses which are economically unavoidable and technically essential to produce a product or service. Each specific expense has a norm and if this expense satisfies the norm it is regarded as a cost. Care must be taken that avoidable wastages are not regarded as costs, but rather as a loss.

However, in certain instances it is not so easy to determine the costs of products or services. For example, if an enterprise needs office equipment and decides to manufacture it itself, then determining the cost of the equipment is far more complex than if a quotation were to be obtained and the equipment purchased, as the cost of manufacturing the equipment includes the cost of material, labour and the cost of plant and equipment used.

Likewise, if management requests a 100-page computer printout regarding a specific aspect, how will the cost of the printout be determined? Factors that must be considered include the cost of the computer, salaries of computer personnel, computer maintenance and paper costs. The cost of the area occupied by the computer and other supporting costs must also be considered to determine the cost of the report.

There are many different cost reports that can fulfil the needs of management.

A manager only needs certain information to make a particular decision. To measure costs accurately and to satisfy management's needs for a specific type of cost report, a careful description and identification of the product or activity to be reported on is required.

From the previous discussion the concept cost can be defined as follows: **Cost** is a monetary measure of the resources given or expensed to acquire goods or services that benefit the enterprise at present or in the future. Any avoidable expenditure is not to be considered as part of the cost of the product or service.

COST OBJECTS

The first step in determining the cost of any product or activity (service) is to precisely define the cost object. The **cost object** is *any product, activity (service) or project requiring the costs to be measured*. A cost object is not the actual costs: it is the products, services, departments, divisions or any other activity or object which requires the cost to be determined.

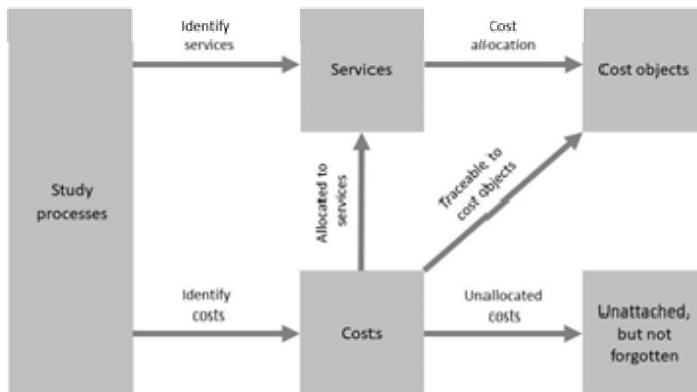


Diagram 2.1 (Adapted from www.principlesofaccounting.com)

For example, to determine the cost of office equipment that the enterprise plans to manufacture, the characteristics, size and quality of the equipment must be decided upon. Therefore, the cost object must be clearly stated so that all the costs of manufacturing the product can be included.

In a manufacturing enterprise, products are the primary (though not the only) cost object. However, there are also other cost objects that the enterprise must consider if the enterprise is to be managed effectively. These include marketing costs and the cost of the administration of the enterprise.

In this book we first discuss costing for *tangible products, and not activities (services) or projects* because it is relatively easy to visualise the production activity and the corresponding cost as the product moves through the production process. Consider the following example:

Example 2.1

Black Wattle Ltd manufactures office furniture and their main product is an office table called Office1. The following details relate to the Office1 table:

Labour – The table requires two hours of woodwork to be done by specialist carpenters. The average rate per carpenter is R110 per hour. The table then requires one hour of assembly at a rate of R86 per hour.

Material – An average table requires 32 meters of high-grade wood at R22 per meter and of this, three meters of wood is wasted in the process.

The labour and material required to produce the table is expenses and because all are necessary to produce the table it is all classified as costs. The Office1 table is identified as a *cost object* and therefore the costs are allocated as follows:

Office1 – Costing sheet

Labour – Specialist carpentry	2 hours × R110	R220
Labour – Assembly	1 hour × R86	R86
Material	32 meters × R22	R704
Total cost		R1 010

Note that the three meters unused wood is a normal unavoidable part of the manufacturing process and therefore it is also allocated to the total cost of the Office1 table.

ACCOUNTING FOR COST

At the time that it is incurred the cost represents an offer made to obtain an economic benefit. If the benefit has already have been received (for example, payment for the rental of a building for a period that has already expired) it is an accounting expense and is recognised on the Statement of Profit or Loss and Other Comprehensive Income (the term 'Statement of Profit or Loss' will be used throughout this text) for the past period. If the benefit will be received in the future it will be carried as a deferred or unexpired cost (for example, prepaid insurance, raw material inventory on hand and the carrying value of machinery) on the Statement of Financial Position. All deferred and unexpired costs are shown as *assets* in the Statement of Financial Position of the enterprise. An **asset** is a *present economic resource controlled by the entity as a result of past events. An economic resource is a right that has the potential to produce economic benefits.*

Costs where the benefit has already been received (for example, inventory that has been sold) will be recognised as an **expense**.

The following demonstrates the flow of information and follows on from Example 2.1:

Cost object	Office1 table		
Costs	Labour – Specialised	220	
	Labour – Assembly	86	
	Material	704	
	Total cost	1 010	
Total number of tables sold		7	
Total number of tables on hand		3	
Total number of tables manufactured		10	
Deferred cost	3 × 1 010	3 030	Asset in Statement of Financial Position
Expensed cost	7 × 1 010	7 070	Expense in Statement of Profit or Loss

It follows from the above that costs can briefly be described as the total sources used to achieve specified aims. Because there is a wide range of aims that can be pursued there are different ways in which costs can be classified. As with any other discipline cost accounting also has its own terminology. Since an understanding of this terminology and classification is necessary for the study of cost and management accounting, certain basic concepts and classifications will be touched on in the remainder of this chapter. A further treatment of each of the concepts and classifications will be given in relevant chapters in this book as progress is made.

In the following discussions the manufacturing enterprise is taken as the basic point of departure.

COST CLASSIFICATION

Classification of costs by their nature

All the costs that are allocated to a cost object can be classified in a variety of ways. Each classification depends on management requirements. Typically, the type of classification will assist with a financial decision that is under consideration or it can be according to a reporting requirement. The operating costs of a manufacturing enterprise can be classified into two broad categories according to the basic nature of the cost as follows:

- ☐ Manufacturing costs.
- ☐ Commercial costs.

Manufacturing costs is the sum of all the costs incurred in the manufacturing process, direct materials, direct labour and manufacturing overheads.

Commercial costs are all non-manufacturing costs that support the effective functioning of the business as a whole and can be divided into:

- ☐ **marketing costs** are part of commercial costs and include all the costs associated with the promotion of the product, the acquisition of orders, the administration of the marketing function and the delivery of finished goods; and
- ☐ **administrative costs** relate to executive, organisational and clerical costs of an enterprise, which exclude the costs, related to the manufacturing and marketing functions.

Marketing costs include the costs of obtaining the orders for and the delivery of manufactured products. Administrative costs include all costs relating to the day-to-day functioning of the enterprise.

Diagram 2.2 illustrates these basic classifications:

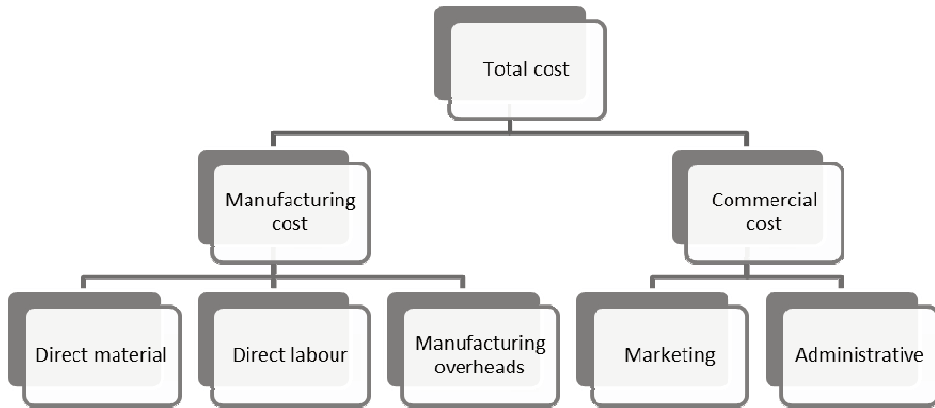


Diagram 2.2

This basic classification can be expanded further and subdivided into several other types of classifications, as described below.

Classifying costs by their timing

Costs can also be classified as product and period costs.

Period costs are the *costs associated with a given accounting period rather than a given product*. For example, marketing and administrative costs are normally costs incurred to generate income in a given period but it is not relative to the sale of given units. The rentals incurred for the hire of the locations necessary for the marketing of products are also normally a fixed amount per month which is not influenced by the volume of sales. In accounting the practice is to match costs incurred during a particular accounting period against the income earned during the same period. Therefore, commercial costs are classified as period costs.

Any period costs for which the related benefit has not yet been received will be classified as an *asset* in the Statement of Financial Position (for example, prepaid advertising costs).

Product costs, on the other hand, are *costs associated with the products that are manufactured*. Since this type of cost is coupled with the product it is sometimes treated as an asset and sometimes as an expense, depending on whether the product with which the cost is associated has already been sold. If still on hand it will be an asset (for example, cost of finished goods on hand) and will thus be shown as an *asset* in the Statement of Financial Position. Once the product is sold the cost becomes an expense and is transferred to the cost of goods sold and brought into account against the income generated by the sale of the product in the Statement of Profit or Loss. These principles are illustrated in Example 2.2.

Example 2.2

Ngwenya Enterprise Ltd was incorporated on 1 January 2015 with an initial capital of R10 000 cash. During January the enterprise purchased 2 000 units of the only product in which it trades at a cost price of R3 per unit. No units were sold in January, but in February 1 200 units were sold for cash at R5 each. Assuming that no other transactions took place, the enterprise's Statement of Financial Position and Statement of Profit or Loss is as follows on 1 January 2015, 31 January 2015 and 28 February 2015.

Statement of Financial Position as at:	1 Jan 2015	31 Jan 2015	28 Feb 2015
	R	R	R
Equity			
Capital	10 000	10 000	10 000
Add: Net income	—	—	2 400
	<u>10 000</u>	<u>10 000</u>	<u>12 400</u>
Assets			
Cash	10 000	4 000	10 000*
Inventory	—	6 000	2 400**
	<u>10 000</u>	<u>10 000</u>	<u>12 400</u>
* (R4 000 + R6 000)			
** (800 @ R3)			

Statement of Profit or Loss for the month ended:	31 Jan 2015	28 Feb 2015
	R	R
Income	—	6 000*
Less: Cost of goods sold	—	(3 600)**
Net income	<u>—</u>	<u>2 400</u>
* (1 200 @ R5)		
** (1 200 @ R3)		

As no sales took place in January, it would be incorrect to bring into account, as an expense, the amount expended during the month on the acquisition of the inventory. Therefore, it is shown as an asset in the Statement of Financial Position on 31 January. In February, the cost of 1 200 units which were sold during that month is brought into account as an expensed product cost against income derived from the sale of the same products to determine the net income for the month. The costs associated with the remaining 800 units are still shown as an asset.

This process whereby product costs are associated with the income earned from the sale of the same products, and period costs are associated with the period in which they expire, is the well-known 'matching concept' found in financial accounting.

Diagram 2.3 illustrates the matching concept:

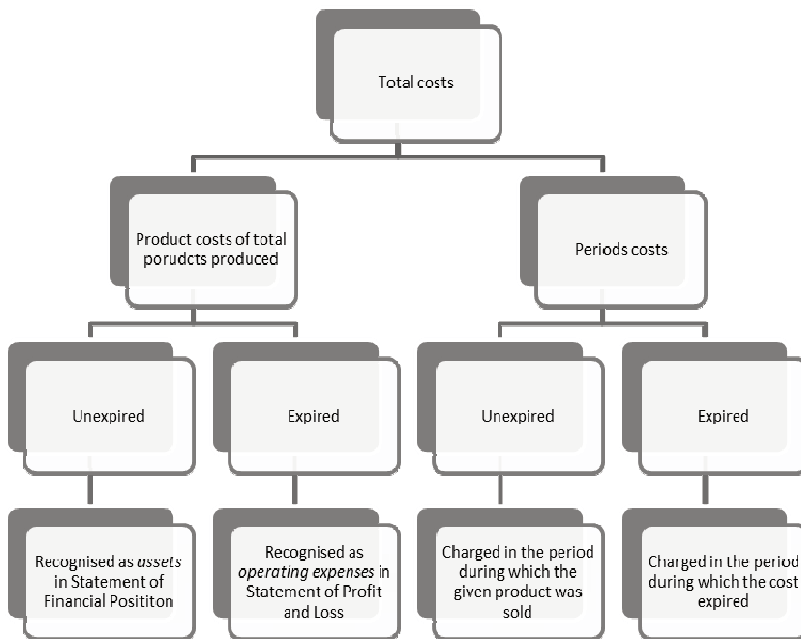


Diagram 2.3

Classifying costs by their function

Management decides what the cost of goods manufactured in a manufacturing enterprise consist of. They do this by:

- ☐ knowing which costs are product costs in such an enterprise; and
- ☐ understanding the flow of costs through the accounts of a manufacturing enterprise.

In this section product costs in a manufacturing enterprise are discussed. Cost flows are discussed in a later unit. Product costs can also be classified in different ways. As will be seen, the various classifications are not mutually exclusive, but overlap to an extent.

Product **manufacturing costs** consist of the following three elements:

- ☐ Direct material
- ☐ Direct labour
- ☐ Manufacturing overheads.

Direct material consists of *primary material and is easily traceable to the manufacturing of goods or services rendered*. It forms an integral part of the final product and usually consists of a predetermined measurable quantity proportional to the volume of production usage. Direct material forms a cost element on its own.

Indirect material consists of *secondary material which may or may not form part of the end product and the quantity used is not directly related to the volume of production. It cannot be conveniently linked directly to a cost object*. Indirect material does not form a cost element on its own and is normally grouped under manufacturing overheads.

To illustrate the difference between direct and indirect material the use of wood and sandpaper in a furniture factory can be taken as an example. The quantity of wood required for the manufacture of a specific piece of furniture can be determined accurately beforehand. However, the quantity of sandpaper used depends on the quality of the wood and can vary from piece to piece. Further, the sandpaper does not form part of the final product and consequently it is classified as indirect material.

Similarly, the concept **direct labour** refers to the cost of all essential labour physically expended on the manufacturing of a product and can be conveniently traced to the manufacturing of goods or services rendered.

In this case, too, it will not be possible to attribute certain labour costs incurred during the manufacturing process directly to a particular unit (or group of units). For example, the wages of welders who work in the manufacturing process would be classified as direct labour. On the other hand, the wages of machine maintenance personnel would not be classified as such but rather as indirect labour costs, which are classified under manufacturing overheads.

The difference between direct and indirect costs depends on the cost object. Depending on the traceability to the cost object, costs can be classified as direct or indirect. For example, the cost object can be to determine the costs associated with getting client orders. In this instance salaries, commissions and expenses of sales personnel will be direct costs whilst the costs of the personnel section that is responsible for the appointment of sales personnel will be indirect costs, as the costs of the personnel section are not directly related to obtaining orders.

Indirect labour can thus be defined as *labour costs that cannot be conveniently linked directly to a cost object*.

The following example illustrates the allocation of direct and indirect costs:

Example 2.3

Agri Export (Pty) Ltd is an exporting agent for agricultural products. The marketing function is not situated at their head office. Agri's costing information for the month is as follows:

	R
Salary: Marketing manager	120 000
Salary of the secretary of the marketing manager	15 000
Head office: Office rent	500 000
Salary: Managing director	200 000
Direct labour: Agricultural products	40 000
Wages: Head office, cleaning function	20 000
Salaries: Agricultural product staff	500 000

Required

Determine the direct costs of the marketing department and the agricultural product section.

Solution 2.3

	Marketing department R	Agricultural section R
Salary: Marketing manager	120 000	
Salary of the secretary of the marketing manager	15 000	
Direct labour: Agricultural products		40 000
Salaries: Agricultural product staff		500 000
Total	135 000	540 000

A clear distinction between the cost of the marketing function and the agricultural section is possible. Head office rent, the salary of the managing director and the wages of the head office cleaning function (R720 000) are direct costs of the head office but common costs of all other organisational units.

Manufacturing overheads refer to all other costs (excluding direct material and direct labour cost) expended in the manufacturing process. Examples of manufacturing overheads are indirect material, indirect labour, depreciation and insurance costs of production machinery and equipment.

The primary characteristic of manufacturing overheads is that they cannot be attributed directly to a particular unit, but they are, in fact, incurred during the production process. The amount that can be applied to a specific product can only be estimated. This can be done by determining the total of the manufacturing overheads for a period and then allocating that cost on some acceptable basis to products manufactured in that period. Consider the following example:

Example 2.4

Manu (Pty) Ltd submits the following information:

	R
Direct materials	100 000
Direct labour	50 000
Overheads	50 000
Units manufactured	2 000 units

Required

Determine the total manufacturing cost as well as the unit costs.

Solution 2.4

	Total costs R	Unit costs* R
Direct materials	100 000	50
Direct labour	50 000	25
Overheads (2 000 × R25 per unit)	50 000	25
Total manufacturing costs/unit costs	<u>200 000</u>	<u>100</u>

* Unit costs = Total cost ÷ 2 000 units

Two further sub classifications of production are:

- ☐ primary costs; and
- ☐ conversion costs.

Primary costs refer to the *total of the direct material and direct labour costs*. Initially in the development of costing, the emphasis was on these two relatively easily determinable costs only, while manufacturing overheads were (wrongly) treated as mere period costs.

The concept conversion cost is still commonly used today and has a bearing on the total of the direct labour costs and manufacturing overheads. In this context the concept of **conversion cost** refers to the *cost that must be employed to convert raw materials to a finished product*, which is direct labour and manufacturing overheads.

Diagram 2.4 illustrates the classification of the total costs of a manufacturing enterprise as developed in this unit:

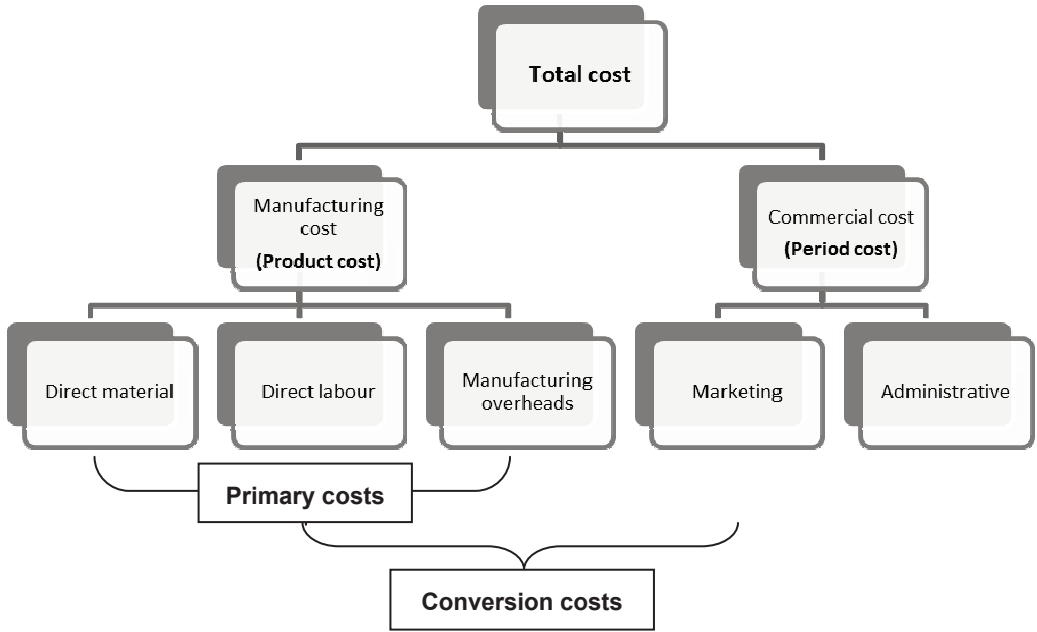


Diagram 2.4

The following example illustrates this cost classification:

Example 2.5

Rundu (Pty) Ltd submits the following information:

	R
Direct materials	30 000
Direct labour	20 000
Manufacturing overheads	50 000

Required

Determine the following costs:

- ☐ Primary costs
- ☐ Conversion costs
- ☐ Total manufacturing costs

Solution 2.5

	R
Primary costs:	
Direct materials	30 000
Direct labour	20 000
Primary costs	50 000
Conversion costs:	
Direct labour	20 000
Manufacturing overheads	50 000
Conversion costs	70 000
Manufacturing costs:	
Direct material	30 000
Direct labour	20 000
Manufacturing overheads	50 000
Total manufacturing costs	100 000

Classifying costs according to their behaviour

Certain costs demonstrate a defined behavioural response to a change in the activity levels of an enterprise. This relationship between cost and activity level can be summarised in four broad categories, namely, variable cost, fixed cost, step cost and mixed cost. It is important to know what the impact will be on the profit of an enterprise should there be any such changes. The activity level is usually measured in terms of the quantity of units produced.

Variable costs

Variable costs are all costs that vary in direct proportion with the activity level of the enterprise. These types of costs are usually direct costs and display a direct relationship with the cost object. Examples of these types of costs are direct material and direct labour, which are incidentally also product costs. For example, should production increase, then the direct material and labour costs would also increase. If there are any selling costs and the number of units sold decreases, then the direct selling cost would also decrease.

Consider Example 2.1, where Black Wattle Ltd produced an office table called Office 1. For every table produced there is a very specific amount of labour and materials used and if two tables were produced then the amount of labour and material required will double. Should the product be profitable then it can be said that the profit would also double. The relationship can be illustrated as follows:

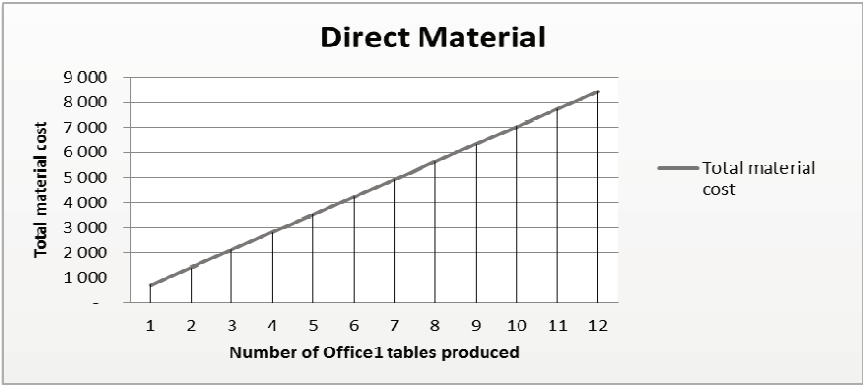


Diagram 2.5

From this example, it is clear that to produce one table requires R704 in material cost. For every additional table produced, an additional R704 is needed, therefore, to produce two tables will cost R1 408. There is a *direct proportion* between the quantity of tables produced and the material cost, hence this is a direct variable cost. Note that the total direct material cost steadily increases but remains R704 per unit.

Fixed cost

Fixed costs are typically period commercial costs that do not vary with the particular level of activity within an enterprise. The cost remains constant throughout the period under consideration. As an example, rental costs are usually fixed for a period of one year. Should Black Wattle Ltd pay R15 000 per month to rent premises from which to manufacture their tables this cost will be classified as fixed. It does not matter how many tables are produced (or not produced), this cost will remain the same. The cost can be illustrated as follows:

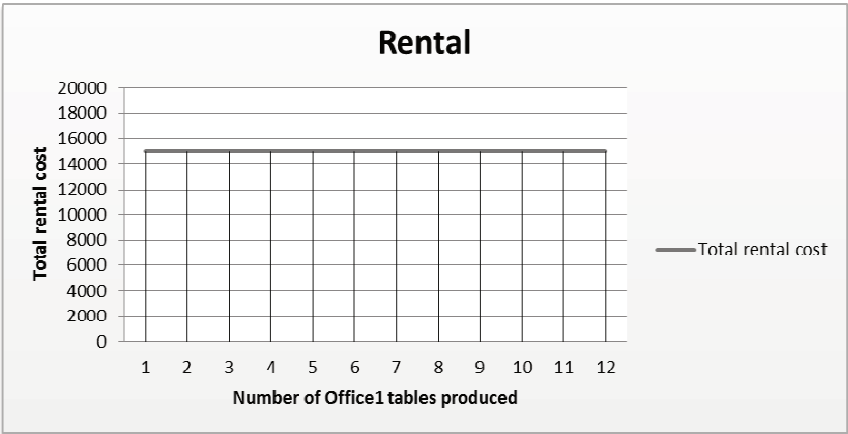


Diagram 2.6

Step cost

Step costs are fixed costs that respond in a step fashion to the chosen activity level of the enterprise. In our example tables are manufactured and sold. Let's assume that for

every five tables that are stored in the warehouse, an additional amount of R3 000 needs to be paid to the landlord as storage costs. The relationship can be illustrated as follows:

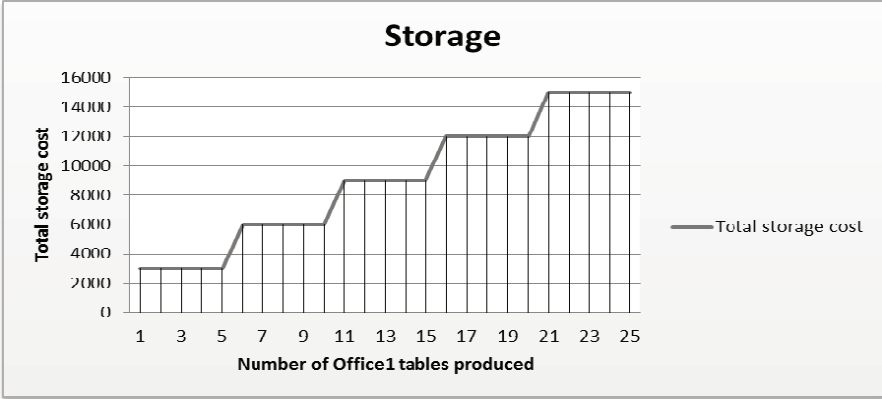


Diagram 2.7

Note how the cost behaves in response to a change in activity level. Up to five tables can be produced that will incur a fixed storage cost of R3 000. If one more table is produced, giving a total of six, then the fixed cost 'steps' up to the next level of R6 000.

Mixed cost

A mixed cost has a variable and fixed component. For example, if an enterprise makes use of a fixed fibre line for internet connectivity, it will incur a fixed monthly rental fee as well as a variable cost dependent on the amount of data that was used. Consider the following example: Black Wattle Ltd rents a fibre line for R2 500 per month and pays approximately R100 in data usage fees for every table that was sold. This is due to its marketing department that sells the tables via the internet. The relationship can be illustrated as follows:

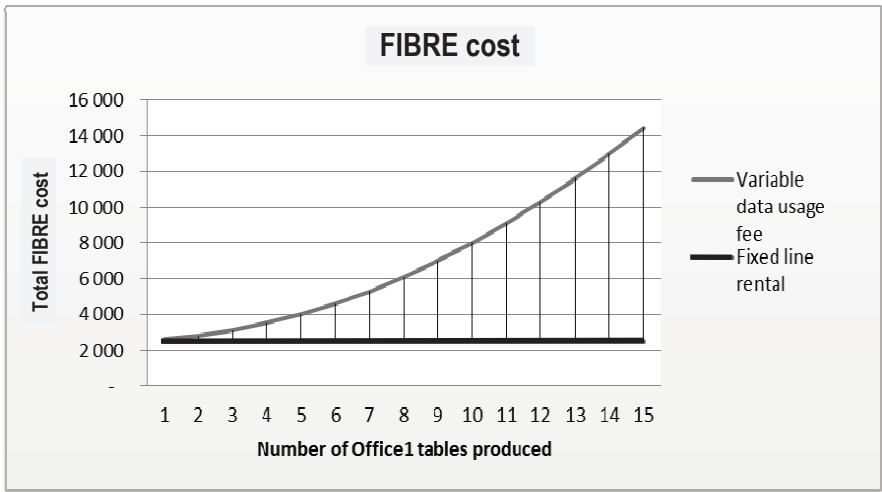


Diagram 2.8

Note how the cost does not start at zero but rather starts at R2 600 (R2 500 + R100). If the company used no data during the month, the total cost will still be R2 500. Any additional costs above this level will only be as a result of the variable data usage cost.

SUMMARY

Costs are necessary sacrifices to deliver products and services. Any avoidable expenditure is not to be considered as part of the cost of a product or service but is regarded as wastage. The cost object is not the actual costs, but it is any product, service, activity or project which must be measured.

Expenses are costs that are incurred where the benefit has already been received and is reflected as such in the Statement of Profit or Loss. Assets are costs where the benefit has not yet been received by the enterprise and are disclosed in the Statement of Financial Position.

Manufacturing costs include direct materials, direct labour, and manufacturing overheads, whereas commercial costs are the sum of marketing and administrative costs.

Period costs are the costs associated with a given accounting period rather than a specific product. Product costs, on the other hand, are associated with the products that are manufactured.

Primary costs are the total of direct materials and direct labour costs, while conversion costs are the total of the direct labour costs and manufacturing overheads.

A variable cost is constant per unit, but changes in total in direct relation to the number of units. Fixed costs are those costs that do not change in total within the relevant range as activity in relation to the output changes.

Direct costs are costs that can be accurately traced to a particular cost object. Indirect costs are costs that cannot accurately be traced to a specific cost object.

PERSPECTIVES ON COSTING

Knowledge

You should know the following:

- ☐ definitions of cost elements;
- ☐ cost is a monetary measure of the resources given up to acquire goods or services to benefit the enterprise at present or in the future;
- ☐ cost objects are products, services, departments, divisions or any other activity or object which cost must be measured;
- ☐ the operating costs of a manufacturing enterprise is divided into manufacturing costs and commercial costs;
- ☐ the commercial costs are divided into marketing costs and administrative costs;
- ☐ product costs are associated with manufactured products;
- ☐ period costs are costs associated with a given accounting period rather than products;
- ☐ the difference between primary and conversion cost;
- ☐ the difference between fixed and variable cost; and
- ☐ the difference between direct and indirect cost.

Skills

You should be able to:

- ☐ differentiate between expired and unexpired costs;
- ☐ classify costs in product and period costs;
- ☐ divide operating costs into manufacturing and commercial costs;
- ☐ divide commercial costs into marketing and administrative costs;
- ☐ classify manufacturing costs in their different cost elements;
- ☐ classify manufacturing costs into primary and conversion costs;
- ☐ differentiate between fixed and variable costs;
- ☐ differentiate between direct and indirect costs; and
- ☐ solve basic problems with regard to the above.

KEY TERMS AND CONCEPTS

Administrative costs	17	Indirect labour	21
Assets	16	Indirect material	20
Commercial costs	17	Manufacturing costs	17
Conversion costs	23	Manufacturing overheads	22
Cost	14	Marketing costs	17
Cost object	15	Period costs	18
Direct labour	21	Primary costs	23
Direct material	20	Product costs	18
Expenses	14	Wastage	14

REVIEW PROBLEMS

Problem 2.1

Big T manufactures printed T-shirts. A selection of costs associated with the manufacturing process of the T-shirts and the general operations of the company are provided below:

1. A single printed T-shirt uses one of the 7 standard colours of T-shirt to print on. Such a standard colour T-shirt costs R25.
2. Each T-shirt is manually loaded into and out of the printing machine and at the same time a quality check is performed on the T-shirt. Such an employee will earn a monthly salary of R12 000. However, for any special orders that required the employee to come to work over a weekend, an additional R2 per T-shirt is paid to the worker, over and above his/her normal monthly salary.
3. Each job order is also quality inspected by a factory supervisor who is paid a monthly salary of R25 000 per month regardless of the level of production.
4. Electricity consumption per printing machine averages at R150 per hour regardless of whether it is active or idle.

5. The depreciation cost of the printing machine used to print on the T-shirts totals R25 000 per year.
6. The salary of the operations director is R225 000 per year.
7. Big T spends R200 000 per year on advertisement costs.
8. Sales personal do not earn a salary but are paid R2.50 per T-shirt sold.
9. Big T orders the 7 standard colour T-shirts in bulk from its supplier in the East. Big T stores these bulk orders of inventory in a storage facility at a fixed cost of R30 000 per month. At times, this storage facility is insufficient in capacity, resulting in Big T renting out more storage space at an additional R10 000 per month to mitigate this issue.

Required

- (a) Using the table below, classify the above list of costs according to their cost nature.

	Manufacturing cost (product cost)		Commercial cost (period cost)		Cost behaviour			
	Direct cost	Indirect cost	Marketing costs	Administrative cost	Variable cost	Fixed cost	Step cost	Mixed cost
1								
2								
3								
4								
5								
6								
7								
8								
9								

- (b) Group the above costs, by their listed number provided, as primary costs and conversion costs.

Solution 2.1

(a)

	Manufacturing cost (product cost)		Commercial cost (period cost)		Cost behaviour			
	Direct cost	Indirect cost	Marketing costs	Administrative cost	Variable cost	Fixed cost	Step cost	Mixed cost
1	X				X			
2	X							X
3	X					X		
4		X			X			
5		X				X		
6				X		X		
7			X			X		
8			X		X			
9		X					X	

(b)

Primary costs = 1 + 2 + 3

Conversion costs = 2 + 3 + 4 + 5 + 9

Problem 2.2

The following information has been taken from the accounting records of STEEL Ltd for the year ending 31 December 2015 and is presented as follows:

	R
Work-in-progress stock, 1 January	1 570 000
Raw material opening stock, 1 January	600 000
Marketing costs	2 000 000
Factory equipment maintained	500 000
Finished goods in stock 31 December	850 000
Sales revenue	35 500 000
Raw material purchased during the year	5 000 000

continued

	R
Depreciation	600 000
Direct labour costs	3 800 000
Raw material in closing stock, 31 December	
Factory insurance	100 000
Work-in-progress stock, 31 December	1 354 000
Indirect labour	1 500 000
Administrative costs	8 500 000
Finished goods in stock, 1 January	1 000 000

Required

- (a) Prepare a schedule of cost of goods manufactured.
 (b) Calculate the cost of goods sold.
 (c) Using the data provided as well as your answers calculated in (a) and (b), prepare a Statement of Profit and Loss for STEEL Ltd.

Solution 2.2

(a)

	R	R
Direct materials:		5 150 000
Raw material opening stock, 1 January	600 000	
Add: Purchases of raw material	5 000 000	
Raw material available for use	5 600 000	
Less: Raw materials in closing stock, 31 December	(450 000)	
Direct Labour:		3 800 000
Direct labour costs	3 800 000	
Manufacturing overheads:		2 700 000
Indirect labour	1 500 000	
Maintenance	500 000	
Depreciation	600 000	
Insurance	100 000	
Total manufacturing costs:		11 650 000
Add: Work in progress stock, 1 January		1 570 000
Less: Work in progress stock, 31 December		(1 354 000)
Cost of goods manufactured		11 866 000

(b)

	R
Finished goods in stock, 1 January	1 000 000
Add: Cost of goods manufactured	11 866 000
Goods available for sale	12 866 000
Less: Finished goods in stock, 31 December	(850 000)
Cost of goods sold	12 016 000

(c)

	R	R
Sales		35 500 000
Less: Cost of goods sold		(12 016 000)
Gross profit		23 484 000
Less: Marketing and administrative costs		10 500 000
Marketing costs	2 000 000	
Administrative costs	8 500 000	
Profit/(Loss)		12 984 000

EXERCISES

2.1 Identify the relevant accounting information

Instrument Traders Ltd have for the past number of years used a delivery service to do their rural deliveries. The cost of the service in the current year was an average of R0.30 per kilogram for 600 000 kilograms delivered. The delivery enterprise informed the company that in the following year their costs would increase by 20%. The management of the company is not happy about this and is considering performing their own deliveries.

The management of the company has asked you to obtain information that is relevant to the consideration of such a decision. You have gathered the following data:

- ☐ A branch of the company in another province already pays an independent delivery enterprise R0.27 per kilogram for deliveries.
- ☐ Two new delivery vehicles have the capacity to deliver 500 000 kilograms per year can be purchased at R95 000 each, with a scrap value of R5 000 after five years.

Other variable costs relating to the vehicle with an average per kilogram are the following:

	R
Insurance	0.02
Fuel and oil	0.08
Maintenance	0.03
Personnel	0.10

The cost for loading and delivery will be R0.08 per kilogram. If the vehicles had been purchased in the previous year, they would have cost only R65 000 each.

Required

- (a) Determine the delivery cost per kilogram if the company decides to do its own deliveries. Must the company accept the alternative?
- (b) Which information did you not consider in answering part (a)? Motivate your answer.

2.2 Identification of product and period costs

Classify the following items as product or period costs:

- (a) Wages of workers that handle material during the production process.
- (b) Advertising costs.
- (c) Depreciation of a vehicle that is used by the managing director.
- (d) The production manager's salary.
- (e) Lease payments on manufacturing equipment.
- (f) Lease payments on vehicles that are used by the sales personnel.
- (g) Depreciation on manufacturing equipment.
- (h) Rent of factory building.
- (i) Cleaning materials used by the production workers.

2.3 Identify product and period costs

The following is a list of the accounts used by Tinsel Manufacturers Ltd:

- (a) Wages of dispatch clerks and full-time packers.
- (b) Accident insurance premium for production personnel.
- (c) Direct labour.
- (d) Assessment rates in respect of manufacturing facilities.
- (e) Depreciation on equipment in administration office.
- (f) Maintenance costs for manufacturing equipment.
- (g) Insurance costs for manufacturing equipment.
- (h) Sales commission.
- (i) Depreciation on manufacturing equipment.
- (j) Direct material.
- (k) Fire insurance on completed goods.
- (l) Fire insurance on unprocessed materials.
- (m) Storing and handling costs on unprocessed materials.
- (n) Salaries of sales personnel.
- (o) Lease costs for a computer that is used exclusively for scheduling of production.
- (p) Running costs for administrative personnel's cafeteria.
- (q) Running costs for the first aid room for manufacturing personnel.
- (r) Administrative salaries.
- (s) Advertising costs.
- (t) Indirect material.

Required

Classify each of the above items as a product or a period cost. In the case of items that you have classified as product costs, also indicate whether these are direct or indirect costs.

2.4 Identification of fixed and variable costs

Classify each of the following as fixed or variable costs:

- (a) Salaries of two supervisors.
- (b) Electronic components in a TV assembling plant.
- (c) Depreciation of production equipment.
- (d) The production manager's salary.
- (e) Lease payments on office equipment.
- (f) The salary of the secretary of the production manager.
- (g) Staples used during the assembling process of the products.
- (h) Wages of the cleaning personnel in the factory.
- (i) Cartons as packaging material for the TV sets.

2.5 Identification of direct and indirect costs

Classify each of the following as direct or indirect costs:

- (a) Wages of the cleaning staff spending 75% of their time in the factory and the other 25% in the office building.
- (b) Advertising costs.
- (c) Depreciation of a vehicle that is used by the managing director.
- (d) The production manager's salary.
- (e) Lease payments on office equipment.
- (f) Lease payments on production equipment.
- (g) Rent of the office building.
- (h) Rent of the factory building.
- (i) Cleaning materials used by the production workers.

3

Elements of cost



LEARNING OUTCOMES

What is the role of material costs in a business?

MATERIAL

- Define the different terms and concepts in respect of inventory-holding
- Describe the concept of inventory piling
- Determine the value of inventory according to the LIFO, FIFO and AVCO (weighted average) methods
- Implement all aspects of an EOQ inventory management system

What is the role of labour costs in a business?

LABOUR

- Explain the complexity of labour
- Apply labour control measures
- Draw up labour records
- Determine net remuneration including calculations for overtime and normal deductions
- Differentiate between direct and indirect labour
- Record all accounting entries in respect of remuneration
- Understand and apply various wage incentive schemes
- Calculate the labour recovery rate
- Explain and apply the effect of the learning curve

What is the role of overhead costs in a business?

OVERHEADS

- Explain the difference between manufacturing, administrative and marketing overheads
- Divide total overheads into fixed, variable and semi-variable components

What is the role of marketing costs in a business?

MARKETING

- Classify marketing costs as costs related to the acquisition of orders and costs related to the execution of orders
- Determine, plan and control marketing costs by product, area, salesperson and size of order
- Calculate net income of individual products
- Calculate net income by area
- Calculate net income by salesperson
- Allocate marketing costs by order

CHAPTER OUTLINE

In this chapter, the various cost elements (i.e., *material, labour, overheads and marketing*) are introduced. Each cost element can be subdivided further to obtain a very refined and precise grouping of costs.

Material, the first cost element, forms the major grouping of all costs and consists of the physical raw materials used in the manufacturing process. Materials are ultimately transformed through a manufacturing process that incorporates a variety of activities, into a more refined finished product. Material is a very broad concept that includes raw material, work-in-progress and finished goods and once finished goods are sold the cost appears as an expense in the Statement of Profit or Loss.

Labour, the second cost element to be discussed, is a comprehensive and involved topic. This is attributable to the fact that no two employees are the same – their personalities, work capacity and needs all differ. The *individuality* of each employee must always be borne in mind and the psychological aspects form just as important a component as the purely technical aspects. Because labour has a uniquely human characteristic the calculations surrounding this cost need to be adapted to reflect this reality.

Overheads, the third cost element, include all the costs that are necessary for the enterprise's activities but that cannot be allocated to the two cost elements already discussed, namely, direct material and direct labour.

Marketing costs, the final cost element discussed, are part of commercial costs and include all the costs associated with the activities that promote the product, the acquisition of orders, the administration of the marketing function and the delivery of finished goods. This section will introduce profitability analysis of individual products in the product series, different sales representatives, different areas and different types of orders.

MATERIAL COST

TERMINOLOGY

- **Primary material** is the basic raw material that is converted to a more refined product by the manufacturing process. Examples of primary material are the wood converted into completed pieces of furniture in a furniture factory and the flour used in a bakery for making bread. Primary material is also referred to as **direct material**.
- **Secondary material** is the material used in the manufacturing process which contributes to the conversion of the primary material, for example, the sandpaper used to give a piece of furniture the finishing touches before it leaves the factory. Secondary material does not usually form part of the end product produced and is also referred to as **indirect material**.
- **Incomplete work** is primary material which has already entered the manufacturing process but is not yet complete and cannot be classified as a finished product. Normally a portion of labour and overheads is already allocated so that the incomplete work comprises all three cost elements.
Different names are given to this type of material, *inter alia* incomplete work, work in progress and half-finished work. However, in this book preference is given to the term *work in progress*.
- **Finished goods** are the finished products produced from the primary material in the manufacturing process.
- **Commercial inventories** consist of finished products obtained from factories or wholesalers for resale purposes. Commercial enterprises only have commercial inventories and not raw materials, work in progress and finished goods inventories as in the case of manufacturing organisations.
- The term **inventory** includes all the material (primary and secondary), work in progress and finished goods in the manufacturing enterprise's possession at a given moment and only commercial inventories in the case of commercial enterprises. It is thus a relatively broad concept.

INVENTORY PILING

The main reason for inventory piling taking place is that usually, in practice, there is a time difference between the acquisition of the material and the use or employment thereof. For example, material may be purchased now but used in a week or two's time. In the meantime, it is held as inventory.

It is very important that material is available when it is required, otherwise unnecessary costs and losses may occur. Consider what would happen if a furniture manufacturer did not have any wood or a bakery any flour – the entire manufacturing process would grind to a halt.

The same situation can occur in a commercial enterprise. A consumer who cannot purchase petrol at a filling station because there is no inventory will simply go to another. The filling station that did not have inventory of petrol consequently loses the transaction and the income that would have flowed therefrom.

Inventory piling also takes place for various other reasons, and the following terminology is important in this regard.

Normal inventory

This is the material which is in stock of necessity because it is in the process of production, is about to enter production, or has just been completed.

Buffer inventory

As the name indicates, this is a type of inventory piling used to form a buffer between production and usage in situations where there is constant production, but usage is erratic. The supply of water to a city is a good example. There is a fixed quantity of water that can be delivered per hour and the usage thereof fluctuates, depending on the time of day. Water is stored temporarily whenever usage is low to make provision for peak periods when usage is higher than supply.

Safety inventory

This is a broader concept than buffer inventory and is specifically aimed at ensuring that the enterprise can continue with production as usual if it should happen that a specific type of material is not delivered within the normal delivery period (lead-time) or is temporarily unavailable. Therefore, safety inventory can be defined as extra inventory carried to prevent stock-outs (see below).

Stock-out

A stock-out occurs when a certain material is not available for production purposes or when there is a demand for a product that is not available.

Strategic inventory

This is inventory held for strategic reasons – more quantity than usual is purchased in order to cope with possible unavailability in the future.

Speculative inventory

This is inventory held for economic reasons – a large price increase may be expected and therefore more than the usual quantity is purchased before the increase.

Inventory-in-transit

This is inventory that has already been purchased but has not yet been received, in other words, it is still in the process of delivery.

Economical and technical inventory

Technical inventory is *inventory that is physically in the enterprise's possession*, while **economic inventory** represents *the amount of inventory after all adjustments have been considered*, for example, inventory already paid for but not yet received and inventory already sold but not yet delivered.

Overstocking and under-stocking

Overstocking occurs *whenever the amount of inventory held is not justified by the volume of production*. **Under-stocking** is the *opposite situation*.

Average inventory

The average inventory is a figure often used in calculations. Naturally it is possible to determine the average inventory precisely, but it is so cumbersome that the following formulae are usually sufficient for calculating it:

$$\text{Average inventory} = (\text{Opening inventory} + \text{closing inventory}) \div 2$$

or alternatively:

$$\text{Average inventory} = (\text{Order size} \div 2) + \text{safety inventory}$$

Maximum inventory

This is the greatest possible inventory a particular item can carry in the interests of the enterprise. It is more than the order size and the safety inventory. It usually occurs when a new order is delivered earlier than the normal delivery period.

INVENTORY ACTIVITIES

The different activities associated with inventory piling can be categorised as follows:

- ☐ Acquisition
- ☐ Storage
- ☐ Distribution and consumption
- ☐ Inventory valuation.

Acquisition

In larger enterprises this function is normally fulfilled by a *purchasing department*. It is more comprehensive than it first appears and includes, *inter alia*, the following activities:

Determination of the requirements

This function can be summarised by the question: “**How much** of **what** is required **when?**”

If too little is purchased, the enterprise runs the risk of finding itself out of inventory. If too much is purchased, capital is unnecessarily invested in inventory and storage space is wasted. If the wrong material is purchased, unnecessary losses may result. The same applies if the material is not received timeously.

Firstly, it is obvious that specifications (**what**) must be prepared before purchasing can proceed. These specifications must clearly indicate the quality, the dimensions and the combination of the material required.

The factory foreman might know that he requires a specific 10mm stainless steel bolt for the manufacturing of gearboxes, but what about the order clerk? The factory foreman must describe clearly what must be purchased on the purchase requisition so that the order clerk can order the correct product, or he might receive 5mm bolts of ordinary steel which he cannot use.

Secondly, the exact quantity (**how much**) to be purchased must be determined. Naturally, usage remains the basic guideline. Should an additional quantity not be purchased as safety inventory? Or perhaps speculative inventory should be considered as a means of counteracting a possible price increase. The material can be so

important, indispensable, and difficult to obtain that a strategic inventory should be maintained.

Thirdly, how much time (**when**) elapses between the date of the placing of the order and the date of delivery? When must the order be placed so that the inventory will be delivered timeously?

As has already been mentioned, it is essential that the material is available to the enterprise when required. Thus, it goes without saying that the order size and date of the order are very important. Delivery time, also called order period, and the reliability of the supplier play an important role here.

The graphic presentation in Diagram 3.1 shows the cycle of the inventory levels of a particular type of material with constant usage:

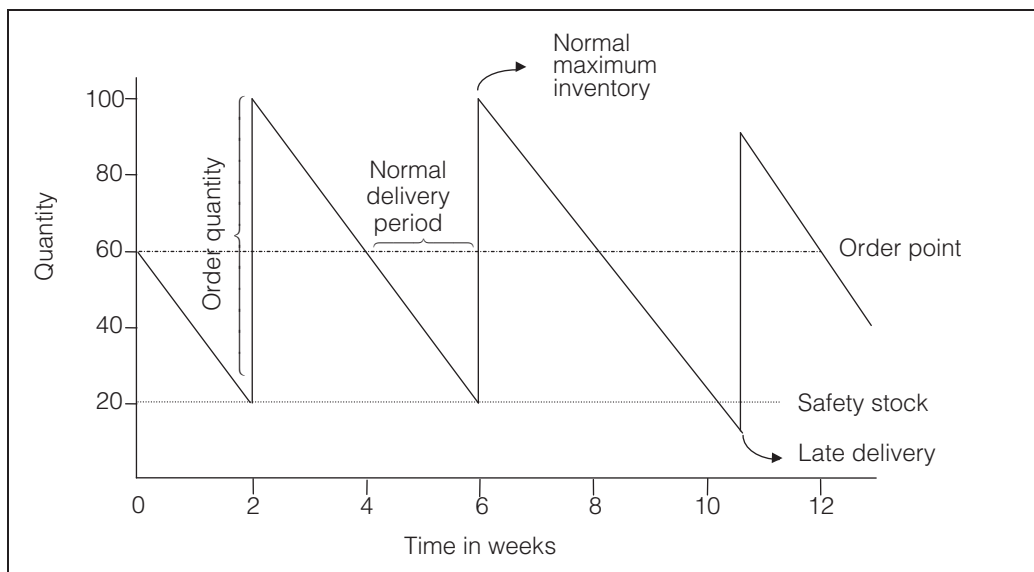


Diagram 3.1

The following assumptions were made in respect of the above presentation:

(i) Average weekly usage	20 units
(ii) Order period	2 weeks
(iii) Order size	80 units
(iv) Maximum order period	3 weeks

In this specific case, a safety inventory of 20 units is maintained. The normal order period is two weeks, but it can be a maximum of three weeks. Therefore, provision is made for a safety inventory of an extra week's usage (20 units).

Safety inventory can be formulated and calculated as follows:

$$\begin{aligned}
 \text{Safety inventory} &= \text{Maximum usage} \times (\text{maximum lead-time} - \text{normal lead-time}) \\
 &= 20 \text{ units} \times (3 \text{ weeks} - 2 \text{ weeks}) \\
 &= 20 \text{ units}
 \end{aligned}$$

The order period is usually two weeks. This means that a new order must be placed two weeks prior to the date on which the material is required, or, put differently, once the inventory level falls to the level where only two week's consumption requirements plus the safety inventory are on hand, a new order must be placed – in this case 60 units. This is based on a normal usage of 20 units per week for the two weeks that it takes to execute the order plus the safety inventory of 20 units. The inventory level at which a new order must be placed is called the *order point*. The following formula is used for the calculation of the order point:

$$\begin{aligned}\text{Order point} &= (\text{Order period} \times \text{normal usage}) + \text{safety inventory} \\ &= (2 \times 20) + 20 \\ &= 60 \text{ units}\end{aligned}$$

The order size is of great importance, especially in the light of capital which might be tied up in inventory. Two divergent cost items influence the decision regarding the quantity to be ordered at any one time, namely:

- ☐ the cost of placing the order; and
- ☐ the cost of holding inventory.

A balance between the two cost items must be maintained, since a reduction in the cost of one increases the cost of the other, and *vice versa*. The most economical combination of the two cost items can be determined by applying the following formula:

$$\text{Economic order quantity (EOQ)} = \sqrt{\frac{2 \times C \times U}{H}}$$

where C = Cost of placing an order
 U = Yearly usage
 H = Inventory-holding cost per unit.

Using the information given in the previous graphic presentation, as well as that given below, the economic order quantity (EOQ) can now be calculated:

Cost of placing an order.....	R10
Inventory-holding costs per unit.....	2.50

$$\begin{aligned}\text{EOQ} &= \sqrt{\frac{2 \times C \times U}{B}} \\ \text{EOQ} &= \sqrt{\frac{2 \times 10 \times (52 \times 20)}{2.50}} \\ &= \sqrt{\frac{20\,800}{2.50}} \\ &= \sqrt{8\,320} \\ &= 91 \text{ units per order}\end{aligned}$$

Thus, it will be more economical to purchase 91 units rather than 80 units per order. The validity of this hypothesis can be verified as follows:

Order size (units)	80	91	100
Order costs	R130	R114	R104
Number of orders*	13	11.4	10.4
Cost per order	R10	R10	R10
Inventory-holding costs:	R100	R113.75	R125
Average inventory**	40	45.50	50
Storage costs per unit	R2.50	R2.50	R2.50
TOTAL COST	R230.00	R227.75	R229.00

* $1\ 040 \div 80 = 13$ ** $80 \div 2 = 40$
 $1\ 040 \div 91 = 11.4$ $91 \div 2 = 45.5$
 $1\ 040 \div 100 = 10.4$ $100 \div 2 = 50$

Note: The safety inventory has not been taken into consideration and the figures for the number of orders have not been rounded off to whole numbers to illustrate the effect of different order sizes more clearly.

However, it is important to bear in mind the size of the inventory investment, since this usually represents a material amount on which interest must be paid if the money is borrowed or interest is lost if the inventory is financed internally.

The formula can be expanded to make provision for the effect of interest on the investment tied up in inventory:

$$EOQ = \sqrt{\frac{2 \times C \times U}{(P \times i) + H}}$$

where P = Cost per unit
i = Interest rate.

The effect of a high interest rate on the previous calculation is evident in the following example:

Supposing that the cost per unit is R10 and the interest rate (cost of capital) is 25% per year, then:

$$\begin{aligned}
 EOQ &= \sqrt{\frac{2 \times C \times U}{(P \times i) + H}} \\
 &= \sqrt{\frac{2 \times 10 \times (52 \times 20)}{(R10 \times 25\%) + 2.50}} \\
 &= \sqrt{\frac{20\ 800}{5.00}} \\
 &= 64 \text{ units}
 \end{aligned}$$

Due to the high interest rate and the cost of capital, smaller orders should be placed more often to reduce the investment in inventory.

Ordering

Once the order quantity and the order point are known, the next step is to place the order. Prices and conditions of payment, as well as delivery dates and the reliability of the different suppliers, must be compared. The credit terms and discount policy of the different suppliers also play an important role and quantity discounts may influence the order quantity. Naturally the order is given to the supplier who offers the most favourable transaction, the above factors being taken into consideration.

Written orders should be placed. The pre-printed order form must make provision for all the relevant information to be given thereon, including product specifications, quantity, price, discount, delivery date and conditions of payment.

Effective control must be exercised over the purchase function at all times and authorised persons must approve and sign all orders.

A record must be kept of all orders placed and this must be checked frequently to ensure, for example, that the goods will be delivered within the agreed period of time and that they comply with the given specifications.

Storage

When the order is executed by the supplier it is important that it is controlled to see whether it complies with the specifications laid down in the order, that the quantity is correct and that the supporting documents have been supplied. A goods received-voucher is then issued and the goods are stored in a safe place, usually a warehouse.

The layout of the warehouse must be such that it does not hinder the efficient flow of inventory. The following factors should be considered when the layout of a warehouse is planned:

- ☐ The allocation of storage must be done in an orderly way according to a predetermined classification policy.
- ☐ Safety aspects must be considered when storage space is allocated to a product series.
- ☐ The unique characteristics of each product must be taken into account. For example, perishable goods will be handled and stored differently from, say, fuel.
- ☐ Inventory that moves quickly and is issued regularly must be easily accessible and should be near the entrance.
- ☐ Entrances to the warehouse must be kept to the minimum. Also, only authorised personnel should be allowed access to the warehouse.

An additional very important aspect is whether one centralised warehouse or several small, decentralised warehouses should be used. The nature of the enterprise and the products stored will play a major role in this decision. With the increasing use of computers and terminals as aids for the supervision and administration of inventory control, these aspects do not play such an important role in the decision between centralisation or decentralisation. Rather, practical implications require greater consideration.

As a result of computerised inventory records, the classification and codification of inventory is very important. Various methods of codification are used, the most important being the numerical method. The numerical code can be divided into different fields, each field being linked to a certain characteristic of the product being

stored. Thus, for example, a six-figure code divided into three fields can comprise the following:

020.05.8
Field 1: Basic classification • Figure 1: Liquid products • Figure 2: Steel products • Figure 3: Gas products Field 2: Sub-classification • Figure 4: Gears • Figure 5: Bolts Field 3: Various types of sub-classification • Figure 6: Quality grade

Thus code 020.05.8 can refer to a 10 mm bolt of a certain length and type, for which a product specification is drawn up to eliminate any uncertainty. The codes can be extended to make provision for more sophisticated techniques and basically have unlimited usage.

Even though computerised inventory systems are being used more and more for inventory control (thereby replacing the old manual systems of bin cards and accessories), the principle remains the same as these electronic systems are employed to do the same work faster and more efficiently.

A bin card (so called because it is normally kept in the bin or on the shelf on which the inventory is stored) is/was used to obtain (on a continuous basis) a record of the quantity of each type of material in the warehouse. All receipts and issues are shown on it and it forms a valuable aid for the efficient control of the physical inventory, although it does not form part of the accounting records. Other relevant information such as the order point, order quantity and safety inventory are also shown on the bin card. The bin card forms the basis of a continuous inventory system to exercise control over the inventory quantities on a daily basis. Obviously, the use of computerised inventory systems means that this information is now more easily kept up to date.

As has already been mentioned, bin cards do not form part of the accounting records. They also do not show the value of the relevant inventory items, but only the physical quantity. An inventory ledger card is used to calculate the value of each inventory item.

However, a physical inventory count must be done from time to time, usually at the end of the financial year, to determine the correct value and quantity of each inventory item separately and of the inventory in total. The bin cards and the inventory ledger cards must be compared with the physical inventory count and any differences should be investigated thoroughly. Differences can usually be ascribed to theft, incorrect calculations and/or transactions which do not appear on the continuous inventory system.

Distribution and consumption

Efficient controls over the issue of material by the warehouse must be maintained at all times. If the issuing of inventory is not properly controlled, the enterprise may sustain large losses.

A requisition is used as the basic document for the issuing of inventory from the warehouse and has the dual purpose of:

- ☐ providing authorisation for the storekeeper or person in charge of the inventory to issue the material, and
- ☐ serving as a source document for the accounting entries in the books of the enterprise and must therefore also show the reason for the issue.

Inventory valuation

Determining the cost of material purchased poses no problem as each item has its own value. When materials are stored and used at a later stage, a valuation method for the issuing thereof is required. Purchase prices are being subjected to constant change, as a result of among others, inflation, exchange rate changes and changes in suppliers.

The most popular methods to value material issues are the following:

- ☐ FIFO method (first-in, first-out)
- ☐ LIFO method (last-in, first-out)
- ☐ AVCO method (weighted average cost method)
- ☐ Standard price method
- ☐ Market price method.

With the **FIFO** method of inventory valuation, *inventory is issued in the order in which it is received*. Thus, the material that is received first is issued first at the price that was paid for it. With the **LIFO** method, the material that is received last is issued first. Please remember however that International Accounting Standards (IAS 2) only permit the use of FIFO, WAM and standard cost as inventory valuation methods.

The **AVCO** method uses the actual average purchase prices (weighted by the applicable quantities) to calculate the issue price. Its disadvantage is that after every receipt, a new weighted average issue price must be determined.

The standard price method values inventory by means of a predetermined standard unit price. Differences between the actual price paid and the predetermined standard cost are identified as price variances.

The market price method, on the other hand, uses the ruling market price as a basis for determining the issue price of inventory. The first three methods of inventory valuation are the most important and are discussed and explained in detail. Steps in valuating inventory are as follows.

Step 1: Prepare an inventory ledger card using four columns showing the date and receiving, issuing, and balancing columns. Each column contains the following information: quantity, unit price and total amount.

Date	Received			Issued			Balance		
	Unit (quantity)	Unit price	Total amount	Unit (quantity)	Unit price	Total amount	Unit (quantity)	Unit price	Total amount

Step 2: Transactions regarding units received must be entered into the receiving column of the inventory ledger card and transactions regarding units issued must be entered into the issued column of the inventory ledger card.

Step 3: After each transaction, both unit and total amount balances must be updated. Thus, under a perpetual inventory system, the inventory balance is available after each transaction.

Step 4: The cost of sales value is the sum total of the issuing column.

The first three inventory valuation methods are the most important and are discussed by means of a simple example of an inventory ledger card:

Example 3.1

Transactions concluded in respect of a particular inventory item:

1 January:	Inventory on hand	50 units	@ R5 per unit
3 January:	Issued	20 units	
4 January:	Received	80 units	@ R6 per unit
5 January:	Issued	20 units	
6 January:	Issued	30 units	
7 January:	Returned to supplier	10 units	(received on 4 January)

Solution 3.1

Inventory ledger card using the FIFO method:

Date	Receipts			Issues			Balance		
	Quantity	Price	Amount	Quantity	Price	Amount	Quantity	Price	Amount
1 January							50	5.00	250.00
3 January				20	5.00	100.00	30	5.00	150.00
4 January	80	6.00	480.00				30	5.00	150.00
							80	6.00	480.00
5 January				20	5.00	100.00	10	5.00	50.00
							80	6.00	480.00
6 January				10	5.00	50.00			
				20	6.00	120.00	60	6.00	360.00
7 January	(10)	6.00	(60.00)				50	6.00	300.00

continued

Inventory ledger card using the LIFO method:									
Date	Receipts			Issues			Balance		
	Quantity	Price	Amount	Quantity	Price	Amount	Quantity	Price	Amount
1 January							50	5.00	250.00
3 January				20	5.00	100.00	30	5.00	150.00
4 January							30	5.00	150.00
	80	6.00	480.00				80	6.00	480.00
5 January				20	6.00	120.00	30	5.00	150.00
							60	6.00	360.00
6 January				30	6.00	180.00	30	5.00	150.00
							30	6.00	180.00
7 January	(10)	6.00	(60.00)				30	5.00	150.00
							20	6.00	120.00

Inventory ledger card using the AVCO method (weighted average cost method):									
Date	Receipts			Issues			Balance		
	Quantity	Price	Amount	Quantity	Price	Amount	Quantity	Price	Amount
1 January							50	5.00	250.00
3 January				20	5.00	100.00	30	5.00	150.00
4 January	80	6.00	480.00				110	5.73*	630.00
5 January				20	5.73	114.60	90	5.73	515.40
6 January				30	5.73	171.90	60	5.73	343.50
7 January	(10)	6.00	(60.00)				50	5.67	283.50

* (R150 + R480) ÷ (30 + 80) = R5.73 per unit

You will notice that the value of the inventory is calculated according to the three different methods (R300; R270; R283.50).

Although the FIFO and AVCO methods are generally used more often, there is not much to choose between the various methods. What is more important is that an enterprise must use the same method throughout and not change from year to year.

JUST IN TIME INVENTORY-HOLDING (JIT)

As the name indicates, JIT inventory-holding implies that the inventory is received shortly before it is to be used. Inventory-holding is thus limited to the minimum.

The application of JIT inventory-holding policy has numerous advantages for the business concern, that is:

- ☐ inventory-holding is limited to a minimum,
- ☐ the capital investment in inventory is minimised, and
- ☐ less storage space is used.

The application of a JIT inventory policy necessitates thorough planning and scheduling of production activities. The exact time when inventory should be available must be

determined precisely and orders must be placed well in time. Inventory will then be delivered on time.

This necessitates prior arrangement with the supplier, notifying them that smaller quantities will be ordered more frequently, that delivery must take place at a pre-determined point of time, and that orders with scheduled delivery dates will be placed timeously, and negotiating prices and conditions in advance.

The advantages gained from the application of a JIT system must be compared with the disadvantages arising from the system. The increased ordering and handling costs due to the increase in the number of deliveries must be compared with the savings arising from the smaller investment and smaller storage space being used.

The reliability of the suppliers should also be considered because late deliveries may increase costs both quantitatively (increased idle time) and qualitatively (delay in production may result in customers' orders not been met, ultimately resulting in reputational damage).

ACCOUNTING ENTRIES

Although the accounting aspects are discussed in a separate chapter, for the sake of continuity a schematic representation of the flow of accounting entries in respect of material in the books of the enterprise is given:

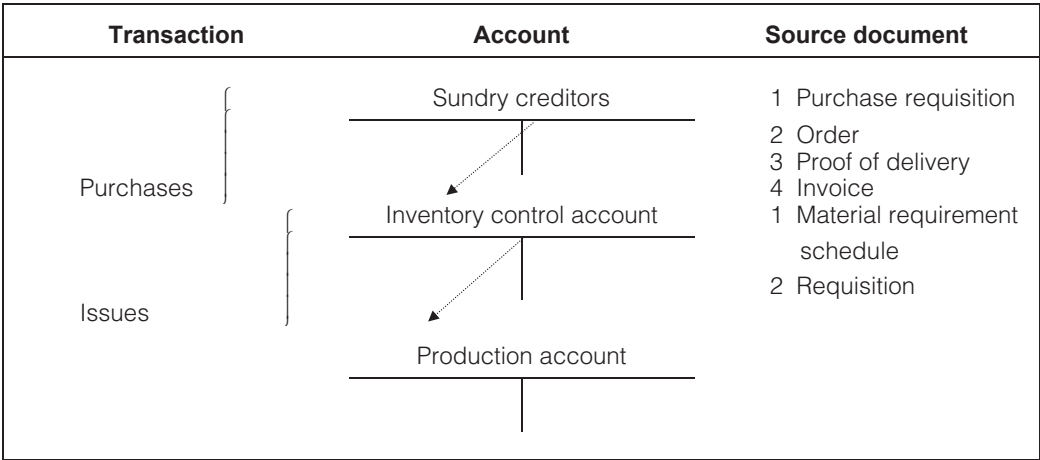


Diagram 3.2

The following example will explain the flow of materials in a manufacturing enterprise:

Example 3.2		
The following information in the accounts of Collins (Pty) Ltd for the period is as follows:		
	Dr	Cr
	R	R
Balance as at the beginning of the period:		
Material inventory	5 600	
Creditors		240 000
Work in progress	24 000	

continued

	Dr R	Cr R
The entries for the period are as follows:		
(1) Material purchases on credit	48 000	
(2) Materials issued: Direct	40 000	
Indirect	1 600	
Required		
(a) Prepare journal entries.		
(b) Prepare the ledger accounts.		

Solution 3.2			
(a) Journal entries		Dr R	Cr R
(1) Stock Control Account		48 000	
	Creditors		48 000
(2) Work in progress		40 000	
	Manufacturing overhead	1 600	
	Stock Control Account		41 600
(b) Ledger accounts			
Materials			
Balance	5 600	(2) Work in progress	40 000
(1) Creditors	48 000	(2) Manufacturing overheads	1 600
		Balance	12 000
	<u>53 600</u>		<u>53 600</u>
Balance	12 000		
Work in progress			
Balance	24 000		
(2) Materials	40 000		
	<u>64 000</u>		
Creditors			
		Balance	240 000
		(1) Materials	48 000
			<u>288 000</u>
Manufacturing overheads			
(2) Materials	1 600		

SUMMARY

Material is a very important cost element, but material control is often seen only as a means of preventing theft. Although it forms an important aspect thereof, material control is a much broader concept and includes aspects such as investment in inventory, receiving and issuing procedures, storage, and efficient consumption.

REVIEW PROBLEMS – MATERIAL

Problem 3.1

Aspen (Pty) Ltd is a general dealer. Transactions recorded for the period are as follows:

2 March	Opening inventory	100 units	@ R5.00 per unit
5 March	Received	120 units	@ R5.75 per unit
6 March	Received	180 units	@ R6.00 per unit
7 March	Issued	200 units	
8 March	Issued	150 units	
9 March	Return to supplier*	20 units	
10 March	Issued	20 units	
* For the FIFO and AVCO methods, the units returned to the supplier were units purchased on 6 March. For the LIFO method, the units returned to the supplier were units which were in the opening balance.			

Required

Calculate the value of the closing inventory, using the following valuation methods:

- (a) FIFO method.
- (b) AVCO method (weighted average method).

Solution 3.1

(a) Inventory ledger card using the FIFO method:

Date	Receipts			Issues			Balance		
	Qty	Price	Amount	Qty	Price	Amount	Qty	Price	Amount
2 March							100	5.00	500.00
5 March	120	5.75	690.00				120	5.75	690.00
6 March	180	6.00	1 080.00				180	6.00	1 080.00
7 March				{ 100	5.00	500.00	20	5.75	115.00
				100	5.75	575.00	180	6.00	1 080.00
8 March				{ 20	5.75	115.00			
				130	6.00	780.00	50	6.00	300.00
9 March	(20)	6.00	(120.00)				30	6.00	180.00
10 March				20	6.00	120.00	10	6.00	60.00
	280		1 650.00	370		2 090.00	10	6.00	60.00

(b) Inventory ledger card using the AVCO method:

Date	Receipts			Issues			Balance		
	Qty	Price	Amount	Qty	Price	Amount	Qty	Price	Amount
2 March							100	5.00	500.00
5 March	120	5.75	690.00				220	5.41	1 190.00
6 March	180	6.00	1 080.00				400	5.68	2 270.00
7 March				200	5.68	1 136.00	200	5.67	1 134.00
8 March				150	5.67	850.50	50	5.68	283.50
9 March	(20)	6.00	(120.00)				30	5.45	163.50
10 March				20	5.45	109.00	10	5.45	54.50

Problem 3.2

BBBEE STAINLESS STEEL Ltd imports 1 000 units of 3-meter 316 stainless steel tubing per year. Management is interested in finding the optimal ordering level.

The account clerk states that placing an order costs R1 500 and the cost to hold a single 316 stainless steel tube is R3.

Required

- Calculate the EOQ for the 316 stainless steel tubing.
- Assume that the ordering cost increase to R1 800 due to unfavourable exchange rates. What will be the effect on the EOQ?
- Assume that the holding cost of a single 316 stainless steel tube increases to R5 and the ordering cost remains unchanged at R1 500. What will be the effect on the EOQ?
- With reference to your answer in question (b) and (c), why does the EOQ change as compared to the benchmark level of question (a).
- Ignoring the addition information given in required (a) to (d), calculate the EOQ considering the effect of interest on the investment on the investment tied up in inventory. BBBEE STAINLESS STEEL Ltd's cost of capital is 18% and the cost per a 316 stainless steel tube is R500.

Solution 3.2

$$\begin{aligned}
 (a) &= \sqrt{\frac{2 \times C \times U}{H}} \\
 &= \sqrt{\frac{2 \times 1500 \times 1\,000}{3}} \\
 &= \sqrt{\frac{3\,000\,000}{3}} \\
 &= 1\,000 \text{ units per order}
 \end{aligned}$$

$$\begin{aligned}(b) &= \sqrt{\frac{2 \times C \times U}{H}} \\&= \sqrt{\frac{2 \times 1800 \times 1\,000}{3}} \\&= \sqrt{\frac{3\,600\,000}{3}} \\&= 1\,095 \text{ units per order}\end{aligned}$$

$$\begin{aligned}(c) &= \sqrt{\frac{2 \times C \times U}{H}} \\&= \sqrt{\frac{2 \times 1500 \times 1\,000}{5}} \\&= \sqrt{\frac{3\,000\,000}{5}} \\&= 775 \text{ units per order}\end{aligned}$$

(d) Answer (b) and (c) compared with the benchmark of (a) suggests that as ordering cost increases (d), it becomes more favourable to order larger amounts of inventory and reduce the frequency of orders. As holding costs increase (c) it becomes more favourable to hold less inventory and order more frequently.

$$\begin{aligned}(e) &= \sqrt{\frac{2 \times C \times U}{(P \times i) + H}} \\&= \sqrt{\frac{2 \times 1500 \times 1\,000}{(500 \times 18\%) + 3}} \\&= \sqrt{\frac{3\,000\,000}{93}} \\&= 180 \text{ units per order}\end{aligned}$$

LABOUR

EMPLOYEE AND EMPLOYER EXPECTATIONS

Although, like material cost, labour is a cost element, and it requires a much wider spectrum of involvement from management. It is not merely a case of a certain price being paid in exchange for a certain quantity of labour of a specific standard – it also refers to expectations from both the employee and the employer.

There are certain employee expectations, which must be satisfied, for example:

- ☐ the payment of a reasonable compensation to enable the employee to maintain a certain living standard within his social milieu;
- ☐ job satisfaction;
- ☐ security; and
- ☐ the opportunity to develop to full potential.

On the other hand, the employer expects more than just a labour input from the employee and lays claim to:

- ☐ the loyalty of the employee;
- ☐ the highest possible productivity of which the employee is capable; and
- ☐ subjective contributions such as initiative in the working environment, leadership and reliability.

Therefore, an enterprise that has an effective labour force at its disposal will view it as one of its most important assets and will be prepared to go to great lengths to keep it and even to extend it.

A loyal and productive labour force does not establish itself. The enterprise must give continuous attention to good employee/employer relationships, building on the factors that will give rise to further improvements and removing those that might have a negative influence.

The following aspects should be given close attention in any enterprise to keep potential problem areas to a minimum:

- ☐ The chain of command must be properly identified so that every employee knows exactly to whom he is accountable and from whom he receives his orders.
- ☐ People in positions of authority must be well grounded in the maintenance of good human relationships.
- ☐ The job and responsibility of each employee must be properly defined.
- ☐ A channel must be created so that employees' complaints and dissatisfactions can be brought to the attention of higher management.
- ☐ Discrimination, especially that which arises from personal conflicts, must be kept to a minimum.
- ☐ Acknowledgement must be given for a job well done.
- ☐ The ambitions of employees must not be unnecessarily suppressed, especially when employees have the potential to develop further.

There are many other aspects that could be mentioned here, all having the common characteristic that they contribute to the achievement of a happy and contented labour force. As a result, each employee, no matter how petty his job, feels that he is part of a team that is striving towards the achievement of a common goal. The advantage for the employer is that job satisfaction is usually associated with increased productivity from employees.

Productivity

Productivity is generally described as *the ratio between a certain amount of output and a certain amount of input*. By comparing the ratios of different periods and, especially, noting the trend, management is furnished with a barometer with which to evaluate productivity.

Output to labour hours worked is generally used to determine labour productivity and any change in the ratio between two periods is viewed as a change in productivity.

Determining the actual labour productivity for a given period does not present much of a problem – the output (for example, units manufactured) is simply compared with the input (for example, hours worked). However, determining the standard or ideal productivity level is very difficult because, firstly, use is made of subjective data, and secondly, productivity varies from moment to moment and from person to person.

By comparing the productivity level, and especially the tendency that it shows, with external information supplied by production organisations, government institutions and others, the state of the enterprise as a whole and of labour in particular can be determined. If the comparison is negative then corrective action should be taken, and if it is positive then the fruits of good management and interrelationships are plucked.

One of the basic principles of good management is to strive for the highest possible productivity level.

Humanitarian factors that have an influence on labour productivity

When it appears that an employee cannot maintain a certain productivity level, it must not merely be accepted that the person is a poor employee who must be dismissed. First it must be determined why the employee is not capable of maintaining the required productivity and then attempts must be made to solve the problem before drastic action is taken. This will allow employees to enjoy an increased feeling of security because the fear of dismissal will decrease.

The following are possible reasons why an employee is unable to maintain the required productivity level:

- ☐ The employee is physically incapable of carrying out a physically demanding job.
- ☐ The employee's personality and talent is such that a particular job does not allow him to develop to his full potential and the job bores him.
- ☐ Adequate training to enable the employee to carry out the job properly is not given.
- ☐ Job satisfaction is lacking and the employee is not motivated to produce a higher output.
- ☐ The standard or required productivity level is set too high so that employees find it too tiring to comply with in the long run.
- ☐ The fault might lie with the employee himself or herself in the sense that he or she is lax and does not want to produce a higher output.

External factors that have an influence on productivity

- ☐ Lighting – if the lighting in the work environment is not correct it may cause the workers unnecessary stress and fatigue.
- ☐ Temperature – work capacity is at its highest level at normal room temperature and any deviation from this will result in a fall in productivity.

- ☐ Humidity – work capacity is higher in slightly moist air, subject to the moisture content remaining within limits.
- ☐ Noise – noise is a disturbing factor and must be limited to a minimum, especially high-pitched and intermittent noise.
- ☐ Time – productivity decreases in proportion to the number of hours worked. Productivity is also generally lower during the afternoon period.
- ☐ Various other external factors such as political unrest and the economic stability of the country also have an influence on the employees' productivity.

PERSONNEL ADMINISTRATION

Personnel administration is a field of study in its own right and hence it is only briefly referred to here.

*The main purpose of **personnel administration** is to provide an efficient labour force.* Basic requirements are the accomplishment of a well-thought-out personnel policy, the maintenance of sound labour relations and the striving towards the highest possible productivity level.

The following personnel functions are closely related to cost control:

- ☐ determining labour requirements;
- ☐ employment procedures;
- ☐ job description;
- ☐ job evaluation;
- ☐ time and motion studies; and
- ☐ resignation.

The basic requirements for labour are established by the production planning section. The number of man hours (and usually the number of workers) and the levels of skill required to meet the expected production activities of the enterprise are determined for a future period.

The department head or foreman compares this information with the existing labour force and, if there is a need for additional personnel, a request is sent to the personnel department.

The personnel department then follows the normal employment procedures of recruiting personnel, selecting, conducting interviews and aptitude tests, and presents a short-list to the department head/foreman for the final selection of suitable candidates who meet the requirements of the particular vacancy.

It is always important to consider people who are already employees in the service of the company for promotion if a higher post becomes vacant.

A detailed job description must be prepared for each employee to indicate precisely what is expected of him or her and for what functions or jobs he or she is responsible. It must also be placed at the disposal of the employee.

Eventually, both job and employee are evaluated on the basis of the job description. It is important that the evaluation is carried out as objectively as possible, because it forms the basis for upgrading or downgrading the particular job and expanding or curtailing it and also for reviewing the employee's job capabilities and standard.

It is very important that the effective execution of the job is always aimed at and that methods to improve and even develop such execution are investigated. Time and motion studies are used to find the most efficient way of doing a specific job and to ensure the efficient employment of labour.

If it is found that a worker does not meet the requirements set for him and after all alternative actions have been considered to no avail, then he may be dismissed. However, the dismissal of an employee should be handled with caution because it can give rise to personnel unrest.

Voluntary resignations should be investigated thoroughly and the reasons behind them established. A high **labour turnover** indicates that everything is not in order and that corrective action should be implemented.

Labour turnover is calculated by means of the following elementary formula:

$$\frac{\text{Employees appointed during the period}}{\text{Total number of employees}} \times \frac{100}{1}$$

or a more complicated one:

$$\frac{(\text{Employees appointed} + \text{dismissed}) \div 2}{\text{Average number of employees}} \times \frac{100}{1}$$

By comparing the turnover figure with that of the rest of the industry a measure of the job satisfaction within the enterprise can be obtained.

For the efficient control of labour costs some or other norm or standard must be set against which the efficiency of labour can be measured, and which can serve as a basis for quantifying the difference between the expected norm (standard) and the actual output.

Basically, labour is controlled mainly by a comparison between:

1. what must be done, and the labour time allowed for it; and
2. what is done, and the labour time taken to do it.

This aspect is dealt with in more detail in chapter 14.

This gives rise to the most important requirement for any labour control system, namely, the gathering and recording of data for the calculation of actual labour costs and time, which is used partially as a basis for the calculation of the standard labour costs and time.

As has already been mentioned in chapter 1, financial accounting and management accounting use a common database. While financial accounting is directed more at external reporting according to generally accepted accounting practice and management accounting more at planning and control, there will also be a different emphasis with regard to the information required in respect of labour.

This becomes evident in the table in Diagram 3.3:

Financial accounting	Management accounting
Total hours available	Time actually spent on each task, product, process, or section
Total earnings of each employee on a daily, weekly, or monthly basis	Labour costs in respect of each task, product, process, or section
Control: Comparison with budget	Control: Comparison with standards
Book entries:	Book entries:
In the financial ledger:	In the cost ledger:
Labour control account xxx	Production account xxx
Salaries payable xxx	Overheads control
PAYE* xxx	account (Indirect labour) xxx
Pension** xxx	Labour control account xxx
Etc xxx	

* Tax on the employee's earnings deducted according to the current tax system.

** The employee's own contributions to the pension fund.

Diagram 3.3

EMPLOYMENT RECORDS

Personnel records

Naturally the personnel records, which contain the following information, are very important:

- ☐ The history of each employee: date of appointment, salary, promotions, increases, leave and sick leave and evaluation reports.
- ☐ Legally required information to comply with deductions, unemployment insurance, trade unions and medical and pension funds.

The keeping of these records is usually a centralised function carried out by the personnel department.

Clock cards

The first step towards labour control is the accurate determination of the labour time purchased from the employee. The **clock card** *supplies indisputable evidence of the employee's attendance and serves as a basis for the calculation of his gross wages.*

Important technological developments have taken place in this area over the past decade and different types of mechanised and computerised clocks are now in use. Most of these clocks are designed so that it is almost impossible to tamper with the clock cards – something that often happened in the past in that one employee could, for example, clock in for another person.

Job cards

While the clock card can be compared to the invoice from the supplier in material purchases, the job card can be compared to the requisition for the issue of the material.

The **job card** *forms the source document for the calculation of the time actually spent* (or how the time purchased is spent) and also indicates which task or product the time was spent on.

The clock card is of more importance to the financial accountant while the job card forms the basis for the apportionment of labour costs to the various branches and/or products by the management accountant.

The job cards must be reconciled with the clock cards on a regular basis and any material differences must be shown as idle time.

A certain amount of idle time is acceptable because time is lost due to rest periods, tea and mealtimes, but it must be monitored to ensure that unproductive time does not take on too great a dimension.

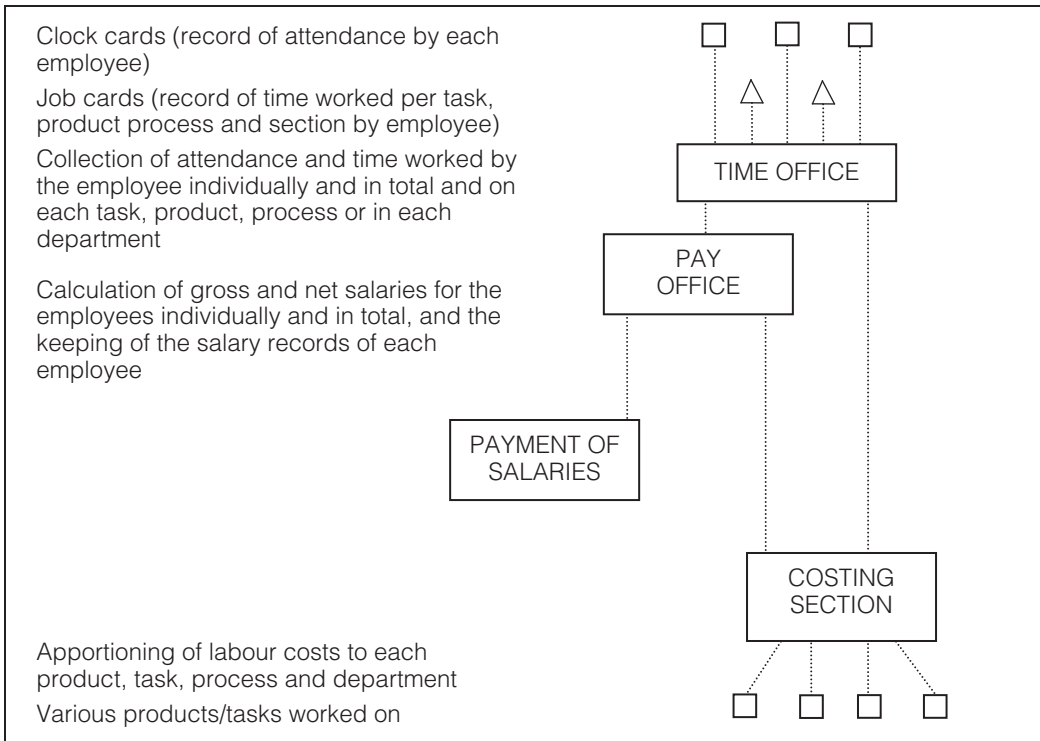
Production reports

Production reports are prepared on a regular basis and contain the following information which is used for control purposes:

- ☐ total hours available;
- ☐ total hours worked;
- ☐ what was worked on; and
- ☐ how much was produced.

ASSIMILATION OF INFORMATION

Although the format and layout of personnel records, clock cards and job cards may differ from enterprise to enterprise depending on the equipment in use, the aim is to initiate the flow of data through the various phases of manufacture, as illustrated in Diagram 3.4:

**Diagram 3.4**

The basic function of the **time office** is *the collection of the attendance of the employees individually and in total and the tasks and/or products on which the time was spent*. Seen from a costing point of view, the total time spent on each task and/or product is very important for the determination of the labour costs of the specific task and/or product.

The pay office calculates the gross salaries of the employees according to the hours of attendance (as supplied by the time office). All deductions from the gross salaries are brought into account and the net salaries are paid to the employees. Salary records for each employee are kept up to date on a weekly or monthly basis.

The costing section then uses the information collected by the time office and the pay office to allocate the labour costs to the various tasks, products, processes and/or sections.

LABOUR REMUNERATION

Methods of remuneration

As has already been mentioned, a fair wage is one of the requirements laid down by the employee. The emoluments that an employee receives depend on the type of work that he performs, the degree of skill that is required for the specific work, the quality of the work that he does and, as with so many other facets of economic life, supply, and demand.

The following are the methods of remuneration used:

- **Fixed salary method:** According to this method *the employee receives a fixed salary irrespective of the quantity of work that he does or the time that it takes*. This form of compensation is found in administrative and supervisory functions especially and has the disadvantage that it bears no relation to the employee's output, or the number of hours worked.
- **Hourly wages:** Here *the worker is remunerated in accordance with the number of hours that he works*. The disadvantage of this method is that it also does not keep pace with the employee's output, but it is advantageous in that it pays only for the number of hours that the employee is present.

Calculation:

$\text{Hours worked} \times \text{Rate per hour} = \text{Gross remuneration}$

- **Piecework:** *The employee is paid for the work that he does and not according to the time it takes him*. This method can be used only where each employee's output can be determined precisely. It is advantageous to the employer in that he pays only for what is done.

Calculation:

$\text{Units manufactured} \times \text{Rate per unit} = \text{Gross remuneration}$

Various methods of combining hourly wages, piecework and fixed salaries have already been developed with the aim of utilising the advantages of each system and eliminating the disadvantages. The employee thus receives a minimum hourly wage which increases as his output increases in accordance with piecework, with a minimum guaranteed fixed salary.

Important terminology

Direct labour is a crucial part of the manufacturing process, and the following terminology is important:

- **Remuneration** is *the compensation for labour done*.
- **Direct labour costs** are *the costs to compensate production employees for the time that they worked to convert materials into finished goods*. These costs are accurately allocated to the specific products. The production line will come to a standstill without this labour force.
- **Indirect labour costs** are *the costs to compensate those employees (for example, cleaners, supervisors and material handlers) who do not work directly on the enterprise's production lines but who are supporting the production processes*. Indirect labour costs cannot be accurately allocated to particular products or production lines and as a result, are regarded as overheads.
- **Normal time** is *the money paid to employees for time spent on work during normal working hours*.
- **Overtime** is *the extra compensation paid to an employee for hours spent on work beyond the normal working hours*.

- **Overtime premium** is the extra compensation paid to an employee in addition to the normal rate (for example, time-and-a-half during *weekdays* and double time over *weekends* and *holidays*) to an employee for hours spent on work beyond the normal working hours.
- **Idle time** is the time the production processes cease to operate, causing the direct labourers to be unoccupied for the same period of time. These non-productive times are normally regarded as overheads.
- **Gross pay** is *total wages* (normal time, over time and bonus) *before deductions* (pension, PAYE, medical aid and UIF).
- **Net remuneration** is *gross wages less deductions*.
- **Manufacturing overheads** are *all manufacturing costs other than direct material and direct labour costs*. These include, *inter alia*, indirect labour, idle time, overtime premium and employers' contributions.

Calculation of remuneration

The calculation of the normal gross salary/wage is done in accordance with one of the above-mentioned remuneration methods. In addition, any extra earnings (including overtime, incentive bonus and holiday bonus) are added to compute the total gross remuneration for the period.

Ordinary overtime, that is, the hours over and above the normal weekday hours worked, is usually remunerated at the normal tariff plus 50%. Hours worked on Sundays and public holidays are usually remunerated at double the normal tariff.

Employer contributions in respect of medical and pension funds are not usually considered in the calculation of individual salaries, nor are they shown on the salary advice. They are calculated in total and are journalised separately. However, it has become compulsory to show fringe benefits such as housing, transport and entertainment subsidies or allowances on the salary advice, together with the corresponding deduction.

Certain deductions are made from the gross remuneration to determine the net remuneration of the employee. Some deductions are legally required, such as taxation per the Pay-As-You-Earn system (PAYE and SITE taxes) and unemployment insurance contributions (UIF), but most enterprises allow non-compulsory deductions (for example, housing payments and recreational club contributions) which are paid over to the relevant authority on behalf of the employee.

For the calculation of the PAYE deduction (income tax according to the Pay-As-You-Earn system), the taxable amount on which the deduction is based must be determined first. The taxable amount represents the employee's total gross remuneration plus taxable fringe benefits less pension fund contributions. The calculation of the net salary is illustrated in Example 3.3.

Example 3.3

The following information is applicable to a weekly paid employee: *

Normal working week (6 days)	45 hours
Number of hours worked	50 hours
Monday	8
Tuesday	8
Wednesday	10
Thursday	8
Friday	8
Saturday	5
Sunday	3
Normal hourly wage	R5.00
Pension fund (based on normal remuneration):	
Employer's contribution	5%
Employee's contribution	7.5%
Medical fund:	
Employer's contribution	R13.00
Employee's contribution	R13.00
PAYE deduction	13% on taxable income
UIF deduction	R1.00

* Assume that no fringe benefits are applicable.

Required

Calculate the employee's net salary for the week.

Solution 3.3

	R
Normal pay	
45 hours @ R5 per hour	225.00
Overtime pay	
2 hours $\times 1\frac{1}{2} \times R5$	15.00
3 hours $\times 2 \times R5$	30.00
Total gross remuneration	270.00
Less: Pension fund contributions ($7.5\% \times R225$)	(16.88)
Taxable income	253.12
Less: Sundry deductions	(46.91)
PAYE ($13\% \times R253.12$)	32.91
Medical fund	13.00
UIF	1.00
Net salary, payable in cash	206.21

Salaries are recorded and calculated in the salary or wage register and only the totals are journalised, but in this case, for the sake of clarity, the book entry for the above salary calculation is shown:

	Dr R	Cr R
Salary account	270.00	
Salaries payable		206.21
Pension fund		16.88
PAYE		32.91
Medical fund		13.00
UIF		1.00

The employer's contributions are journalised as follows:

	Dr R	Cr R
Employer's contribution/Salary account	24.25	
Pension fund (5% × R225)		11.25
Medical fund		13.00

Depending on the nature and management of an enterprise, further analysis can be made in the books, for example, by keeping a separate account for overtime pay against which overtime wages are debited.

When the salaries are paid out and the deductions are paid over, the book entries are as follows:

	Dr R	Cr R
Pension fund (R16.88 + R11.25)	28.13	
PAYE	32.91	
Medical fund (R13.00 + R13.00)	26.00	
UIF	1.00	
Salaries payable	206.21	
Bank (per the Payments cash book)		294.25

WAGE INCENTIVE SCHEMES

Wage incentive schemes are aimed at promoting higher productivity and output by means of additional or increased remuneration if the employees perform well and maintain or produce a higher productivity.

Some of the incentive schemes are named after the people who originally developed them, namely, Taylor, Halsey, Bedaux, Gantt and others. Few of the systems are still used in their original form today, but they are important because the principles laid down in them still form the basis for modern incentive systems.

Straight piecework

Piecework remuneration is based on the individual's outputs of products or services, at a certain rate per unit, irrespective of the time it has taken. Thus, time is *not* taken into consideration. Nevertheless, management will normally expect certain production

levels to be achieved in a specific period of time as productivity is viewed as an important business factor to them, therefore time targets are usually set.

The formula for calculating piecework remuneration is:

$$\text{Units produced} \times \text{rate per unit}$$

To illustrate, consider Example 3.4:

Example 3.4

Employee A is employed to wash and polish floor space at a commercial bank. The standard time to wash and polish a 10 m² unit is 12 minutes; remuneration is R6 per hour and the duration of a working day is eight hours. For washing more than the allocated quota, the employee receives one-and-a-half time her hourly rate. Employee A washed and polished 480 m² for the day.

Required

Calculate Employee A's earnings for the day as well as the differential piecework amount.

Solution 3.4

50 m² per hour [10 m² × 5 (5 parts of 12 minutes in an hour)] × 8 hours = 400 m² standard output

480 m² (actual output) – 400 (standard output) = 80 m² (additional output)

	R
8 hours @ R6 per hour	48.00 standard wage
Add: 1,6 hours (80 m ² ÷ 50 m ²) × R9	14.40 differential piecework amount
Total earnings	<u>62.40</u>

Taylor's differential piecework system

Taylor used a differential rate whereby employees who achieved an output lower than the standard received compensation at a lower rate per unit and employees who managed an output higher than the standard were compensated at a higher rate per unit. This system was developed to discourage employees from not maintaining the standard, since no minimum wage was guaranteed.

The standard time system

In this variation of the straight piecework system, standards are always based on the time per unit manufactured. Instead of a fixed rate per unit manufactured, the standard time per unit manufactured is used in determining the remuneration. If an employee manufactures 20 units in an eight-hour shift and the standard is 16 units (or two units per hour), he is paid his normal hourly rate for ten hours (the standard time allowed for 20 units). Consider Example 3.5:

Example 3.5

Employee B is employed to wash and polish floor space at a commercial bank. The standard time to wash and polish is 400 m² per eight-hour shift. The standard rate for cleaners is R6 per hour. Employee B washed and polished 480 m² during the previous shift.

Required

Calculate Employee B's earnings for the shift.

Solution 3.5

50 m² unit per hour [10 m² × 5 (5 parts of 12 minutes in an hour)] × 8 hours = 400 m² standard output

480 m² (actual output) – 400 m² (standard output) = 80 m² above standard

R

8 hours (8 × 50 m² units) @ R6 per hour

48.00 standard wage

Add: 1.6 (80 m² ÷ 50 m²) units per hour × R6

9.60 differential piecework amount

Total earnings

57.60

Halsey bonus scheme

In this scheme, employees receive an incentive for the time they save. If an employee manufactures 20 units in an eight-hour shift for which the standard has been set at 16, then two hours per day (or 15 minutes per unit) have been saved, for which she is compensated at her normal rate.

Emerson's efficiency scheme

A minimum daily wage is guaranteed, and a standard time is determined for each product or task. Records are kept of the actual and standard time and when the remuneration is calculated the actual time is expressed as a percentage of the standard time. If the percentage is lower than 67%, the employee receives only their minimum wage, but if it is between 67% and 100%, a small bonus is paid. If the percentage is greater than 100%, an additional bonus equivalent to the amount greater than 100% is added to their normal hourly rate and the employee is remunerated according to the higher rate.

Bonus points

Bedaux and others allocated points on completion of each task or product, based on a standard of one point per minute. For the first 60 points per hour obtained, the employee receives their normal wage. If more than 60 points per hour are obtained, then a bonus is paid on these points. Sometimes this bonus is divided between the employee and the supervisor so as to motivate the supervisor as well.

Measured day work

This was an effort to combine the best characteristics of fixed remuneration and incentive systems. An employee received an increase if he performed constantly better than the standard for a certain period (say quarterly).

Group bonus systems, share incentive schemes and profit-sharing schemes

These were also developed specially to involve employees at the higher levels of management in incentive schemes.

The question that must be asked now is: is it advantageous to the enterprise if the largest portion of the savings obtained from higher productivity is paid over to the employees in the form of an incentive scheme? The answer is yes, because the enterprise still has the advantage of better utilisation of the production facilities and consequently savings in manufacturing overheads.

RECOVERY OF DIRECT LABOUR COSTS

As has already been stated, **direct labour** forms a separate cost element and consists of *labour that is directly involved in the manufacturing process and contributes to the physical transformation of the product*. Machine operators and employees who perform the physical transformation of the product fall into this category.

Indirect labour is labour that is not directly involved in the manufacturing process and falls under manufacturing overheads. Supervisors and cleaners, for example, fall into this category.

It is logical, although in practice it is not always the case, that all the costs associated with direct labour should fall under direct labour costs. Thus, for example, the employer's contribution to pension funds for direct labour should be allocated to direct labour costs, while the normal wage for a person who does indirect work is allocated to manufacturing overheads.

As has already been mentioned, this principle is not always followed in practice and the tendency is to show only the variable portion of direct labour costs as such (for example, normal wages) while the fixed component (for example, the employer's contribution to medical funds) is allocated to manufacturing overheads.

Direct labour costs are usually calculated on an hourly basis and then allocated to the various products according to the number of hours worked.

It is very important that the hourly recovery tariff is calculated as accurately as possible to minimise the possibility of over- or under recovery. This means that the expected number of hours for a certain future period as well as the corresponding direct labour costs for the relevant period must be determined as accurately as possible. Provision for holiday leave as well as idle time must be made and brought into account. Usually only one tariff is calculated per department or cost centre rather than one for each employee, as shown in the following example:

Example 3.6

Number of weeks per year	52
Less: Holiday leave	(3)
Available weeks	49
Hours per week (5 working days, 8 hours each)	× 40
Available hours	1 960
Less: Public holidays (10 × 8 hours each)	(80)
	1 880
Less: Idle time (estimated as 10%)	(188)
Expected productive hours	1 692
Normal yearly gross salary (including leave)	4 800
Holiday bonus	480
Employer contributions	305
Total salary cost	5 585
Hourly recovery tariff	= $\frac{R5\,585}{1\,692\text{ hours}}$
	= R3.30 per hour

LEARNING CURVE

Employees are able to make fewer mistakes and to complete tasks in less time as they gain experience in repeating certain tasks.

This tendency, that a person is capable of completing a new task in less time each time he/she repeats it, until he/she reaches an optimum speed, has a fixed pattern, and gave rise to the development of the *learning curve theory*.

The learning curve effect

The **learning curve** can be used to estimate the number of labour hours. Labour hours tend to decrease in a fixed pattern as the labourer gains experience and become more competent in completing a certain task.

During, and just after the Second World War, American advisers to their aviation industry, began to study the effect of the learning curve on the manufacturing of aircraft.

A learning curve of, for example, 90%, indicates that the cumulative average time per unit will decrease with 10% if the production quantity is doubled. Assume that it takes 60 hours to manufacture the first unit of a certain product, then the cumulative average time of the subsequent units, with a 90% learning curve, will be as follows:

Units	Cumulative production	Cumulative average time per unit (hours)	
1	1	60	
1	2	54	(90% × 60)
2	4	48.6	(90% × 54)
4	8	43.74	(90% × 48.6)

As soon as the learning effect is completed, the decrease in the cumulative average time per unit will cease.

The following activities are subject to the learning effect:

- ☐ New activities, or activities which will be carried out by different production methods in future
- ☐ New employees who are not experienced with the specific operation
- ☐ The usage of a new type of material
- ☐ Short production runs, immediately prior to subsequent activities.

Example 3.7

A manufacturing concern launched a new product that is labour intensive in the production of this particular product. It is estimated that it will take 100 hours to manufacture the first unit. Management is of the opinion that an 80% learning effect will be experienced, and that it will cease at the 16th unit.

Required

- (a) Calculate the total number of hours to product the 16 units.
- (b) How many labour hours does it take to complete the first unit as compared to the second unit?
- (c) How many hours does it take to complete the third and fourth units?

Solution 3.7**(a) Total number of hours to product the 16 units**

Output	Average time per unit	Cumulative hours
1	100	100
2	80 ($80\% \times 100$)	160 (80×2)
4	64 ($80\% \times 80$)	256 (64×4)
8	51 ($80\% \times 64$)	408 (51×8)
16	41 ($80\% \times 51$)	656 (41×16)

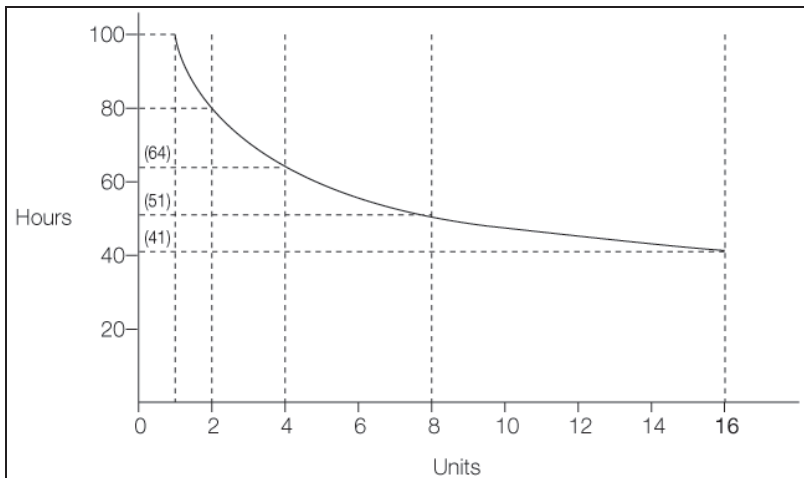
(b) Labour hours taken to complete the first unit as compared to the second unit

First unit =	100 hours
Second unit =	60 hours ($160 - 100$)

(c) Hours taken to complete the third and fourth unit

Cumulative hours for the first four units	256 hours
Cumulative hours for the first two units	160 hours
Total hours to complete units three and four	96 hours

The above presentation has its shortcomings because it does not show the cumulative hours to manufacture, for example, five units. However, to bridge this problem, it can be presented as a graph:

**Diagram 3.5**

The curve tends to have a rather sharp initial decline, but it flattens out as the learning effect is completed to the 16th unit.

Learning curve formula

At this point, it is understood that the learning curve is only applicable when a double up pattern is present. However, in some situations this may not be the case. The learning curve formula is thus applied when dealing in situations that do conform to the double up principle.

The learning curve formula is presented as follows:

$$Y = aX^b$$

Where

- a = the first time required to produce the first unit
- X = the cumulative number of units
- b = the learning coefficient OR
log of the learning curve ÷ log 2
- Y = The cumulative average time per unit to product X amount of units (this corresponds to the X input above)

Example 3.8

WATCHPIECE Ltd has an 80% learning curve in its product of it is latest handmade watch GTX. To date 34 units have been produced. For the coming month, April, another 20 units of GTX must be made in order to reach required demand. The time taken to produce the first GTX watch was 38 hours.

Required

Using the learning curve formula, calculate the budgeted total labour time for April.

Solution 3.8

Applying the learning curve theory to this problem, the total hours required to produce the next 20 units will be the difference between the total cumulative hours to complete the total 54 units (34 + 20) and the total cumulative hours already taken to complete the first 34 units. Thus, two figures are required here:

- (a) The total cumulative hours to complete 54 units.
- (b) The total cumulative hours to complete the first 34 units.

(a) $Y = aX^b$

a = 38 as it took 38 hours to complete the first unit

X = 54 is the cumulative units

b = $\log 0.8 \div \log 2 = -0.322$ (do not forget to use the negative sign)

$$Y = 38 \times 54^{-0.322}$$

$$Y = 10.52$$

The answer of 10.52 equals the cumulative average time per unit and not to total time to produce the 54 units. Thus, we must multiply 10.52 by 54 (10.52×54) in order to get the total time taken to product 54 units.

$$10.52 \times 54 = 568.08 \text{ total hours for 54 units}$$

- (b) The same process can now be applied to the total cumulative hours to complete the first 34 units.

$Y = aX^b$

a = 38 as it took 38 hours to complete the first unit

X = 34 is the cumulative units

b = $\log 0.8 \div \log 2 = -0.322$

$$Y = 38 \times 34^{-0.322}$$

$$Y = 12.21$$

$$12.21 \times 34 = 415.14 \text{ total hours for 34 units}$$

The total labour hours required will this be the difference between the total labour hours for 54 units and the total labour hours for the 34 units.

$$568.08 - 415.14 = 152.94 \text{ hours}$$

The budget hours to produce 20 units in April is thus 152.94 hours. Furthermore it may be said that the average time taken to complete a unit between 34 and 54 units is $152 \div 20 = 7.65$ hours.

Application value

Learning curves are an important management tool as far as the following aspects are concerned:

- ☐ the calculation of prices to be quoted including special orders;
- ☐ the determination of labour standards; and
- ☐ compiling of budgets.

It is also an important tool for control purposes. Actual hours worked can be compared with the learning curve to evaluate the labour output.

Challenges with the application of the learning curve

- ☐ It may be challenging to acquire data to determine the learning curve.
- ☐ The learning curve phenomenon is not always present in every situation.
- ☐ Very importantly, the learning curve assumes that workers are fully engaged in the manufacturing process and are motivated to enjoy the benefits of the learning curve.
- ☐ The learning curve does not consider break downs or long periods of breaks such as a weekend that may interrupt the learning process.

SUMMARY

Labour makes great demands on management and requires particular attention at all times because of its specific nature. What complicates the situation further is the fact that labour is not always as adaptable as it is made out to be. When material is not required, it is stored for later use. As a result of legislation, trade unions and other external factors, as well as internal factors such as job security and a satisfied labour force, labour cannot be dismissed immediately if it is not necessary – it remains unused but is still a cost to the enterprise. This has resulted in labour costs, as a whole, moving away from a variable tendency to a more fixed character – from a controllable item to an uncontrollable item. In South Africa there is a remuneration philosophy that employees should be remunerated according to a fixed wage structure and not according to contributions to profits. Thus, an employee is on a wage scale with fixed increments, irrespective of contributions to profit or productivity.

Labour presents a particular challenge to management and demands careful planning and cautious control by the management accountant because of the involvement of human personalities and capacity differences. Therefore, an enterprise with an effective labour force at its disposal will view it as one of its most important assets.

Output to labour hours worked is generally used to determine productivity and any change in the ratio between two periods is viewed as a change in productivity. One of the basic principles of good management is to strive for the highest possible productivity level.

When it appears that an employee cannot maintain a certain productivity level, it must not merely be accepted that the person should be dismissed. There are both humanitarian and external factors that may enable an employee to perform satisfactorily.

The main purpose of personnel administration is to provide an efficient labour force. Basic requirements are the accomplishment of a well-thought-out personnel policy, the

maintenance of sound labour relations and striving towards the highest productivity level.

Employment records consist of, among others, personnel records, clock cards, job cards and production reports. From a costing point of view, the total time spent on each product, service, job or project is very important for the determination of labour costs spent on the cost object.

REVIEW PROBLEMS – LABOUR

Problem 3.3

Health Hospital submits the following information for the week:

Name	Position	Normal rate	Hours worked	
			Normal	Overtime
P Adams	Nurse	R40	40	6
J Baloyi	Theatre sister	R60	40	4
S Clayton	Nursing manager	R80	40	3

Notes

- Overtime is remunerated at time-and-a-half of the normal rate.
- The following deductions are applicable:

Income tax	20%
Pension	7.5%
Medical aid	R50 per person
- The hospital contributes 7.5% to pension and R80 for medical aid.

Required

- Prepare a payroll with all the detailed information regarding gross wages, deductions, and net wages.
- Analyse the labour cost into direct and indirect labour cost.
- Journalise the necessary entries.
- Prepare ledger accounts.

Solution 3.3

(a) Payroll					
Name	Normal rate	Overtime rate	Hours worked		Total
			Normal	Overtime	
P Adams	R40	R60	40	6	46
J Baloyi	R60	R90	40	4	44
S Clayton	R80	R120	40	3	43
Remuneration					

continued

	P Adams R	J Baloyi R	S Clayton R	Total R
Normal	1 600	2 400	3 200	7 200
Overtime: Basic at normal rate	240	240	240	720
: Premium	120	120	120	360
Gross	1 960	2 760	3 560	8 280
Pension fund	(120)	(180)	(240)	(540)
PAYE	(368)	(516)	(664)	(1 548)
Medical fund	(50)	(50)	(50)	(150)
Net pay	1 422	2 014	2 606	6 042

(b) Direct and indirect labour

Name	Designation	Direct labour R	Indirect labour R	Overtime premium R
P Adams	Nurse	1 840		120
J Baloyi	Theatre sister	2 640		120
S Clayton	Nursing manager		3 440	120
Pension contribution by employer			540	
Medical aid contribution by employer (3 employees × R80)			240	
		<u>4 480</u>	<u>4 220</u>	<u>360</u>

(c) Journal entries

	Dr R	Cr R
Salary account	8 280	
Salaries payable		6 042
Pension		540
PAYE		1 548
Medical fund		150

Firstly, the employer's contributions must be journalised.

Journal entries

	Dr R	Cr R
Salary account (Employer's contribution)	780	
Pension (R7 200 × 7,5%)		540
Medical fund (3 employees × R80)		240

Secondly, salaries were paid out to the employees and the employees' deductions must be journalised.

Journal entries	Dr R	Cr R
Pension (R540 + R540)	1 080	
PAYE	1 548	
Medical fund (R150 + R240)	390	
Salaries payable	6 042	
Bank		9 060

(d) Ledger accounts			
Salaries			
	R		
Salaries payable	6 042		
Pension fund	540		
PAYE	1 548		
Medical fund	150		
Pension fund	540		
Medical fund	240		
	<u>9 060</u>		
Salaries payable			
	R		R
Bank	6 042	Salaries	6 042
Pension			
	R		R
Bank	1 080	Salaries	540
		Salaries	540
	<u>1 080</u>		<u>1 080</u>
PAYE			
	R		R
Bank	1 548	Salaries	1 548
Medical Fund			
	R		R
Bank	390	Salaries	150
		Salaries	240
	<u>390</u>		<u>390</u>
Bank			
	R		R
		Pension	1 080
		PAYE	1 548
		Medical fund	390
		Salaries pay	6 042
			<u>9 060</u>

Problem 3.4

The budget for the production cost of a new product was based on the following assumptions:

1. Time for the first batch of output = 10 hours.
2. Learning rate = 80%.
3. Learning will cease after 40 batches, and thereafter the time per batch will be the same as the time of the final batch during the learning period, i.e. the 40th batch.
4. Budget production 60 units.

Further analysis of actual results has shown that, due to similarities between this product and another that was developed last year, the rate of learning that should have been expected was 70% and that the learning should have ceased after 30 batches. The actual production was 50 units.

Required

Calculate the time taken to produce that actual production.

Solution 3.4

$$Y = aX^b$$

$$Y = 10 \times 30^{-0.5146} = 1.737 \text{ hours}$$

Total time for 30 batches = $30 \times 1.737 \text{ hours} = 52.11 \text{ hours}$

The average time for 29 batches:

$$Y = aX^b$$

$$Y = 10 \times 29^{-0.5146} = 1.768 \text{ hours}$$

Total time for 29 batches = $29 \times 1.768 \text{ hours} = 51.27 \text{ hours}$

Therefore the time for the 30th batch = $52.11 \text{ hours} - 51.27 \text{ hours} = 0.84 \text{ hours}$

Total time for 50 batches = $52.11 \text{ hours} + (20 \text{ batches} \times 0.84 \text{ hours}) = 68.91 \text{ hours}$

MANUFACTURING OVERHEADS

Overheads, the third cost element to be discussed, can be subdivided as follows:

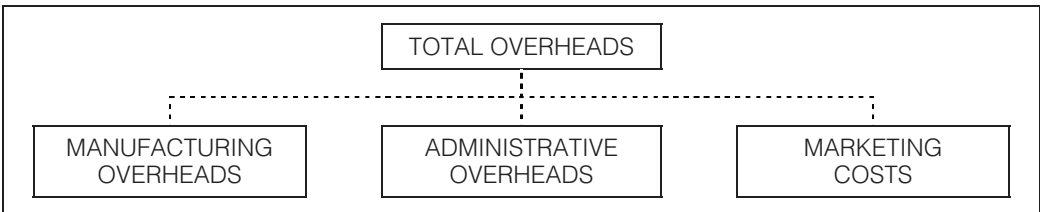


Diagram 3.6

Manufacturing overheads, sometimes called factory or production overheads, can be summarised as all the manufacturing costs necessary for the efficient continuation of the manufacturing process, excluding direct material and direct labour which are shown as separate cost elements, and thus constitute the third element of total manufacturing costs.

Direct material	XXX
Direct labour	XXX
Manufacturing overheads	XXX
Total manufacturing costs	<u>XXX</u>

In the years prior to the Industrial Revolution, manufacturing overheads were largely ignored as a cost element. The small industries of that time mainly revolved around the labourer who did the handiwork, and overheads did not exist or were so trifling that they were not separately accounted for. They were merely shown as an expense in the Statement of Profit or Loss. Material and labour costs were shown as the total of the manufacturing costs.

Only after the Industrial Revolution, when the emphasis changed from labour-intensive to capital-intensive manufacturing processes and the machine to a large extent replaced the worker, did overheads come into their own right. Today overheads are of such a size that no manufacturing concern can neglect to control them properly.

It will be noticeable from the following examples of cost items that are classified as manufacturing overheads that the importance and volume thereof have increased in proportion to mechanisation and automation, which have become the centre of the modern manufacturing set-up:

- ☐ hire of factory premises;
- ☐ maintenance of machinery and equipment;
- ☐ depreciation;
- ☐ supervision; and
- ☐ quality control.

In the small cottage industries of the past, the above cost items would not have had much influence on the cost structure and on the determination of the price.

COST PRICE CALCULATION AND MANUFACTURING OVERHEADS

Problems associated with overheads

The apportionment of manufacturing overheads to the various products manufactured is the single largest problem with regard to cost calculation.

The cost of direct material used in the manufacture of a product can easily be calculated from the material requisitions. Labour costs can be determined reasonably accurately from the clock and job cards. Manufacturing overheads, however, are not so easily determined.

In earlier times manufacturing overheads were calculated on a historical basis. The sum total of the manufacturing overheads for a certain period, usually a day or week, was divided by the number of units manufactured during that period to give the overheads per unit.

However, due to the administrative workload and the greater extent of modern production facilities, it is no longer practical to prepare statements on a daily or weekly basis to determine the figure. To aggravate the complexity of the problem the information is also no longer so easily collectable. Think of the cost of power, where electricity usage

is calculated on a monthly basis and the enterprise is informed of the cost a few weeks after the end of the month. In addition, diversification has ensured that an enterprise seldom manufactures only one product, as was the case in the past, but usually manufactures a series of products simultaneously. All these factors have contributed to the calculation of unit costs and cost prices on a historical cost basis becoming obsolete.

A new method had to be found to bring manufacturing overheads into account in determining the cost. These days the cost is allocated on the basis of the **causal relationship** between the products. Here *the cause (cost) is linked to the effect (the product)*, and *vice versa*. But this division is also very difficult, especially in enterprises which manufacture heterogeneous products in different departments.

Classification and analysis of overheads

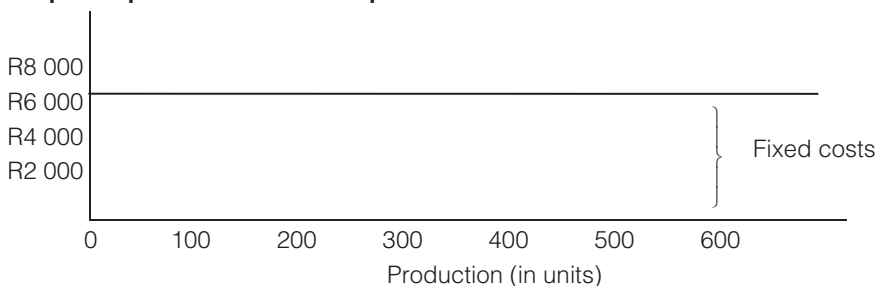
In order to divide the manufacturing overheads by means of the causal relationship which exists between costs and products, analysis and classification of the overheads are necessary. The most important classification of manufacturing overheads is according to their fixed and variable characteristics:

- ☐ fixed manufacturing overheads;
- ☐ variable manufacturing overheads;
- ☐ semi-fixed manufacturing overheads; and
- ☐ semi-variable manufacturing overheads.
- ☐ **Fixed manufacturing overheads**, sometimes also called period costs, are *costs that are constant in total for a certain period and are not linked to the number of units manufactured during that period*. They can also be viewed as the costs that are incurred to establish the capacity (manufacturing facility), that is to say the costs of being in business. An example is the rent of a factory location, a fixed amount per annum irrespective of the number of units manufactured during the year. A very important fact is that the cost is fixed in total, but if it is calculated per unit, it decreases as long as the number of units increases.

Example 3.9

	100 units	500 units
Total rent per annum	R6 000	R6 000
Rent per unit per annum	60	12

Graphic representation of example 3.9



The rent remains constant in total at R6 000 per annum and does not vary with the volume of production. The cost per unit produced decreases as the volume of production increases.

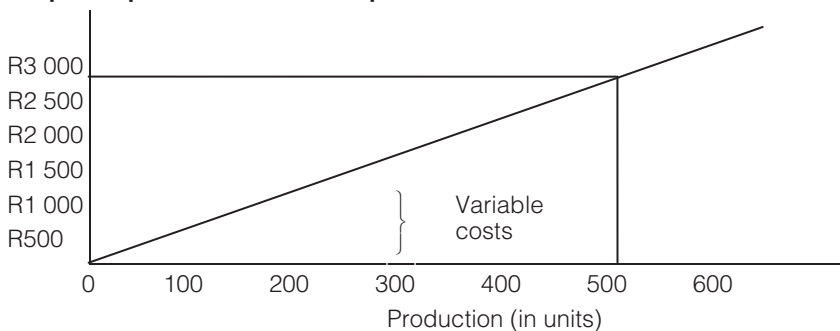
- Fixed costs are fixed for a given capacity level and period only. This **capacity level**, usually indicated by minimum and maximum limits, is known as *the relevant range within which the fixed costs will not change*. If, however, the manufacturing capacity is expanded to a level outside the relevant range, the total amount of fixed costs will also increase.
- **Variable manufacturing overheads**, sometimes also called direct overheads, have characteristics opposite to those of fixed manufacturing overheads. These are *incurred in the utilisation of the available capacity, that is to say they are the costs of doing business*.

Variable costs have a direct bond with and vary directly in relation to the volume of production, because the cost per unit produced is constant.

Example 3.10

	100 units	500 units
Variable manufacturing overheads per unit	R5	R5
Total variable manufacturing overheads	R500	R2 500

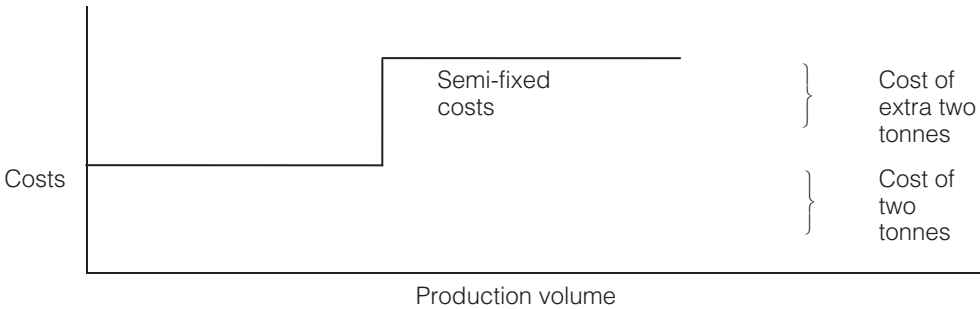
Graphic representation of example 3.10



- **Semi-fixed and semi-variable manufacturing overheads** have both a variable and a fixed element.

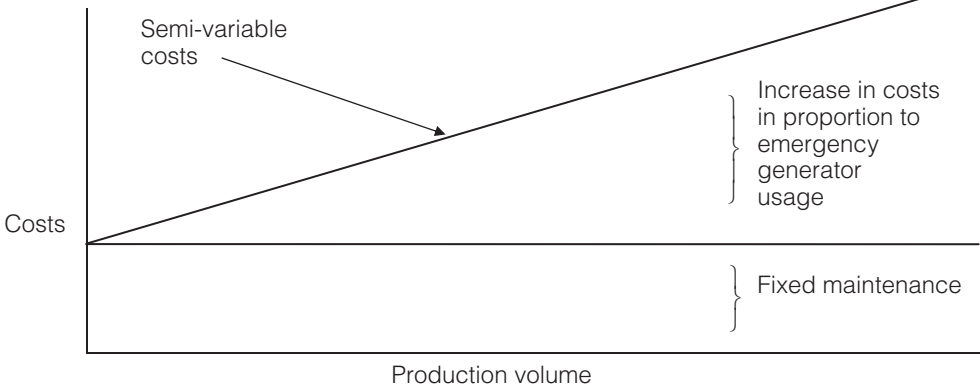
Transport can be taken as an example of semi-fixed costs. A truck with a capacity of two tonnes can transport a certain number of units. Increase the load to more than two tonnes and either a bigger truck must be acquired, or two journeys must be made. The costs thus increase in proportion to the increase in production volume.

Example 3.11



The cost of an emergency generator is a good example of semi-variable manufacturing overheads. Fixed monthly maintenance is a certain amount, but whenever it is used provision must also be made for petrol costs.

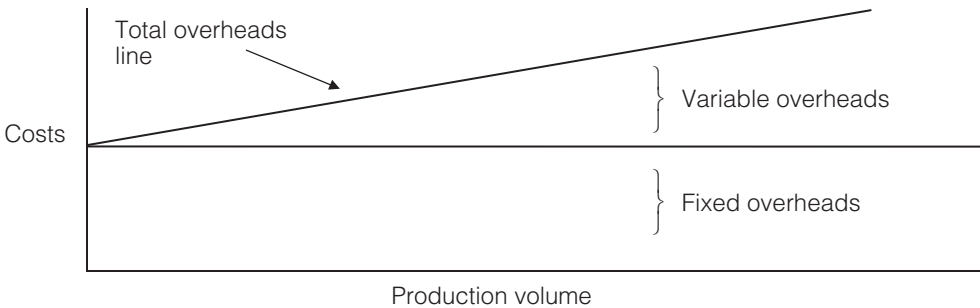
Example 3.12



Since there is little difference in the handling and controlling of semi-fixed and semi-variable manufacturing overheads, in this book no further distinction is made between these two cost types and it is accepted that what is applicable to one is also applicable to the other.

In summary, total manufacturing overheads can be divided into fixed and variable elements, presented graphically as follows:

Example 3.13



TOTAL MANUFACTURING OVERHEADS AND THE LINEAR FUNCTION

Because a constant variable cost per unit is accepted in costing, as well as a based fixed cost level, consequently, the total manufacturing overheads may form a linear cost function. In general, the linear function evolves from a series of observations of activity levels and the related cost. Thus, it can be depicted algebraically by means of the following formula for a linear function:

$$T = a + bx$$

Where T = total manufacturing overheads

a = fixed costs (including the fixed portion of semi-variable costs)

b = variable costs (including the variable portion of semi-variable costs)

x = volume in units

TECHNIQUES FOR DIVIDING MANUFACTURING OVERHEADS

The division of manufacturing overheads into fixed and variable elements has great advantages for control purposes.

The amount of fixed manufacturing overheads is relatively easily controllable because the total amount is constant. If the amount is exceeded there is wastage or ineffective employment of funds and the cause can be determined.

The amount of variable manufacturing overheads is also easily controllable because the cost per unit is constant. The costs per unit multiplied by the number of units manufactured gives the total variable manufacturing overheads, which can be used to determine whether there is any wastage or whether ineffective usage has taken place.

Some types of manufacturing overheads can easily be divided into their fixed and variable elements, but with others this is impossible unless one of the following techniques is used:

- ☐ Scatter diagram.
- ☐ High-low method.
- ☐ Simple regression.
- ☐ Multiple regression.

Scatter diagram

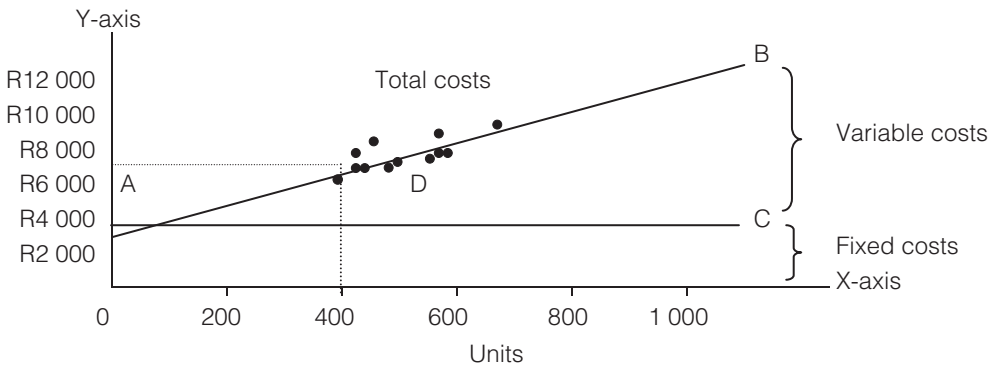
A scatter diagram is a visual method used to illustrate the different observations of volume on one side with the associated costs in respect of the various volumes on the other side. (Graphically the volume is shown on the x-axis and the cost on the y-axis.)

Thus, by drawing a comparison between the volume of production on the one hand (x-axis) and the manufacturing overheads on the other (y-axis), the relationship between the fixed and variable elements can be traced as illustrated in Example 3.14:

Example 3.14

Month	Number of units manufactured	Total manufacturing overheads R
January	450	8 600
February	600	10 200
March	700	11 000
April	650	10 300
May	600	10 100
June	550	9 600
July	550	9 300
August	500	8 800
September	500	9 100
October	450	8 600
November	450	8 400
December	400	8 000

Graphic representation of example 3.14



By drawing a straight line (line AB), known as the line of best fit, through the middle of the various points, as indicated, and by connecting it to the Y axis (point A) and then drawing a straight line parallel to the X axis from the intersection at A to point C, we create a graphic representation of the fixed and variable elements of the total manufacturing overheads.

In order to complete the cost function ($T = a + bx$), a and b are required.

In this case line AC or the y-intercept represents the fixed overheads of R4 000 which is a , the constant in our cost function.

The total variable overheads are represented by the area between lines AB and AC. To obtain the variable cost per unit a point exactly on the line of best fit must be chosen. Then, the variable cost of that point must be divided by number of units of that

point. In this case we select the point December (D) R8 000 total cost – R4 000 fixed cost = R4 000 variable cost $4\,000 \text{ variable cost} \div 400 \text{ units} = \text{R}10 \text{ variable cost per unit}$.

Thus, the linear cost function can be expressed as:

$$T = 4\,000 + 10x.$$

It must be noted that this method is not very accurate, since everyone will draw the line AB with a different gradient through the various points. The division between fixed and variable will therefore differ, but should still provide adequate information for control purposes.

High-low method

The high-low method is similar to that of finding the gradient of a line (change in Y over the change in X) except that it takes only the highest and lowest volumes into consideration. The advantage of this method, although it is not as accurate as the others, is that it is quick and easy to make the distinction.

Example 3.15

(Using the same information as in Example 3.14)

	Volume	Manufacturing overheads
Highest observation	700	11 000
Lowest observation	400	8 000
Difference	<u>300</u>	<u>3 000</u>

As a starting point, the principle that fixed costs are constant in total and do not vary with the production volume, is used. Thus, the increase in manufacturing overheads (R3 000) is attributable only to the variable element, namely, the manufacture of the 300 extra units. Variable manufacturing overheads thus amount to R10 per unit, or R3 000 divided by 300 units.

The fixed costs can now be calculated as follows:

	Total overheads R	Variable R	Fixed R
Highest observation	11 000	7 000*	4 000
Lowest observation	8 000	4 000	4 000

* $700 \times \text{R}10 = \text{R}7\,000$

Thus, the linear cost function can be expressed as:

$$T = 4\,000 + 10x$$

If the costs of the highest and lowest volumes show an abnormality (i.e. out of the relevant range), for example, exceptionally low costs compared with the highest volume, the high-low method cannot be used for the division as it will show an unrealistic amount for the fixed costs.

Simple regression

In contrast with the scatter profile, where the line is drawn according to the judgement of the person who prepares it, it can also be determined with mathematical precision by means of a technique known as **simple regression** (or the **ordinary least squared method**). Simple regression is *the development of an equation which indicates the relationship between one fixed and one variable factor*, that is mathematical solving for the constant a and the gradient b in the linear cost function.

Simple regression is a mathematical technique whereby the following two equations must be solved:

$$(i) \sum xy = a\sum x + b\sum x^2$$

$$(ii) \sum y = na + b\sum x$$

x = number of units produced

y = total overheads for the relevant production volume

n = number of observations

a = fixed overheads for the period

b = variable overheads for the period

In Example 3.16 the application of simple regression and the solving of the equations are illustrated. (The symbols X and Y are used to indicate the production volume and the total overheads respectively.)

Example 3.16

(Using the same information as in Example 3.14)

	Production volume		Overheads	
Month	X	Y	XY	X ²
January	450	8 600	3 870 000	202 500
February	600	10 200	6 120 000	360 000
March	700	11 000	7 700 000	490 000
April	650	10 300	6 695 000	422 500
May	600	10 100	6 060 000	360 000
June	550	9 600	5 280 000	302 500
July	550	9 300	5 115 000	302 500
August	500	8 800	4 400 000	250 000
September	500	9 100	4 550 000	250 000
October	450	8 600	3 870 000	202 500
November	450	8 400	3 780 000	202 500
December	400	8 000	3 200 000	160 000
	<u>6 400</u>	<u>112 000</u>	<u>60 640 000</u>	<u>3 505 000</u>

Σ = the sum of

ΣX = 6 400

ΣY = 112 000

ΣXY = 60 640 000

ΣX^2 = 3 505 000

Solution 3.16

$$(i) \sum xy = a\sum x + b\sum x^2$$

$$(ii) \sum y = na + b\sum x$$

By replacing x and y with values:

$$(i) (a) \quad 60\,640\,000 = (a \times 6\,400) + (b \times 3\,505\,000)$$

$$(ii) (a) \quad 112\,000 = (12 \times a) + (b \times 6\,400)$$

By substitution:

$$(i) (b) \quad 6\,400a = 60\,640\,000 - 3\,505\,000b$$

$$(ii) (b) \quad 12a = 112\,000 - 6\,400b$$

If equation (ii) (b) is multiplied by 533,333 (obtained by dividing 6 400a by 12a) the two equations will have the same value in respect of 6 400a.

Deduct the second equation:

$$(i) (c) \quad 6\,400a = 60\,640\,000 - 3\,505\,000b$$

$$(ii) (c) \quad \begin{array}{r} 6\,400a = 59\,733\,332 - 3\,413\,333b \\ \hline 0 = 906\,668 - 91\,667b \end{array}$$

By substitution:

$$91\,667b = 906\,668$$

$$b = \frac{906\,668}{91\,667}$$

$$b = R9.89 \text{ (variable cost per unit)}$$

Replace b with R9.89 in equation (ii) (b):

$$\begin{aligned} 12a &= 112\,000 - (6\,400 \times 9.89) \\ &= 112\,000 - 63\,296 \\ &= 48\,704 \\ a &= R4\,058.66 \text{ (fixed cost per month)} \end{aligned}$$

The linear cost function can thus be presented as follows:

$$T = 4\,058.66 + 9.89x$$

Where the R4 058.66 represents the fixed costs and the R9.89 is the variable product cost per unit produced.

Alternatively, to the above method the following formulas can be used to solve for a , the fixed costs and b the variable costs:

$$b = \frac{n(\sum xy) - (\sum x)(\sum y)}{n(\sum x^2) - (\sum x)^2}$$

$$a = \frac{(\sum y) - b(\sum x)}{n}$$

Where

n = the number of observations

Using the information presented in Example 3.16 from Example 3.14 the formulas are thus applied as follows:

$$\begin{aligned}
 b &= \frac{n(\sum xy) - (\sum x)(\sum y)}{n(\sum x^2) - (\sum x)^2} \\
 b &= \frac{12(60\,640\,000) - (6\,400)(112\,000)}{12(3\,505\,000) - (6\,400)^2} \\
 b &= \frac{10\,880\,000}{1\,100\,000} \\
 b &= \text{R}9.8909 \text{ (variable cost per unit)} \\
 a &= \frac{(\sum y) - b(\sum x)}{n} \\
 a &= \frac{(112\,000) - 9.8909(6\,400)}{12} \\
 a &= \frac{48\,698.24}{12} \\
 a &= \text{R}4\,058.18 \text{ (fixed cost per month)}
 \end{aligned}$$

The linear cost function can thus be presented as follows:

$$T = 4\,058.18 + 9.89x$$

You will notice that the two methods proposed under simple regression result in the same answer, although, in some cases slight differences are expected due to decimal usage in the calculations. Furthermore, it must be noticed that although the two simple regression methods present similar answers, the high-low method presented a different answer to that of the simple regression calculations. This difference is due to that fact that regression considers all the data points given and that the high-low method only considers two points, namely, the highest and the lowest.

Multiple regression

For the sake of completeness, attention can also be given to multiple regression which shows the influence of one fixed component and two or more variable components. The application takes place by means of the following simple formula:

$$Y = a + bx + b^1x^1 + \dots + b^nx^n$$

Where Y = total cost

a = fixed costs

x..... xⁿ = the variables that have an influence on Y

b..... bⁿ = the values of the variables

For example, x can be represented by man-hours, machine-hours or any other variable, while b represents the tariff per man-hour/machine-hour or such variable.

Just as the total manufacturing overheads in the previous three methods can be divided between the fixed and variable elements, each individual cost element can also be divided into its fixed and variable components.

As has already been mentioned, for control purposes it is necessary that overheads are divided. It is also an important aid for pre-planning and for the preparation of budgets.

SUMMARY

Overheads include all the costs that are necessary for the enterprise's activities, except direct material and direct labour costs. Overheads can be subdivided into manufacturing overheads, administrative overheads and marketing overhead costs.

Manufacturing overheads are allocated to cost objects based on the most appropriate basis. Manufacturing overheads are classified as fixed, variable, semi-fixed and semi-variable.

Techniques for dividing manufacturing overheads into fixed and variable components include, among others, the scatter graph, high-low method, simple regression and multiple regression.

REVIEW PROBLEM – MANUFACTURING OVERHEADS

Problem 3.5

Use the following information from the records of Caprivi Hospital to break down a maintenance cost into their fixed and variable elements using:

- (a) the high-low method; and
- (b) the simple regression method.

Month	Activity level: Patient days	Maintenance costs incurred R
January	500	8 000
February	700	10 100
March	550	11 000
April	600	10 200
May	750	10 300
June	650	9 000

Solution 3.5

(a) Using the high-low method:

Step 1: Determine the highest level and the lowest level of activity with its associated cost and determine both the differences in activity level and costs.

	Patient days	Maintenance costs
Highest observation	750	10 300
Lowest observation	500	8 000
Difference	<u>250</u>	<u>2 300</u>

Step 2: Determine the estimated variable cost per unit.

$$\begin{aligned}\text{Variable cost} &= \frac{\text{Change in cost}}{\text{Change in activity}} \\ &= \frac{\text{R2 300}}{250 \text{ units}} \\ &= \text{R9.20}\end{aligned}$$

Step 3: Determine the fixed cost.

	Maintenance costs R		Variable R		Fixed R
Highest observation	10 300	–	6 900 (750 units × R9.20 per unit)	=	3 400
Lowest observation	8 000	–	4 600 (500 units × R9.20 per unit)	=	3 400

The cost of maintenance can also be expressed in a linear relationship for a straight line as follows:

$$T = \text{R3 400} + \text{R9.20} \times x$$

Where:
 T = Total maintenance costs and
 x = Number of patient days

(b) Using simple regression:

	Patient days X	Main- tenance Y	XY	X ²
Month				
January	500	8 000	4 000 000	250 000
February	700	10 100	7 070 000	490 000
March	550	11 000	6 050 000	302 500
April	600	10 200	6 120 000	360 000
May	750	10 300	7 725 000	562 500
June	650	9 000	5 850 000	422 500
	<u>3 750</u>	<u>58 600</u>	<u>36 815 000</u>	<u>2 387 500</u>

Σ = The sum of

ΣX = 3 750

ΣY = 58 600

ΣXY = 36 815 000

ΣX^2 = 2 387 500

(i) $\Sigma xy = a\Sigma x + b\Sigma x^2$

(ii) $\Sigma y = na + b\Sigma x$

By replacing x and y with values:

(i) (a) $36\,815\,000 = (a \times 3\,750) + (b \times 2\,387\,500)$

(ii) (a) $58\,600 = (6 \times a) + (b \times 3\,750)$

By substitution:

(i) (b) $3\,750a = 36\,815\,000 - 2\,387\,500b$

(ii) (b) $6a = 58\,600 - 3\,750b$

If equation (ii) (b) is multiplied by 625 (obtained by dividing 3 750a by 6a) the two equations will have the same value in respect of 3 750a.

continued

Deduct the second equation:

$$\begin{array}{rcl} \text{(i) (c)} & 3\,750a & = 36\,815\,000 - 2\,387\,500b \\ \text{(ii) (c)} & \underline{3\,750a} & = \underline{36\,625\,000 - 2\,343\,750b} \\ & 0 & = 190\,000 - 43\,750b \end{array}$$

By substitution:

$$\begin{aligned} 43\,750b &= 190\,000 \\ b &= \frac{190\,000}{43\,750} \\ b &= R4.34 \text{ (variable cost per unit)} \end{aligned}$$

Replace b with R4.34 in equation (ii) (b):

$$\begin{aligned} 6a &= 58\,600 - (3\,750 \times 4.34) \\ &= 58\,600 - 16\,275 \\ &= 42\,325 \\ a &= R7\,054.17 \text{ (fixed cost per month)} \end{aligned}$$

Alternative solution

$$\begin{aligned} b &= \frac{n(\sum xy) - (\sum x)(\sum y)}{n(\sum x^2) - (\sum x)^2} \\ b &= \frac{6(36\,815\,000) - (3\,750)(58\,600)}{6(2\,387\,500) - (3\,750)^2} \\ b &= \frac{1\,140\,000}{262\,500} \\ b &= R4.34 \text{ (variable cost per unit)} \\ a &= \frac{(\sum y) - b(\sum x)}{n} \\ a &= \frac{(58\,600) - 4.34(3\,750)}{6} \\ a &= \frac{42\,314.12}{6} \\ a &= R7\,052.35 \text{ (fixed cost per month)} \end{aligned}$$

MARKETING COSTS

In contrast to manufacturing costs, most business enterprises neglect marketing costs. However, the planning, control, classification, and allocation of marketing costs are just as important as they are for manufacturing costs.

This unit explains the classification of marketing costs. It also explains the difference between the acquisition costs of orders and the execution costs of orders. A discussion of, and the allocation bases for each type of marketing cost follow with an illustration of the apportionment.

This section also emphasises the importance of the planning and control of marketing costs. Planning is an important element since a reduction in certain of these costs may result in a decline in sales. A long-term advertising programme that will ensure that increased sales volumes in consecutive years will be achieved should enjoy more attention than the planning of manufacturing costs normally requires.

Marketing costs are normally classified into two categories, namely, those arising from the acquisition of orders and those for the execution of orders. Diagram 3.7 illustrates the difference:

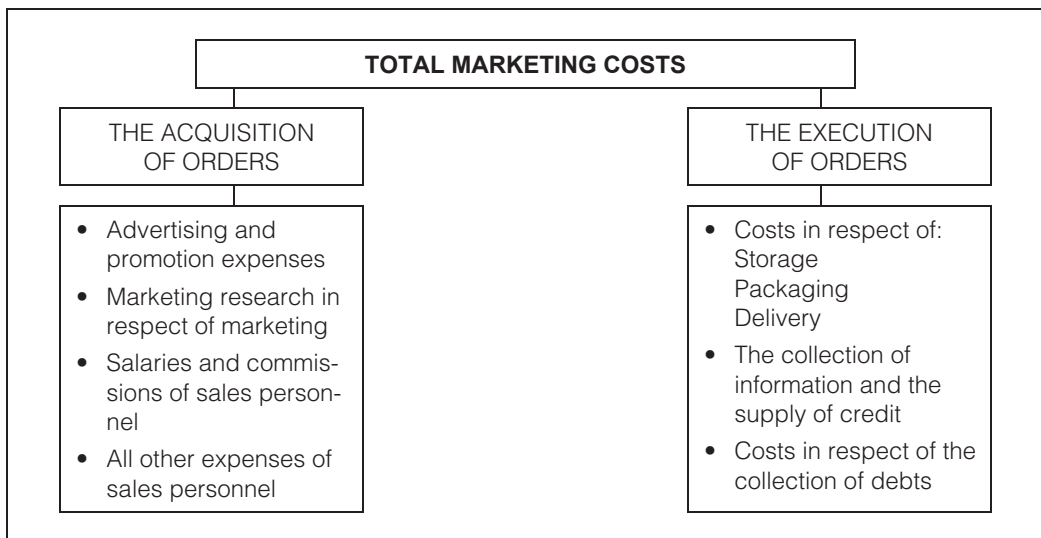


Diagram 3.7

Dividing each given item into its respective fixed and variable components is important so that management may exercise effective control.

BASES FOR APPORTIONMENT

The type of product marketed, the type of marketing cost incurred, and the nature of the enterprise determine the basis of allocation of marketing costs to different products and/or areas. The allocation basis for the apportionment of marketing costs to vegetables will obviously differ from those used to allocate marketing costs to different motor vehicle types.

Diagram 3.8 illustrates the most typical allocation bases.

Type of cost	Basis of apportionment
Direct selling expenses:	
Salaries of sales personnel	Selling value of product
Commissions of sales personnel	
Bonuses of sales personnel	
Sales management expenses	
Administrative expenses:	
Salaries and office expenses	Number of sales invoices
Expenses in respect of accounts section	Number of sales invoices
Other expenses	Sales value of each product or number of orders received for each product
Advertising expenses:	
Salaries and office expenses	Sales value of product
General advertising expenses	Sales value of product
Product advertising	Directly to product
Samples	Specific costs of each product sample
Storage costs:	
Salaries of personnel	Number of units sold or ratio of weight of product to total handled
Depreciation	
Material supplied	Average value of each product on hand
Insurance	
Packaging costs	
Transport costs:	
Freight-out	Sales value of product or weight of product or ratio of size of product weighted to quantity sold
Salaries of sales department	
Delivery costs	
Expenses in respect of credit provision and collection of debt:	
Salaries	Sales value of product
Indirect material	
Hire	
Legal costs	Number of accounts and products sold to each
Uncollectible	

Diagram 3.8

PLANNING AND CONTROL

Like manufacturing overheads, marketing costs require an effective planning and control system. The aim in manufacturing is to keep the manufacturing costs as low as possible to maximise profits. Enterprises should apply the same principle to marketing costs with caution, since a reduction in certain marketing costs may cause lower sales in the long term.

By applying the following four methods of analysis this section will briefly illustrate effective planning and control of marketing costs:

- ☐ by product.
- ☐ by sales representative.

- ☐ by area.
- ☐ by size of order.

Products

By applying this method, marketing costs are allocated to the various products marketed. An example is the allocation of storage costs to various products according to the space utilised by each product.

Example 3.16

The following information relates to Masters Ltd, who manufactures and markets products M and L:

		R
Sales:	M 600 000 units @ R2 each	
	L 400 000 units @ R3 each	
Cost of sales:	M	900 000
	L	800 000
Advertising expenditure (M 60%; L 40%)		50 000
Selling costs		60 000
Storage costs		18 000
Delivery costs		15 000
Packaging costs		30 000
Sales office expenses		
	60 000	
Direct selling expenses		
	15 000	
Additional information:		
(a) Storage space used: m ³ per R100 of sales:		
M.....	4 m ³	
L	5 m ³	
(b) Number of orders executed:		
M.....	30 000 orders	
L	10 000 orders	
(c) Delivery costs:		
M.....	45% of total delivery costs	
L	55% of total delivery costs	

Required

Calculate the net income for products M and L separately.

Solution 3.16

Statement of Profit or Loss				
	Basis	Total R	M R	L R
Sales:		2 400 000		
600 000 × R2			1 200 000	
400 000 × R3				1 200 000
Less: Cost of sales		(1 700 000)	(900 000)	(800 000)
Gross profit		700 000	300 000	400 000
Less: Marketing costs		(248 000)	(145 250)	(102 750)

continued

	Basis	Total R	M R	L R
Advertising	60%/40%	50 000	30 000	20 000
Selling costs	Value ¹	60 000	30 000	30 000
Storage costs	4 : 5 ²	18 000	8 000	10 000
Delivery costs	45%/55%	15 000	6 750	8 250
Packaging costs	Units ³	30 000	18 000	12 000
Sales office	Orders ⁴	60 000	45 000	15 000
Selling expenses	Value ¹	15 000	7 500	7 500
Net income		452 000	154 750	297 250

¹ In proportion to total sales value
² Calculation of basis
 Product M $(R1\ 200\ 000 \div R100) \times 4m^3 = 48\ 000m^3$
 Product L $(R1\ 200\ 000 \div R100) \times 5m^3 = 60\ 000m^3$
 Because the turnover of M and L is the same, the ratio remains 4:5
³ In proportion to number of units sold
⁴ In proportion to number of orders

Sales representatives

This method apportions marketing costs to sales representatives thus enabling management to identify sales representatives that accumulate high costs. From Example 3.17 it is clear that high sales volume or sales compositions do not always ensure high profits and sales mix can play an important part in the final profit.

Example 3.17

ABC Ltd manufactures and sells a diversity of products using three sales representatives, John, Peter and James. The following information, taken from the previous accounting period, is available:

Sales representative	Order value R	Net sales R	Cost of sales R
John	520 000	400 000	280 000
Peter	280 000	250 000	150 000
James	400 000	350 000	170 000

Note

Order value includes all orders for the period. Net sales include finalised orders plus the concluded parts of partly completed orders for which an invoice is completed, less returns.

Direct marketing costs:

Sales representative	John	Peter	James	Total
Basic salaries	R2 000	R2 000	R2 000	R6 000
Commission	10% of gross profit			
Travel expenses	R10 000	R2 000	R8 000	R20 000
Telephone	R1 000	R1 000	R2 000	R4 000

Indirect marketing costs:

	Basis of appointment	Total R
Advertising	Net sales	20 000
Storage	Cost of sales	5 000

continued

	Basis of appointment	Total R
Advertising	Net sales	20 000
Storage	Cost of sales	5 000
Administration	Net sales	100 000
Packing	Cost of sales	80 000
Sales office	Order value	100 000
Required		
Calculate the net profit/loss of each sales representative.		

Solution 3.17**Statement of Profit or Loss**

	Allocation basis	Total R	John R	Peter R	James R
Net sales		1 000 000	400 000	250 000	350 000
Less: Cost of sales		(600 000)	(280 000)	(150 000)	(170 000)
Gross profit		400 000	120 000	100 000	180 000
Less: Marketing costs		(375 000)	(155 999)	(89 583)	(129 418)
Basic salary	Direct	6 000	2 000	2 000	2 000
Commission	10% of gross profit	40 000	12 000	10 000	18 000
Travel expenses	Direct	20 000	10 000	2 000	8 000
Telephone	Direct	4 000	1 000	1 000	2 000
Advertising	Net sales	20 000	8 000	5 000	7 000
Storage	Cost of sales	5 000	2 333	1 250	1 417
Administration	Net sales	100 000	400 009	25 000	35 000
Packing	Cost of sales	80 000	37 333	20 000	22 667
Sales office	Order value	100 000	43 333	23 333	33 334
Net profit/(loss)		25 000	(35 999)	10 417	50 582

Areas

Applying this method, marketing costs are allocated to marketing areas thus enabling management to identify non-profitable areas.

Example 3.18

Spreaders Ltd manufactures a single product and markets it in three different areas. The following information, taken from the previous accounting period, is available:

Area	Sales R	Cost of sales R
Brits	400 000	210 000
Ceres	300 000	160 000
Parys	110 000	60 000
Marketing costs:		
Sales personnel		
Salaries		40 000
Commission		40 500
Advertising		
Direct		45 000
Indirect		16 200

continued

	Sales R	Cost of sales R
Storage and transport		32 400
Sales office expenses		15 000
Administrative		60 750
Packing		10 000

Additional information:

(a) Direct advertising costs are allocated as follows:

Brits	20 000
Ceres	10 000
Parys	15 000

(b) Number of orders handled:

Brits	400
Ceres	300
Parys	500

(c) Number of units sold:

Brits	200 000
Ceres	150 000
Parys	50 000

(d) Four commercial travellers are employed, each receiving the same salary plus 5% commission on all sales, as follows:

Brits	2
Ceres	1
Parys	1

Required:

Calculate the total net profit as well as the net profit for each area separately.

Solution 3.18**Statement of Profit or Loss**

Allocation basis	Total R	Brits R	Ceres R	Parys R
Sales	810 000	400 000	300 000	110 000
Less: Cost of sales	(430 000)	(210 000)	(160 000)	(60 000)
Gross profit	380 000	190 000	140 000	50 000
Less: Marketing costs	(259 850)	(124 000)	(83 000)	(52 850)
Personnel				
Salaries 2:1:1	40 000	20 000	10 000	10 000
Commission 5%	40 500	20 000	15 000	5 500
Advertising				
Direct Given	45 000	20 000	10 000	15 000
Indirect Value	16 200	8 000	6 000	2 200
Storage Value	32 400	16 000	12 000	4 400
Sales office Number of orders	15 000	5 000	3 750	6 250
Administration Value	60 750	30 000	22 500	8 250
Packing Units	10 000	5 000	3 750	1 250
Net income (Loss)	120 150	66 000	57 000	(2 850)

Size of orders

An analysis of marketing costs according to the size of orders will show, as a rule, that small orders generally contribute a negative amount to net income.

Analysis per customer group					
Order category	Customer percentage	Volume percentage	Gross profit per 100 units	Marketing cost per 100 units	Net profit per 100 units
R	(%)	(%)	R	R	R
1 – 50	19	2	30	40	(10)
51 – 100	15	4	25	27	(2)
101 – 200	20	5	21	22	(1)
201 – 500	29	16	19	16	3
501 – 1 000	15	17	18	9	9
> 1 000	2	56	15	3	12
Total	<u>100</u>	<u>100</u>			

The above analysis shows that only an order of more than R200 yields a net profit. To calculate the gross profit the cost of sales is deducted from sales. Marketing costs (including administrative costs) are then deducted from gross profit to arrive at net profit.

Only 46% of all customers place orders of more than R200. These orders make up 89% of total sales and are therefore responsible for the larger portion of the profit.

Although orders below R200 yield the higher gross profit, the profit is not sufficient to cover marketing costs. Accepting orders below R200 is therefore not profitable.

Example 3.19 illustrates the allocation of marketing costs to the various order categories. A Statement of Profit or Loss is prepared to illustrate the profitability of the various categories.

Example 3.19

Impala Ltd, acting on the recommendation of a consultant, decided to allocate marketing costs to order value categories for management purposes. The following proposed allocation bases and the previous week's costs and operating information are stated below:

Cost item	Marketing costs R	Allocation basis
Salaries	3 600	Number of customers
Travelling costs	1 960	Number of customers
Customer services	1 280	Number of customers
Sales commission (5%)	5 000	5% of sales
Customer relations	1 380	Number of customers
Distribution costs	2 400	Weight
Stores	1 440	Weight
Advertising	10 940	No allocation
Postage	3 060	Number of customers
Administration	3 940	No allocation
Total	<u>35 000</u>	

continued

Order category	Number of customers	Number of orders	Cost of sales	Total sales	Product A sales	Product B sales
			R	R	R	R
Less than R25	900	3 600	5 500	10 000	4 300	5 700
R25 – R100	300	2 400	11 000	20 000	8 700	11 300
R101 – R200	225	2 400	16 500	30 000	17 400	12 600
More than R200	75	600	22 000	40 000	14 600	25 400
Total	<u>1 500</u>	<u>9 000</u>	<u>55 000</u>	<u>100 000</u>	<u>45 000</u>	<u>55 000</u>

Product	Units sold	Weight per product kg
A	10 000	2
B	30 000	1
Total	<u>40 000</u>	

Required

Prepare a Statement of Profit or Loss showing the allocation of marketing costs to order value categories.

Solution 3.19**Statement of Profit or Loss of Impala Ltd**

	Allocation basis	Less than R25 R	R25 to R100 R	R101 to R200 R	More than R200 R	Total R
Sales		10 000	20 000	30 000	40 000	100 000
Less: Cost of sales		<u>(5 500)</u>	<u>(11 000)</u>	<u>(16 500)</u>	<u>(22 000)</u>	<u>(55 000)</u>
Gross profit		4 500	9 000	13 500	18 000	45 000
Less: Marketing costs:		<u>(7 041)</u>	<u>(4 230)</u>	<u>(4 671)</u>	<u>(4 178)</u>	<u>(20 120)</u>
Salaries	customers	2 160	720	540	180	3 600
Travelling and subsistence	customers	1 176	392	294	98	1 960
Customer services	customers	768	256	192	64	1 280
Sales commission	sales	500	1 000	1 500	2 000	5 000
Customer relations	customers	828	276	207	69	1 380
Distribution costs	weight	241 ¹	481 ¹	701 ¹	9772 ¹	2 400
Stores	weight	144 ²	289 ²	421 ²	586 ²	1 440
Postage	orders	<u>1 224</u>	<u>816</u>	<u>816</u>	<u>204</u>	<u>3 060</u>
Contribution		<u>(2 541)</u>	<u>4 770</u>	<u>8 829</u>	<u>13 822</u>	<u>24 880</u>
Less: General marketing costs:						
Advertising						(10 940)
Administrative						<u>(3 940)</u>
Net profit						<u>10 000</u>

continued

Calculation:

$$\text{Value per kg} = \frac{\text{Sales}}{\text{Units sold} \times \text{kg per unit}}$$

$$\text{Product A} = \frac{\text{R45 000}}{10\,000 \text{ units} \times 2 \text{ kg}} = \text{R2.25 per kg}$$

$$\text{Product B} = \frac{\text{R55 000}}{30\,000 \text{ units} \times 1 \text{ kg}} = \text{R1.83 per kg}$$

1 Distribution

			R
Less than R25:	$\left(\frac{\text{R4 300}}{\text{R2.25}} + \frac{\text{R5 700}}{\text{R1.83}} \right) \div 50\,000 \text{ kg} \times \text{R2 400} =$		241
R25 – R100:	$\left(\frac{\text{R8 700}}{\text{R2.25}} + \frac{\text{R11 300}}{\text{R1.83}} \right) \div 50\,000 \text{ kg} \times \text{R2 400} =$		481
R101 – R200:	$\left(\frac{\text{R17 400}}{\text{R2.25}} + \frac{\text{R12 600}}{\text{R1.83}} \right) \div 50\,000 \text{ kg} \times \text{R2 400} =$		701
More than R200:	$\left(\frac{\text{R14 600}}{\text{R2.25}} + \frac{\text{R25 400}}{\text{R1.83}} \right) \div 50\,000 \text{ kg} \times \text{R2 400} =$		977
Total			<u>2 400</u>

2 Store

			R
Less than R25:	$\left(\frac{\text{R4 300}}{\text{R2.25}} + \frac{\text{R5 700}}{\text{R1.83}} \right) \div 50\,000 \text{ kg} \times \text{R1 440} =$		144
R25 – R100:	$\left(\frac{\text{R8 700}}{\text{R2.25}} + \frac{\text{R11 300}}{\text{R1.83}} \right) \div 50\,000 \text{ kg} \times \text{R1 440} =$		289
R101 – R200:	$\left(\frac{\text{R17 400}}{\text{R2.25}} + \frac{\text{R12 600}}{\text{R1.83}} \right) \div 50\,000 \text{ kg} \times \text{R1 440} =$		421
More than R200:	$\left(\frac{\text{R14 600}}{\text{R2.25}} + \frac{\text{R25 400}}{\text{R1.83}} \right) \div 50\,000 \text{ kg} \times \text{R1 440} =$		586
Total			<u>1 440</u>

SUMMARY

As marketing costs became more important, a need for marketing management developed. The marketing manager must manage his or her department effectively to contribute to the increased profit of the concerned enterprise. He or she must also control the marketing costs sensibly so that savings and curtailments do not take place as they may lead to reduced sales and, eventually, the net profit.

REVIEW PROBLEM – MARKETING

Problem 3.6

The following information applies to ERA (Pty) Ltd which renders two services, Y and Z:

	R
Sales	7 200 000
Cost of sales	3 600 000
Sales office costs	600 000
Advertising costs	102 000
Promotions	64 800
Travelling costs	86 400
Entertainment allowances	32 400

Additional information:

- (a) The selling prices are as follows:
- | | |
|-----------|-------------|
| Service Y | R2 per unit |
| Service Z | R4 per unit |
- (b) The ratio of sales of service Y to Z regarding sales value is 2:1.
- (c) Advertising costs:
- | | |
|-----------|--------|
| Service Y | 30 000 |
| Service Z | 36 000 |
| General | 36 000 |
- (d) The cost of sales for service Y amounts to R0.80 per unit.
- (e) Number of orders executed:
- | | |
|-----------|---------|
| Service Y | 400 000 |
| Service Z | 100 000 |
- (f) Promotions, travelling costs and entertainment allowances are divided in the ratio of Y = 4; Z = 5.

Required

Prepare a comparative Statement of Profit or Loss showing the net income per product.

Solution 3.6

Statement of Profit or Loss – Comparative				
	Basis	Y R	Z R	Total R
Sales (Ratio 2:1)		4 800 000	2 400 000	7 200 000
Less: Cost of sales (2 400 000 × R0,80)		(1 920 000)		
Balance			(1 680 000)	(3 600 000)
Gross income		2 880 000	720 000	3 600 000
Marketing and distribution costs:				
Sales office costs	Orders	480 000	120 000	600 000
Advertising	Direct	30 000	36 000	66 000
Advertising: General	Sales	24 000	12 000	36 000
Promotions	4:5	28 800	36 000	64 800
Travelling costs	4:5	38 400	48 000	86 400
Entertainment allowances	4:5	14 400	18 000	32 400
Total marketing costs		(615 600)	(270 000)	(885 600)
Net income		2 264 400	450 000	2 714 400

continued

Calculations:**Number of units sold:**

	X	Z
Sales value	R4 800 000	R2 400 000
Selling price	R2	R4
Number of units	2 400 000	600 000

PERSPECTIVES ON COSTING

Knowledge

You should know the following:

- ☐ the key terms and concepts presented at the end of this chapter;
- ☐ the basic stockpiling terminology;
- ☐ the lead-time and the reliability of the supplier are essential to ensure that the necessary material is available when required;
- ☐ the layout of the warehouse must be such that it does not hinder the efficient flow of inventory;
- ☐ efficient controls over the issue of materials by the warehouse must be maintained at all times;
- ☐ the methods of inventory valuation include, among others, FIFO, LIFO, AVCO, standard price and the market price methods;
- ☐ the JIT inventory-holding implies that materials are received just before it is to be used in the manufacturing process or commercial goods are received for supplying customers in time;
- ☐ labour cost, like material, is a separate cost element;
- ☐ certain aspects do exist, and they must be complied with to maintain healthy employer/employee relationships;
- ☐ productivity is the ratio between a certain amount of output to a certain amount of input;
- ☐ there are both humanitarian and external factors which may influence the labour productivity of an employee;
- ☐ the main purpose for personnel administration is to provide an efficient labour force;
- ☐ employment records include, among others, personnel records, clock cards, job cards and production reports;
- ☐ the total time spent on each product, service, job or project is very important for the determination of labour costs spent on the cost object;
- ☐ gross remuneration can be calculated in accordance with different methods of remuneration;
- ☐ different wage incentive schemes are promoting higher productivity by additional remuneration;
- ☐ direct labour costs are usually recovered by means of an hourly labour rate;
- ☐ a person is capable to complete a specific task in less time each time he repeats it, until the optimum speed is reached;
- ☐ the difference between manufacturing, administrative and marketing costs;
- ☐ how to divide total overheads into fixed, variable and semi-variable components;

- ☐ marketing costs are part of commercial costs and include all costs associated with the activities that promote the product, acquisition of orders, the administration of the marketing function and the delivery of goods or rendering of services; and;
- ☐ marketing cost analysis is performed by considering product, salesperson, area and order size.

Skills

You should be able to:

- ☐ subdivide inventory in their various categories, namely, direct material, work in progress, finished goods and commercial inventories;
- ☐ calculate EOQ, lead-time, safety inventory, order point and average inventory;
- ☐ perform the steps in placing an order;
- ☐ calculate inventory balances, materials received and stores issued both in monetary value and in quantities according to the LIFO, FIFO and AVCO methods;
- ☐ perform the accounting entries for the flow of materials;
- ☐ determine the labour turnover ratios;
- ☐ determine net remuneration including calculations for overtime and normal deductions;
- ☐ apply various wage incentive schemes;
- ☐ calculate the hourly labour recovery rate;
- ☐ record all accounting entries in respect of remuneration;
- ☐ apply the learning curve technique;
- ☐ separate total manufacturing overhead costs into the fixed and variable elements by applying all of the regression analysis, high-low method and simple regression techniques; and
- ☐ analyse marketing costs by product, salesperson, sales area and order size.

KEY TERMS AND CONCEPTS

AVCO	45	Indirect labour costs	60
Average inventory	39	Indirect material	37
Capacity level	77	Incomplete work	37
Causal relationship	76	Inventory	37
Clock card	57	Inventory valuation	45
Commercial inventories	37	Job card	58
Direct labour costs	60	Labour turnover	56
Direct material	37	Learning curve	67
FIFO	45	LIFO	45
Finished goods	37	Manufacturing overheads	61
Gross pay	61	Marketing costs	89
High-low method	81	Maximum inventory	39
Idle time	61	Multiple regression	84

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Net remuneration	61	Productivity	54
Normal inventory	38	Relevant range	77
Normal time	60	Remuneration	59
Overtime	60	Safety inventory	38
Overtime premium	61	Secondary material	37
Personnel administration	55	Time office	59
Piecework	60	Wage incentive schemes	63
Primary material	37	Work in progress	37
Production reports	58		

EXERCISES

3.1

Draw a distinction between the following concepts by briefly discussing their characteristics and emphasising the differences between them:

- ☐ Buffer inventory and safety stock
- ☐ Economic inventory and technical inventory
- ☐ Direct and indirect material
- ☐ Economic order quantity (EOQ) and order point.

3.2

Briefly discuss how JIT inventory-holding differs from traditional inventory-holding methods.

3.3

- (a) A company marketing a single product on a continuous basis, requests that you assist them in determining the most economic order quantity, the average and safety inventory and the re-order point of the product.

The following information is available:

Normal delivery time	2 weeks
Maximum delivery time	4 weeks
Normal annual usage (units)	57 200
Purchase price per unit	R15
Average annual storage cost per unit	R0,75
Cost of placing an order	R150
Prime interest rate	18%
Production weeks per year	52

The inventory is financed by means of an overdraft.

- (b) Will it be more advantageous for the company if a quantity discount of 2½% on an order of 2 500 plus units can be negotiated?
- (c) What will the most economical order quantity be if the company changes its inventory financing policy and makes use of supplier's credit, in terms of which payment is due only 42 days after delivery of the products?

3.4

Discuss the following statement:

"Inventory control is not merely theft control. Inventory control comprises much more than the physical control over inventory and includes functions such as planning, valuation, scheduling and physical control. In short, inventory control is exercised to decrease the cost of the finished product."

3.5

Name the potential areas where the employee/employer relationship may be damaged.

3.6

Discuss the humanitarian factors that have an influence on labour productivity.

3.7

Discuss the external factors that have an influence on productivity.

3.8

Illustrate the assimilation of information diagrammatically.

3.9

Uitkyk (Pty) Ltd had 200 employees at the beginning of the period. During the period, 10 new employees were employed while 20 employees resigned.

Required

- (a) Determine the labour turnover rate based on the number of employees.
- (b) Determine the labour turnover rate based on the average number of employees.

3.10

Briefly describe what you understand by the following concepts:

- ☐ Productivity
- ☐ Labour turnover
- ☐ Time/clock card
- ☐ Job card
- ☐ Direct labour
- ☐ Indirect labour
- ☐ Learning curve.

3.11

The time sheet of employee Daya shows that she has worked 44 hours during a 40-hour working week. On both Monday and Friday, she worked two hours overtime. Overtime is compensated at $1\frac{1}{2} \times$ the normal tariff. Her normal wage is R6.00 per hour.

Medical and pension fund contributions (6% and 10% of normal wage respectively) are paid on a 50:50 basis by employer and employee. PAYE (12% of taxable income) is deducted.

Required

- Calculate employee Daya's net earnings for the week.
- Assume that employee Daya is the only employee in the business. Show how her wage for the week will be recorded.
- Calculate the labour tariff per hour for employee Daya assuming that a year comprises 52 working weeks; that she is entitled to three weeks annual vacation leave and that the business is closed for eight public holidays during the year. Normal idle time is estimated at $7\frac{1}{2}\%$ and a leave bonus equal to three weeks' normal wage is paid.

3.12

Explain the difference between a clock card and a job card.

3.13 Scatter graph and high-low cost estimation

Presented is the data provided by Thabong City Council on temporary employees that cleaned the roads:

Month	Kilometres cleaned	Labour cost (R)
April	350	7 500
May	300	7 000
June	400	8 500
July	250	5 000
August	375	8 000
September	200	4 500
October	100	4 300

Required

- Develop a cost estimation equation for monthly labour costs by using the high-low method.
- Develop a cost estimation equation for monthly labour costs using a scatter graph.

3.14 Simple regression cost estimation

Presented is the data provided by Country Hospital on cost of beds in the general ward:

Month	Beds occupied	Ward cost (R)
January	300	23 000
February	350	27 000
March	250	20 000
April	400	35 000
May	200	18 000
June	375	24 000

Required

Develop a cost estimation equation to determine ward costs by using the simple regression method.

3.15 Marketing cost analysis by product

The Electrical Company manufactures and markets three types of products. The marketing and distribution costs for the past year were as follows:

	R
Sales personnel:	
Salaries	39 000
Bonuses	3 500
Commission	21 000
Sales office costs	8 000
Advertising costs:	
Direct	50 000
Indirect	14 000
Distribution costs	15 000
Storage costs	6 000
Packaging	8 000
Credit and recovery costs	3 200

Use the following information in the allocation of costs:

Details	Product A	Product B	Product C
Number of sales personnel (all receiving the same salary)	5	6	2
Number of orders	600	700	300
Direct advertising costs	40%	35%	25%
Storage used per m ³ per R100 sales	4	5	10
Sales	R250 000	R300 000	R150 000
Average price per order	R410	R450	R510
Number of units sold	25 000	15 000	5 000

Required

Use the information given above to allocate the costs to each product, and show what the cost of each product per R100 of sales is.

3.16 Marketing cost analysis by product

The following information applies to an enterprise, which manufactures and markets two products, products A and B:

	R
Sales	12 000 000
Cost of sales	6 000 000
Sales office costs	1 000 000
Advertising costs	170 000
Storage costs	108 000
Transportation costs	144 000
Packaging costs	54 000

Additional information

- (a) The selling prices are as follows:
Product AR2 per unit
Product BR4 per unit
- (b) The ratio of sales of product A to B regarding sales value is 2:1.
- (c) Advertising costs:
- | | | R |
|---------|------------|--------|
| Direct | Product A | 50 000 |
| | Product B | 60 000 |
| General | (In total) | 60 000 |
- (d) The cost of sales for product A amounts to R0.80 per unit.
- (e) Number of orders executed:
- | | |
|-----------|---------|
| Product A | 400 000 |
| Product B | 100 000 |
- (f) Storage space used (m³ per R100 sales):
- | | |
|-----------|---|
| Product A | 2 |
| Product B | 5 |

Required

Prepare a Statement of Profit or Loss showing the net income per product.

3.17 Marketing cost analysis by product and by sales representative

Bloubul Ltd has considered the feasibility of allocating marketing expenses to products and sales representatives for managerial purposes. Some costs can apparently be assigned equitably to these classifications, while others cannot. The enterprise's cost accountant proposed the following bases for apportionment:

Cost	By product	By sales representative
Sales salaries	Not allocated	Direct
Travelling expenses	Not allocated	Direct
Sales commission	Direct	Direct
Customer services	Sales value	Sales value
Distribution	Cost of sales	Cost of sales
Store	Not allocated	Cost of sales
Advertising	Not allocated	Not allocated
Debt collection	Sales value	Sales value
Administration	Not allocated	Not allocated

Additional information:

Product	Cost of sales R	Sales R
A	54 000	180 000
B	235 000	270 000
C	315 000	450 000
Sales representative		
Mbazima	229 000	288 000
Eric	172 000	306 000
Johnathan	203 000	306 000

Marketing expenses for the accounting period follows:

	Mbazima R	Eric R	Jonathan R	Total R
Sales salaries	5 400	5 400	7 200	18 000
Travel expenses	7 200	5 400	5 400	18 000
Sales commissions (5%)				45 000
Customer service				18 000
Distribution				36 000
Warehousing				27 000
Advertising				72 000
Debt collection				18 000
Administration				54 000
				<u>306 000</u>

Required

- Prepare a Statement of Profit or Loss showing the allocation of marketing expenses per product.
- Prepare a Statement of Profit or Loss showing the allocation of marketing expenses per sales representative.

4 Cost-volume-profit analysis



LEARNING OUTCOMES

What is the relevance of CVP?

- Describe the importance of CVP
- Explain how a Marginal Statement of Profit or Loss provides CVP information

How is CVP used to make short-term pricing and product decisions?

- Calculate break-even points, safety margins and profit estimations
- Calculate and evaluate changes in cost, sales volume and sales mix

What other financial decisions can CVP be used for?

- Construct break-even graphs
- Apply algebraic calculations to perform CVP calculations
- Perform CVP in a service industry
- Use operating leverage to evaluate profit sensitivity
- Explain the limiting factors of CVP

CHAPTER OUTLINE

Cost-volume-profit (CVP) analysis is a management tool that is used to make financial decisions. This robust tool is introduced in the context of short-term decision-making and can be applied in a variety of situations, ranging from a manufacturing industry to a service industry. This chapter begins by explaining the concept and indicating the basic elements needed to perform the calculation.

CVP analysis is based on a marginal income accounting approach. The marginal income approach requires costs to be classified into fixed and variable components, which is disclosed separately. All sales, less variable costs, equal the contribution that is available to cover the fixed costs of an enterprise. This contrasts with the traditional accounting approach that does not make a distinction between fixed and variable cost, but rather allocates the fixed costs to cost objects using an overhead allocation rate.

A basic assumption is that there is a specific relationship between costs and volume and therefore it is possible to calculate the impact on profitability should any of these

elements change. Costs consist of sales, all variable costs and fixed costs. Volume refers to the number of units produced. In addition, CVP uses these basic elements to calculate the break-even point and the margin of safety. A further concept explained is the operating leverage and algebraic approach to performing a CVP calculation. The chapter ends with a discussion of the assumptions and limiting factors involved.

INTRODUCTION

The success of an enterprise is often measured in terms of the profit that it makes. To a large extent, such success can be ascribed to efficient profit planning and control by the enterprise. To do thorough planning, which is the primary function of management, decisions must be made continuously at all levels of the enterprise. Management must also make choices as to which of various alternative possibilities will be the most advantageous to the enterprise. To help management with these policy decisions, *cost-volume-profit analysis* was developed as a basic technique that can be used for short-term planning. It assumes that there is an underlying relationship between cost and volume within an enterprise.

Cost-volume-profit (CVP) analysis is therefore *a management technique that analyses the impact on profitability that a change in cost or volume would have during a particular period*. Cost in this instance includes sales, manufacturing costs and commercial costs.

The relationship implies that a change in any of the elements will have an influence on the remaining elements. There is a causal relationship between the change which is brought about in one element and the effect of its influence on another element.

CVP thus includes a study of the underlying relationship and intertwining of the following factors:

- ☐ Price of product
- ☐ Volume or level of activity
- ☐ Variable costs per unit
- ☐ Total fixed costs
- ☐ Sales mix
- ☐ Estimated profit.

This technique is used to analyse the influence of volumes on costs, income and profits and, among others, to provide answers to the following questions:

- ☐ What profit will a given sales volume yield?
- ☐ How many units must be sold to achieve the planned profit?
- ☐ How will a change in costs affect profits?
- ☐ What effect will a change in costs have on profit?
- ☐ How will a change in the volume of business affect the profit potential of the enterprise?
- ☐ At what volume of production are costs and income equal?

CVP analysis is thus an important factor in many decisions that management must make although it is subject to certain limitations, which will be pointed out later.

MARGINAL COST ACCOUNTING APPROACH

Chapter 2 discussed how costs can be classified according to their nature, of which two important categories was variable and fixed costs. It was also pointed out that these distinctions are made to assist management in making financial decisions. The question now arises: What does management do with this information?

A very important application of this knowledge is found in a new format of the Statement of Profit or Loss known as the *Marginal* Statement of Profit or Loss.

The traditional Statement of Profit or Loss which we come across in financial accounting follows a functional format in which the functions of production, administration and sales are emphasised. In the traditional Statement of Profit or Loss no attempt is made to distinguish between fixed and variable costs and this type of statement follows an absorption costing approach (more on this in chapter 8). Although this statement is useful for the purposes of external reporting, it is not useful for internal management purposes.

Management requires cost information in a format that promotes their planning, control, and decision-making tasks. These tasks can be performed best (as will be explained in this chapter and other parts of this book) when information on the fixed and variable cost components is available. Consequently, the marginal income approach was developed.

Consider the following example that demonstrates the differences between a traditional Statement of Profit or Loss and a Marginal Statement of Profit or Loss.

Traditional Statement of Profit or Loss

	R
Sales	30 000
Less: Cost of sales	(15 000)
Gross profit	15 000
Less: Operating expenses	(12 500)
Marketing	7 750
Administration	4 750
Net profit	2 500

Marginal Statement of Profit or Loss

	R
Sales	30 000
Less: Total variable costs	(7 500)
Direct material	5 000
Direct labour	1 500
Variable administration	1 000
Contribution	22 500
Less: Fixed costs	(20 000)
Fixed production	10 000
Fixed marketing	6 250
Fixed administration	3 750
Net profit	2 500

The traditional Statement of Profit or Loss is set up according to the function of every expense. Note the lack of disclosure of fixed costs. This is not because there are no fixed costs, but rather because the fixed costs have been allocated as an overhead rate to cost objects and therefore are hidden amongst the other expenses. For short-term management decision-making purposes, this classification is less useful than a behavioural classification. The Marginal Statement of Profit or Loss is classified according to behaviour in that the variable and fixed costs are disclosed separately. The total variable costs are deducted from sales providing Contribution. **Contribution** is the difference between sales and total variable costs and is the amount available to cover fixed costs and that contribute to profit.

CVP ANALYSIS USING THE MARGINAL INCOME APPROACH

CVP analysis is based on the marginal income approach discussed in the above paragraph. The Marginal Statement of Profit or Loss has a few important characteristics that are useful when evaluating the influence of changes in the selling price, cost, or volume, on profits. A thorough understanding of the differentiation between fixed and variable costs are therefore required to perform CVP analysis.

The application of CVP analysis techniques will be illustrated by means of the following example:

Example 4.1

A-JAY Ltd provides you with its Marginal Statement of Profit or Loss for the period May 2015. The enterprise manufactures a single item called Product P.

Marginal Statement of Profit or Loss for May 2015

	Total R	Per unit R
Sales (R20 per unit × 40 000 units)	800 000	20
Less: Variable cost per unit (R15 per unit × 40 000 units)	(600 000)	15
Contribution	200 000	5
Less: Fixed costs	(100 000)	
Net Profit	100 000	

CONTRIBUTION

As already explained, contribution is the amount remaining after variable costs have been deducted from sales revenue. Contribution is utilised first to cover the fixed costs and then to contribute to the profit for the period. If contribution is not enough to cover the fixed costs, there will be a loss.

To illustrate:

If A-JAY Ltd sells only one item of the product P, then the Statement of Profit or Loss of the enterprise will be as follows:

	R
Sales (1 × R20)	20
Less: Variable costs (1 × R15)	(15)
Marginal income	5
Less: Fixed costs	(100 000)
Net loss	(99 995)

Each additional unit of product P that the enterprise sells, will make an additional R5 contribution available to help cover the fixed costs.

The contribution of a product is therefore that portion of the income, which has the potential to become profit after all the fixed costs have been recovered.

Contribution is thus the difference between the sales value and the total variable costs of those sales. Economically speaking, marginal costs are the increase in total costs, which arises if an additional unit is manufactured. Therefore, the description 'marginal income' is also used. Financially speaking **marginal costs** represent *the aggregate of the variable costs applied in the production and marketing of a single product*.

From the example it is also clear that the contribution is first applied to cover the fixed costs and thereafter to contribute to the net income.

The marginal income approach to the Statement of Profit or Loss is often used as an internal planning and decision-making tool, for example, in segmental reporting, budgets and in special decisions such as pricing, manufacture or purchases analysis.

BREAK-EVEN USING THE MARGINAL INCOME APPROACH

The question now is how many units of the product must be sold before the contribution is sufficient to pay for total fixed costs? The *volume (number of units that must be sold) at which the contribution is sufficient to pay the fixed costs* is known as the **break-even point**, and no profit or loss is made at this point.

The **break-even quantity** or volume is thus *the minimum quantity of products that must be sold in a given period to ensure that all the fixed costs are recovered*, and that the enterprise does not sustain a loss.

The break-even quantity in Example 4.1 can be calculated as follows by means of the marginal income per unit method:

Break-even quantity	=	$\frac{\text{Total fixed cost}}{\text{Marginal income per unit}}$
	=	$\frac{\text{R100 000}}{\text{R5}}$
	=	20 000 units

The **break-even value** represents *the sales value of the break-even quantity* and is calculated as follows:

Break-even value	=	Break-even quantity × Selling price per unit
	=	20 000 units × R20
	=	R400 000

Thus, if enough units of product P are sold to provide a contribution of R100 000, then the fixed costs of R100 000 are covered and the enterprise has broken even for the month concerned; that is to say, it will show no profit or loss. To reach this break-even point A-JAY Ltd must sell 20 000 units in May 2015 as each unit has a marginal income of R5:

	Total R	Per unit R
Sales (20 000 × R20)	400 000	20
Less: Variable cost (20 000 × R15)	(300 000)	15
Contribution	100 000	5
Less: Fixed costs	(100 000)	
Net profit	0	

BREAK-EVEN USING THE MARGINAL INCOME RATIO APPROACH

CVP analysis can be performed on a unit level or on a total cost level. In addition to these two methods, income, variable costs, and contribution, can also be expressed on a percentage basis.

With reference to Example 4.1 of A-JAY Ltd:

	Total R	Per unit R	Percentage %
Sales (40 000 unit)	800 000	20	100
Less: Variable costs @ R15 per unit	(600 000)	15	75
Marginal income	200 000	5	25

The *percentage of variable costs to total sales* ($75/100 \times 100/1 = 75\%$) is known as the **marginal cost ratio**.

The *percentage of contribution to total sales* is known as the **contribution ratio** (also as the profit/volume ratio).

For A-JAY Ltd, the contribution ratio is:

Contribution ratio	=	$\frac{\text{Contribution}}{\text{Sales}} \times \frac{100}{1}$
	=	$\frac{R5}{R20} \times \frac{100}{1}$
	=	25%

The contribution (profit-volume) ratio is very useful and can be used in different calculations. When the fixed costs are divided by the contribution ratio the break-even point in sales value can be calculated. For A-JAY Ltd it is R400 000, which is calculated as follows:

Break-even value	=	$\frac{\text{Total fixed costs}}{\text{Contribution ratio}}$
	=	$\frac{\text{R100 000}}{25\%}$
	=	$\frac{\text{R100 000}}{0.25}$
	=	R400 000

Note that the R400 000 calculated above was previously calculated by multiplying the break-even quantity of units with the selling price.

As an *alternative* to the above method, the break-even value can be calculated without first calculating the marginal income ratio, as follows:

Break-even value	=	$\frac{\text{Fixed costs}}{1 - \frac{\text{Variable cost per unit}}{\text{Sales price per unit}}}$
	=	$\frac{\text{R100 000}}{1 - \frac{\text{R15}}{\text{R20}}}$
	=	$\frac{\text{R100 000}}{0.25}$
	=	R400 000

The denominator in the above formula,

$1 - \frac{\text{Variable costs}}{\text{Sales}}$, is the contribution ratio.

Summarised, the break-even point can thus be calculated with the following formulae:

Break-even point in units:	$\frac{\text{Fixed costs}}{\text{Contribution per unit}}$
Break-even in sales value:	$\frac{\text{Fixed costs}}{\text{Contribution ratio}}$

APPLICATIONS OF CVP

The concepts developed in the previous sections have various applications for planning and decision-making. In this section, certain of these applications will be illustrated

with reference to our basic example of A-JAY Ltd, now expanded to include the percentages of every item.

	Total R	Per unit R	%
Sales (40 000 units)	800 000	20	100
Less: Variable costs	(600 000)	(15)	(75)
Contribution	200 000	<u>5</u>	<u>25</u>
Less: Fixed costs	(100 000)		
Net profit	<u>100 000</u>		

Expected profit

With the aid of CVP analysis it can be determined at which sales level a certain net profit will be achieved. Suppose that, in the example, management would like to achieve a net profit of R20 000. In order to calculate the sales level that will deliver R20 000 net profit, the R20 000 needs to be added to the fixed costs of the enterprise. Then to calculate the sales needed in units, the fixed costs plus R20 000 net profit is divided by the contribution per unit. To calculate sales in value the fixed costs plus R20 000 is divided by the contribution ratio. This is illustrated as follows:

Sales volume	=	$\frac{\text{Fixed costs} + \text{Expected profit}}{\text{Contribution per unit}}$
	=	$\frac{\text{R100 000} + \text{R20 000}}{\text{R5}}$
	=	24 000 units
Sales value	=	24 000 units × R20 per unit
	=	R480 000
	OR	
Sales value	=	$\frac{\text{Fixed costs} + \text{Expected profit}}{\text{Contribution ratio}}$
	=	$\frac{\text{R100 000} + \text{R20 000}}{0.25}$
	=	R480 000

Calculating the margin of safety

The **margin of safety** is *the amount by which the sales value exceeds the break-even value* and is calculated in units or sales value. Once the break-even point has been determined, the next step is to calculate the margin of safety. The margin of safety is an arbitrary amount above the break-even point determined by management, and it is used to alert management in the event that sales are insufficient, either not reaching the required profit or perhaps moving down to the break-even level.

The margin of safety can be calculated and expressed in different ways. With reference to A-JAY Ltd the following two formulae are given:

Margin of safety expressed in terms of *value*:

Total sales	–	Break-even sales	=	M/S
R800 000	–	R400 000 (previously calculated)	=	R400 000

Margin of safety expressed in *units*:

Total sales (units)	–	Break-even sales (units)	=	M/S
40 000	–	20 000	=	20 000 units

The margin of safety can also be expressed as a percentage of the sales value, which is known as the *margin of safety ratio*. The ratio is calculated by dividing the margin of safety in value by the total sales:

$$\frac{\text{M/S in value (see above)}}{\text{Total sales}} \times \frac{100}{1} = \text{M/S\%}$$

$$= \frac{\text{R400 000}}{\text{R800 000}} \times 100 = 50\%$$

Alternatively, the margin of safety ratio (%) can be calculated in terms of *units*:

$$\frac{\text{M/S in units (see above)}}{\text{Total sales (units)}} \times \frac{100}{1}$$

$$= \frac{20\,000}{40\,000} \times 100 = 50\%$$

Alternative:

$$\frac{\text{Sales} - \text{Break even sales}}{\text{Sales}} \times \frac{100}{1}$$

$$= \frac{\text{R800 000} - \text{R400 000}}{\text{R800 000}} \times \frac{100}{1} = 50\%$$

The margin of safety ratio is useful to management because it indicates to what extent the volume of sales can fall before the enterprise begins to show a loss.

Evaluating the impact on profit of changes in cost and/or quantity

In the discussion up to now it has been assumed that all the factors such as prices, costs and volumes remained constant. The question now is – what will happen if one or more of these factors change? Such a situation can be illustrated in the following example of Decisions Ltd:

Example 4.2

Capacity utilised	70%
Sales price per unit	R10
Variable costs per unit	R6
Contribution per unit	R4
Total fixed costs for the period	R40 000

Change in selling price

An increase in the selling price of a product inevitably leads to a lower sales volume as a result of consumer resistance. Cost-volume-profit analysis will show management to what level the sales volume can fall before the planned profit suffers.

Take as an example the information relating to Decisions Ltd (Example 4.2) and assume a price increase of 5% and a planned profit of R20 000.

Required

How many units must be sold to:

- (a) break even
- (b) achieve the planned profit.

Solution 4.2: Change in selling price

	Current R	After price increase R
Selling price per unit	10.00	10.50 (+5%)
Less: Variable costs	(6.00)	(6.00)
Contribution	<u>4.00</u>	<u>4.50</u>
(a) Break-even quantity units:		
Fixed costs	R40 000	R40 000
Contribution per unit	= R4	= R4.50
	= 10 000 units	= 8 889 units
(b) Number of units to achieve profit (R20 000):		
Fixed costs + planned profit	R40 000 + R20 000	R40 000 + R20 000
Contribution per unit	= R4	= R4.50
	= 15 000 units	= 13 334 units

Change in variable costs

Variable cost can also either increase or decrease depending on the response of management to market variables. For instance, variable costs have the potential to drop should a more sophisticated machine be used in the production process. Alternatively, the variable costs could also increase due to insufficient maintenance, resulting in higher wastage.

The following analysis shows the influence of a 10% change in variable costs: The enterprise still wants to make a profit of R20 000.

Solution 4.2: Change in variable costs

	Current	Variable costs (10% decrease)
	R	R
Selling price	10.00	10.00
Less: Variable costs	<u>(6.00)</u>	<u>(5.40) (-10%)</u>
Contribution	<u>4.00</u>	<u>4.60</u>
Contribution ratio	40%	46%
1. Break-even volume:		
Fixed costs	= $\frac{R40\,000}{R4}$	= $\frac{R40\,000}{R4.60}$
Contribution per unit	= 10 000 units	= 8 696 units
2. Break-even value:		
Fixed costs	= $\frac{R40\,000}{40\%}$	= $\frac{R40\,000}{46\%}$
Contribution per unit	= R100 000	= R86 957
3. Number of units to achieve planned profit (R20 000):		
Fixed costs + planned profit	= $\frac{R40\,000 + R20\,000}{R4}$	= $\frac{R40\,000 + R20\,000}{R4.60}$
Contribution per unit	= 15 000 units	= 13 044 units

Change in fixed costs

Fixed costs are considered to be constant throughout the year. However, it could happen that fixed costs increase once a certain activity level has been exceeded. In addition, fixed costs can also change on a specific date every year that does not necessarily coincide with the enterprise year-end. For example, every March the rent of the premises increases but the year-end is December. Once a fixed cost changes, it is necessary to recalculate a new break-even point.

An increase of R10 000 in fixed costs (for example, a new advertising campaign) will have the following effect:

Solution 4.2: Change in fixed costs

	Current	Fixed costs increase
	R	R
Selling price	10	10
Less: Variable costs	<u>(6)</u>	<u>(6)</u>
Contribution	<u>4</u>	<u>4</u>
Contribution ratio	40%	40%
Fixed costs	R40 000	R50 000
Break-even value	R100 000	R125 000 (Calculation 1)
Break-even quantity (units)	10 000	12 500 (Calculation 2)
Number of units to achieve planned profit (R20 000)	15 000	17 500 (Calculation 3)

continued

Calculations

- 1 Break-even value:

$$\frac{\text{Fixed costs}}{\text{Contribution ratio}} = \frac{\text{R50 000}}{40\%}$$

$$= \text{R125 000}$$

- 2 Break-even quantity:

$$\frac{\text{Fixed costs}}{\text{Contribution per unit}} = \frac{\text{R50 000}}{\text{R4}}$$

$$= 12\,500 \text{ units}$$

- 3 Number of units to achieve planned profit (R20 000):

$$\frac{\text{Fixed costs} + \text{Planned profit}}{\text{Contribution per unit}} = \frac{\text{R50 000} + \text{R20 000}}{\text{R4}}$$

$$= 17\,500 \text{ units}$$

Product mix

Where more than one product is marketed, the break-even analysis becomes complicated, and a less accurate forecast is the result. Because each product has its own contribution ratio, a sales mix must be established so that a contribution ratio can be calculated on a weighted average basis. In other words, the product contribution needs to be combined in such a way that it reflects a specific mixture of the products as if it was a single product. The procedure is to calculate the total contribution of a specific product mix and then to divide the total contribution by the total number of units in the product mix.

The following example illustrates the situation:

Example 4.3

The following information is a forecast for a manufacturing enterprise which manufactures and sells three different products:

	Products			Total
	A	B	C	
	R	R	R	
Selling price per unit	10	15	20	
Variable costs per unit	7	12	18	
Fixed costs in total				R56 000
Sales mix	5	3	2	

Required

Calculate the break-even quantity and value.

Solution 4.3

	Marginal income R	Mix	Total R
Products: A	3.00	5	15.00
B	3.00	3	9.00
C	2.00	2	4.00
	<u>2.80</u>	<u>10</u>	<u>28.00</u>
Average per unit (R28 ÷ 10)			

Break-even quantity:

Fixed costs

Average marginal income per unit

$$= \frac{\text{R56 000}}{\text{R2.80}}$$

= 20 000 units in total

Break-even quantity with a mix of 5 : 3 : 2

$$\text{A: } \frac{5}{10} \times 20\,000 = 10\,000 \text{ units}$$

$$\text{B: } \frac{3}{10} \times 20\,000 = 6\,000 \text{ units}$$

$$\text{C: } \frac{2}{10} \times 20\,000 = 4\,000 \text{ units}$$

Break-even value:

$$10\,000 \times \text{R10} = \text{R100 000}$$

$$6\,000 \times \text{R15} = \text{R90 000}$$

$$4\,000 \times \text{R20} = \text{R80 000}$$

$$\underline{\underline{\text{R270 000}}}$$

If there is a change in the product mix, the break-even point will also change. This is illustrated in the following example:

Example 4.4

	Product X		Product Y		Total	
	R	%	R	%	R	%
Sales	120 000	100	480 000	100	600 000	100
Less: Variable costs	(90 000)	(75)	(240 000)	(50)	(330 000)	(55)
Contribution	<u>30 000</u>	<u>25</u>	<u>240 000</u>	<u>50</u>	<u>270 000</u>	<u>45</u>
Less: Fixed costs					(180 000)	
Net profit					<u>90 000</u>	

The break-even point for the enterprise is:

$$\begin{aligned} \frac{\text{Fixed costs}}{\text{Contribution ratio}} &= \frac{\text{R180 000}}{45\%} \\ &= \underline{\underline{\text{R400 000}}} \end{aligned}$$

continued

Assume that the product mix changes as follows:

Product X	R480 000
Product Y	R120 000
	<u>R600 000</u>

Although the total sales are the same as in the previous example the mix is reversed. The Marginal Statement of Profit or Loss will now be as follows:

	Product X		Product Y		Total	
	R	%	R	%	R	%
Sales	480 000	100	120 000	100	600 000	100
Less: Variable costs	<u>(360 000)</u>	<u>(75)</u>	<u>(60 000)</u>	<u>(50)</u>	<u>(420 000)</u>	<u>(70)</u>
Contribution	<u>120 000</u>	<u>25</u>	<u>60 000</u>	<u>50</u>	<u>180 000</u>	<u>30</u>
Less: Fixed costs					<u>(180 000)</u>	
Net profit					<u>0</u>	

The change-around in the mix principally to Product X (which has the worst contribution) brings the average contribution ratio for the enterprise down, from 45% to 30%, and means that the net profit is reduced drastically. The break-even point also increases to $R180\,000 \div 30\% = R600\,000$

CHANGE-OVER POINT

If a decision is made to switch over from one CVP ratio to another, this is known as the change-over point. The **change-over point** is thus *the level of activity at which total costs, and hence profits, are the same under two alternative CVP situations*. This concept can be explained by means of the following example:

Example 4.5

The following information was taken from the books of COP Manufacturing Company Ltd for the year ended 30 June 2015:

Sales	40 000 units @ R5 each
Variable costs	R3 per unit
Fixed costs	R30 000

It is planned to change the equipment during the upcoming year so that 50 000 units can be manufactured. This will increase the fixed costs by R10 000, while the variable costs will decrease by R0,50 per unit. The selling price will remain unchanged at R5 per unit.

Required

Calculate the quantity (change-over point) at which the profit will be the same in each of the alternative situations and test the correctness of your answer.

Solution 4.5

Production quantity

$$\begin{aligned}
 & \text{Proposed fixed costs} - \text{Existing fixed costs} \\
 & \text{Existing variable costs} - \text{Proposed variable costs} \\
 & = \frac{R40\,000 - R30\,000}{R3.00 - R2.50} \\
 & = 20\,000 \text{ units}
 \end{aligned}$$

continued

Alternative:

$$\begin{aligned}
 & \text{Proposed fixed costs} - \text{Existing fixed costs} \\
 & \text{Proposed contribution per unit} - \text{Existing contribution per unit} \\
 & = \frac{R40\,000 - R30\,000}{R2.50 - R2.00} \\
 & = 20\,000 \text{ units}
 \end{aligned}$$

Test for correctness:

	Existing R	Proposed R
Contribution		
20 000 × R2.00	40 000	
20 000 × R2.50		50 000
Less: Fixed costs	(30 000)	(40 000)
Net profit	<u>10 000</u>	<u>10 000</u>

BREAK-EVEN ANALYSIS USING A GRAPHICAL APPROACH

The break-even concept has already been referred to at different times in this chapter. Reference is often made to cost-volume-profit analysis as break-even analysis, but break-even analysis is, as already seen, a part of the total CVP concept.

This section deals with the determination of the break-even point and presentation of break-even analysis using graphs.

Break-even graphs

A **break-even graph** shows the relationship between costs, volume, and profit at various sales volumes. The value of a break-even graph lies in the simple way the profit structure is conveyed to management at a glance. The preparation of the graph can best be explained by the following example:

Example 4.6

Expected sales for the period	1 000 units
Selling price per unit	R10
Variable costs per unit	R6
Total fixed costs for the period	R2 000

Procedure for the preparation of the break-even graph:

- Choose a scale suited to the graph paper available. Use the vertical or Y-axis for monetary values. The horizontal or X-axis represents the volume in units. It is important that the scales are shown clearly on the graph.
- The fixed cost line is drawn first, once both the axes have been drawn to scale on the graph paper. In the example, the fixed costs are R2 000 in total and stay the same for all volumes. Therefore, this line is drawn parallel to the X-axis from the R2 000 point on the Y-axis (line FK on the graph).

- (c) From point H on the X-axis measure the total costs, R8 000 [fixed R2 000 + (variable 1 000 × R6)]. The straight line FV represents the total costs, while VK represents the variable costs.
- (d) Draw a straight line from the origin (O-point) of the graph to the maximum value of the proceeds (point S). This represents the total value of the proceeds of R10 000 for 1 000 units.

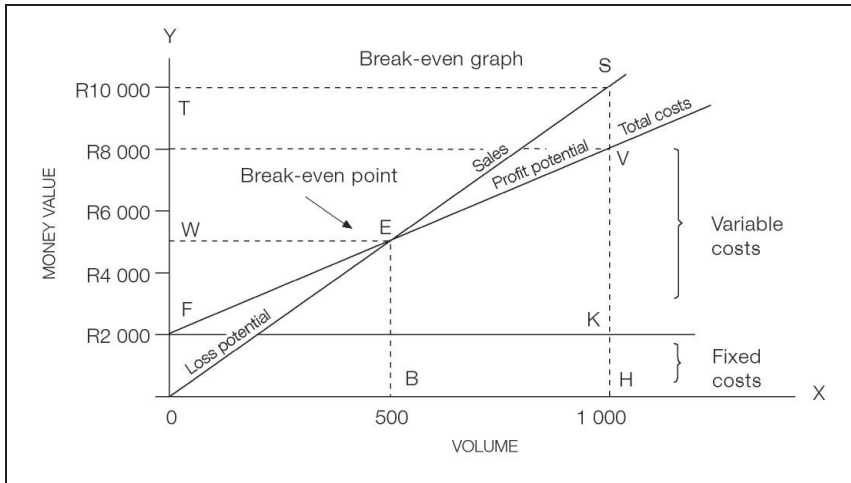


Diagram 4.1

Deductions from the graph:

(a) The break-even point

This is the point at the intersection of the sales line OS and the total costs line FV. If a line EB is drawn perpendicular to the X-axis and line EW is drawn perpendicular to the Y-axis, they show the break-even volume (B) and the break-even value (W) respectively.

(b) Profit/loss

At a given volume the vertical distance between the sales line and the total cost line shows the profit or loss amount. In this example a profit of R2 000 is earned (distance SV) when 1 000 units are sold.

(c) Safety margin

This is the distance between the break-even point and the units sold. The safety margin is the distance BH on the graph, which amounts to 500 units (1 000 – 500).

Contribution graph (Profit-volume diagram)

The contribution graph was developed to overcome certain deficiencies in the break-even graph. The cost line cannot always be expressed as a straight line because there are continuous changes in costs. In addition to being proportional, variable costs can also increase or decrease progressively or digressively in relation to the volume of business. The same argument is applicable to sales because the selling price per unit can also change and then sales can no longer be expressed as a straight line.

A further disadvantage of the contribution graph is that different income and cost lines for the purposes of comparison are not easily drawn on the same graph.

Procedures for the preparation of the graph

Take the example that was used to illustrate the break-even graph. On the horizontal or X-axis, the sales value is measured off on a scale of 1 cm = R1 000. The break-even line divides the Y (or vertical axis) into positive (profit) and negative (loss) portions of 1 cm = R1 000. The portion above the line depicts the profit portion (BY), while the portion below the line represents the losses (OB). The fixed costs are measured off on the Y-axis of the graph at point F (– R2 000), while the profit of R2 000 is measured off on the line SV at point P. Points E and P joined represent the profit line. It is important to note that before production begins there is already a total loss of R2 000, which represents the total fixed costs.

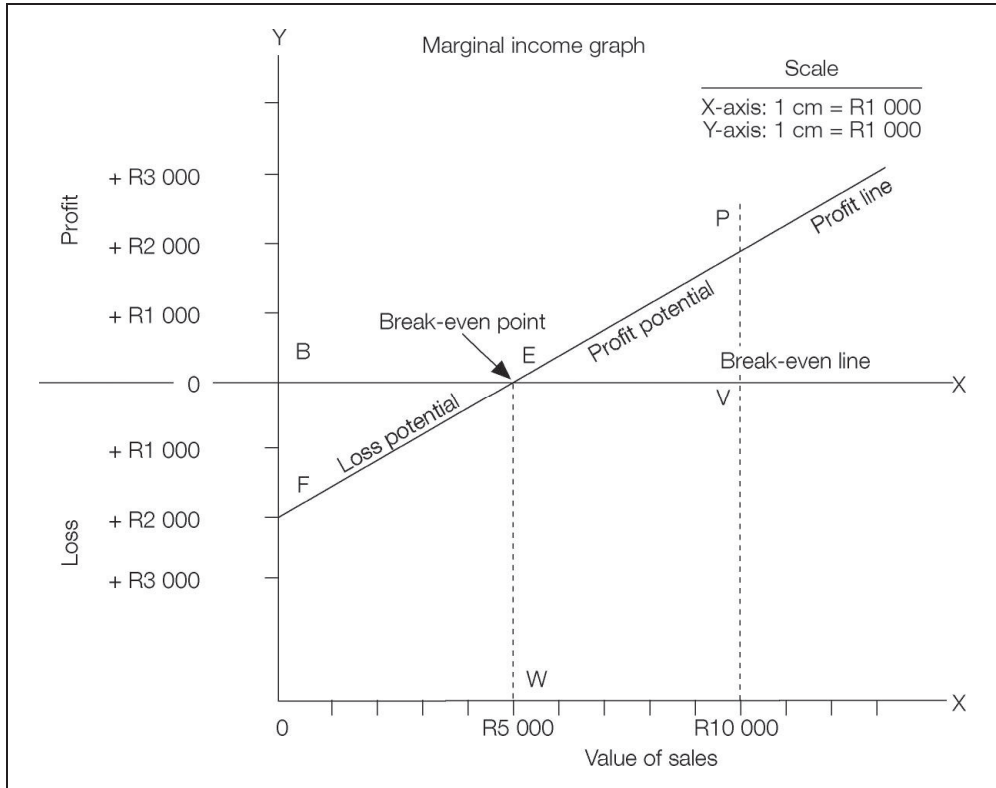


Diagram 4.2

From the graph it is obvious that the break-even point is point E, where the profit line cuts the break-even line. The safety margin is the distance EV.

The usefulness of the contribution graph is highlighted in the following example in which there is a production mix:

Example 4.7

The following information refers to an enterprise which during the past year manufactured products A, B and C:

	Products			Total	
	A	B	C	R	%
Sales	30 000	50 000	20 000	100 000	100
Less: Marginal costs	(18 000)	(25 000)	(18 000)	(61 000)	(61)
Contribution	<u>12 000</u>	<u>25 000</u>	<u>2 000</u>	39 000	<u>39</u>
Fixed costs				(20 000)	
Net profit				<u>19 000</u>	

Required

Determine the break-even value with the aid of a contribution graph.

Solution 4.7

First, calculate the contribution ratio of each product separately and rank them in order from the largest to the smallest.

	A	B	C
Contribution ratio	$= \frac{R12\,000}{R30\,000} \times \frac{100}{1}$	$= \frac{R25\,000}{R50\,000} \times \frac{100}{1}$	$= \frac{R2\,000}{R20\,000} \times \frac{100}{1}$
	= 40%	= 50%	= 10%

Order: B A C

	Y-axis of graph	B	B + A	B + A + C
	R	R	R	R
Sales	0	50 000	80 000	100 000
Net profit	(20 000)	5 000	17 000	19 000
Contribution	0	25 000	12 000	2 000
Brought forward	(20 000)	(20 000)	5 000	17 000

* Fixed costs

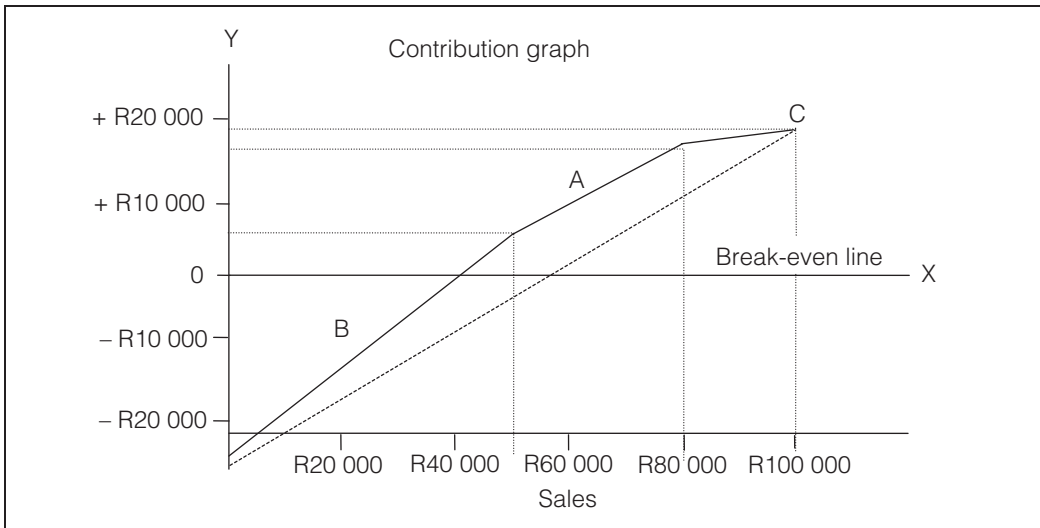


Diagram 4.3

CVP ANALYSIS USING AN ALGEBRAIC AND EQUATION APPROACH

Algebraic method

The graphical method is an effective way to illustrate the relationship between costs, volume, and profit. However, this relationship can also be expressed in algebraic terms as:

$$\text{Sales} - \text{variable costs} - \text{fixed costs} = \text{Profit}$$

or

$$\text{Sales} = \text{fixed costs} + \text{variable costs} + \text{profit.}$$

This formula represents the CVP calculation on a per unit basis. This elementary algebraic equation can also be developed further with the aid of symbols and formulae for calculating unknowns in break-even analysis.

The elementary algebraic equation basically contains every component of a condensed Statement of Profit or Loss, as follows:

Sales	S
Less: Variable costs	V
= Contribution	C
Less: Fixed costs	F
= Profit	P

Each symbol in the above Statement of Profit or Loss can be determined by means of a simple equation:

Sales	S	=	V + F + P
Variable costs	V	=	S - F - P
Contribution	C	=	S - V
Fixed costs	F	=	S - V - P
Profit	P	=	S - F - V

The calculation of the unknowns in the break-even analysis can be expanded further with the aid of the following formulae:

$$\begin{aligned}
 \text{Contribution ratio (CR)} &= \frac{S - V}{S} \text{ or } 1 - \frac{V}{S} \text{ or } \frac{C}{S} \\
 \text{Break-even quantity (BEQ)} &= \frac{F}{\frac{S - V}{S}} \text{ or } \frac{F}{\text{MI per unit}} \\
 &= \frac{F}{S - V} \text{ or } \frac{F}{\text{MI per unit}} \\
 \text{Break-even value (BEV)} &= \frac{F}{\text{CR}} \text{ or } 1 - \frac{V}{S} \\
 \text{Margin of safety (MS)} &= \frac{S - \text{BEV}}{S - \text{BEV}} \text{ or } \frac{\text{RQ} - \text{BEQ}}{\text{RQ} - \text{BEQ}} \\
 \text{Margin of safety ratio (MSR)} &= \frac{S - \text{BEV}}{S} \text{ or } \frac{\text{RQ} - \text{BEQ}}{\text{RQ}} \\
 \text{Required minimum turnover in value (RV)} &= \frac{F + \text{TP}^*}{\text{CR}} \\
 \text{Required minimum turnover in quantity (RQ)} &= \frac{F + \text{TP}}{\text{C per unit}}
 \end{aligned}$$

* Where: TP = planned profit, RQ = sales quantity, BEV = break-even value and BEQ = break-even quantity

Example 4.8

The following information is available:

Sales	R10 000
Variable costs	R6 000
Margin of safety ratio	50%

Required

Calculate the following with the aid of algebraic calculations:

- Contribution
- Contribution ratio
- Net profit
- Fixed costs
- Break-even value
- Safety margin.

Solution 4.8

$$\begin{aligned}
 \text{(a) Contribution:} \quad \text{MI} &= S - V \\
 &= \text{R10 000} - \text{R6 000} \\
 &= \text{R4 000} \\
 \text{(b) Contribution ratio:} \quad \text{MIR} &= \frac{S - V}{S} \\
 &= \frac{\text{R10 000} - \text{R6 000}}{\text{R10 000}} \times \frac{100}{1} \\
 &= \underline{\underline{40\%}}
 \end{aligned}$$

continued

$$\begin{aligned}
 \text{(c) Profit:} \quad P &= S - V - F \\
 &= R10\,000 - R6\,000 - F \\
 &= R4\,000 - F
 \end{aligned}$$

Since there are two unknowns in the above equation, another alternative must be found to solve it.

If the contribution (R4 000) decreases by 50% (safety margin ratio) this represents the profit. In other words, the contribution can decrease by 50% before any losses will occur.

$$\begin{aligned}
 P &= C \times \text{MSR or} \quad CR \times \text{MS} \\
 &= R4\,000 \times 50\% = 40\% \times R5\,000 \\
 &= R2\,000 \quad \quad \quad = R2\,000
 \end{aligned}$$

$$\begin{aligned}
 \text{(d) Fixed costs:} \quad F &= S - V - P \\
 &= R10\,000 - R6\,000 - R2\,000 \\
 &= R2\,000
 \end{aligned}$$

$$\begin{aligned}
 \text{(e) Break-even value:} \quad \text{BEV} &= \frac{F}{CR} \\
 &= \frac{R2\,000}{0.40} \\
 &= R5\,000
 \end{aligned}$$

$$\begin{aligned}
 \text{(f) Margin of safety:} \quad \text{MS} &= S - \text{BEV} \\
 &= R10\,000 - R5\,000 \\
 &= R5\,000
 \end{aligned}$$

Equation method

The profit can also be calculated by means of the equation method, which represents the CVP calculation on a total cost basis. In other words, for every scenario the unit cost is multiplied with the quantity to give an indication of the total cost impact. Assume the same information as in Example 4.1:

$$\begin{aligned}
 \text{Sales value} &= \text{Variable costs} + \text{fixed costs} + \text{profit} \\
 \text{Alternatively:} \\
 \text{Profit} &= \text{Sales value} - \text{variable costs} - \text{fixed costs} \\
 &= (40\,000 \times R20) - (40\,000 \times R15) - R100\,000 \\
 &= R100\,000
 \end{aligned}$$

The break-even quantity of Product P can be calculated as follows if the sales volume is expressed as Q:

$$\begin{aligned}
 \text{Sales value} &= \text{Variable costs} + \text{fixed costs} + \text{profit} \\
 R20Q &= R15Q + R100\,000 + 0 \\
 R20Q - 15Q &= R100\,000 \\
 Q &= 20\,000 \text{ units}
 \end{aligned}$$

CVP ANALYSIS IN SERVICE INDUSTRIES

The contribution approach is not just relevant to manufacturing enterprises. It is also applicable to trading enterprises and non-profit organisations.

The following example illustrates the marginal income approach in a small trading enterprise:

Example 4.9

GREEN STATIONERS
Statement of Profit or Loss

	R
Sales	100 000
Less: Cost of sales	(60 000)
Gross profit	40 000
Less: Operating expenses	(30 000)
Salaries and wages	15 000
Packaging costs	5 000
Municipal costs	2 500
Depreciation	6 500
Sundry expenses	1 000
Net profit	10 000

Assume that a study of the cost-volume relationship indicates the following:

	Total	Variable costs	Fixed costs
	R	R	R
Cost of sales	60 000	60 000	–
Salaries and wages	15 000	10 000	5 000
Packaging costs	5 000	5 000	–
Municipal costs	2 500	–	2 500
Depreciation	6 500	–	6 500
Sundry expenses	1 000	1 000	–

The Statement of Profit or Loss can now be revised according to the marginal income format:

	R	%
Sales	100 000	100
Less: Cost of sales	(60 000)	(60)
Gross profit (Contribution from trade)	40 000	40
Less: Variable operating costs	(16 000)	(16)
Salaries and wages	10 000	
Packaging costs	5 000	
Sundry expenses	1 000	
Contribution from trade operations	24 000	24
Fixed operating costs	(14 000)	
Salaries and wages	5 000	
Municipal costs	2 500	
Depreciation	6 500	
Net profit	10 000	

Questions can be answered by identifying the contribution as follows:

- 1 How much additional profit can be earned if the volume is increased by 10%?

Income and variable costs will increase by 10%. Seeing that fixed costs will stay the same, the contribution will increase by R2 400 ($R24\ 000 \times 10\%$), resulting in an increase in the net profit of R2 400.

The question cannot be answered from the conventional Statement of Profit or Loss.

- 2 What is the sales volume at the break-even point?

Sales at BEP	=	$\frac{\text{Fixed costs}}{\text{Contribution ratio}}$
	=	$\frac{R14\ 000}{24\%}$
	=	R58 333

COST STRUCTURE AND THE OPERATING LEVERAGE FACTOR

The concept **cost structure** refers to *the relative relationship between fixed and variable costs of a particular enterprise*.

The cost structure of a typical manufacturing enterprise in recent years has become more fixed because of automation (for example, the use of robots and computers). An important management objective is to ensure that fixed costs are used effectively irrespective of the actual level of activity. One management evaluation technique known as **operating leverage** is used as a criterion to show the degree of sensitivity of net profit to a change in the sales volume. The technique can also be applied in evaluating the extent to which fixed costs have been utilised.

The concept of operating leverage is illustrated in the following example by looking at the cost structures of two enterprises at the same operating level and having profits that are sensitive to changes in sales volume.

Example 4.10

	Enterprise			
	Y		Z	
	R	%	R	%
Sales	50 000	100	50 000	100
Less: Variable costs	(30 000)	(60)	(15 000)	(30)
Contribution	20 000	40	35 000	70
Less: Fixed costs	(15 000)		(30 000)	
Net profit	5 000		5 000	

Although both enterprises show a net profit of R5 000, they have totally different cost structures and operating leverage ratios. Enterprise Z has the combination of the larger contribution (70% from sales) and the larger fixed costs (R30 00). This means that for every additional Rand sale, Enterprise Z will earn more profit than Enterprise Y. For example, if sales increase to R60 000, Enterprise Z will be better off than Enterprise Y because the contribution ratio is higher. Consequently, profits will also be

higher. However, if sales should fall (for example, to R40 000) Enterprise Y enjoys the advantage as its fixed costs are much lower than those of Enterprise Z. These changes in circumstances can be illustrated as follows:

	Enterprise Y			Enterprise Z		
	Current	20% Increase	20% Decrease	Current	20% Increase	20% Decrease
	R	R	R	R	R	R
Sales	50 000	60 000	40 000	50 000	60 000	40 000
Less: Variable costs	(30 000)	(36 000)	(24 000)	(15 000)	(18 000)	(12 000)
Contribution	20 000	24 000	16 000	35 000	42 000	28 000
Less: Fixed costs	(15 000)	(15 000)	(15 000)	(30 000)	(30 000)	(30 000)
Net profit (loss)	5 000	9 000	1 000	5 000	12 000	(2 000)

By increasing the sales volume by 20%, Z's profit has increased by R7 000 (14%) against the R4 000 (80%) of Y. This shows the effect on profit of an increase in sales volume for an enterprise that has a high operating leverage, but there is also a greater risk if sales volume should fall: a decrease of 20% in sales volume means that the profit of Z will fall by R7 000 (or 40%) against the decrease of Y which is R4 000 (80%). This is because the break-even point of Z is higher than that of Y.

$$\text{BEP} = \frac{\text{Fixed costs}}{\text{Contribution ratio}}$$

$$\text{Z} = \frac{\text{R30 000}}{70\%} = \text{R42 857}$$

$$\text{Y} = \frac{\text{R15 000}}{40\%} = \text{R37 500}$$

To better understand how profit increases and decreases at a higher rate for enterprises with a higher operating leverage, we must consider the operating leverage factor which is calculated as follows:

$$\frac{\text{Contribution}}{\text{Net profit}}$$

The operating leverage factor reflects how much influence a percentage change in sales volume has on net profit. A specific operating leverage factor is valid for a specific sales volume and changes as the sales volume changes.

This is shown in the following example:

Example 4.11

Use the same information as in example 4.10:

The operating leverage factor for Y and Z at different sales levels is as follows:

		Enterprise	
		Y	Z
Sales = R50 000:			
Operating leverage factor	= $\frac{\text{Contribution}}{\text{Net profit}}$	$\frac{\text{R20 000}}{\text{R5 000}}$ = 4	$\frac{\text{R35 000}}{\text{R5 000}}$ = 7
Sales = R60 000:			
Operating leverage factor	= $\frac{\text{Contribution}}{\text{Net profit}}$	$\frac{\text{R24 000}}{\text{R9 000}}$ = 2.67	$\frac{\text{R42 000}}{\text{R12 000}}$ = 3.5

The operating leverage will be reduced in proportion to the increased gap between the sales value and the break-even point.

The operating leverage is a management instrument which shows, relatively easily, the effect of a change in turnover on net income.

Suppose there is an increase of 20% in sales in the above example:

Increase in sales		Operating leverage	% Increase in net income
Y	20%	4	80%
Z	20%	7	140%
Test for correctness:			
$\frac{\text{Increase in net income}}{\text{Net income}} \times \frac{100}{1}$			
Y:	$\frac{\text{R4 000}}{\text{R5 000}} \times \frac{100}{1}$	= 80%	
Z:	$\frac{\text{R7 000}}{\text{R5 000}} \times \frac{100}{1}$	= 140%	

The operating leverage is thus a management technique which indicates the effect of different sales volumes on net income without detailed statements having to be prepared.

EVALUATING CVP ANALYSIS

In our complex modern economy, it is highly unlikely that selling prices and variable costs per unit, fixed costs in total and the sales volume will remain constant for a given period. Therefore, certain assumptions are part of break-even analysis, with its fixed ratio of cost, volume, and profit, and which makes use of linear equations and conventional break-even graphs.

The usefulness of break-even analysis is limited only by the degree of validity of the following assumptions:

- ☐ Selling price per unit remains constant, irrespective of the sales volume. Hence sales are expressed graphically as a straight line.
- ☐ All costs and expenses can be expressed as either fixed or variable.
- ☐ Fixed costs remain constant, irrespective of the volume of business while variable costs vary in a direct ratio with volume. These assumptions ensure straight cost lines in the break-even graph.
- ☐ The sales mixes are constant for different types of products.
- ☐ There is no change in the effectiveness of the variable costs in the production factors. This assumption is also necessary to maintain the linear nature of the variable cost functions.
- ☐ Inventory levels do not change materially during this period.

This is the most subtle of the assumptions. In conventional reporting, the more inventory there is the more fixed costs there are included in the manufacturing cost of the inventory and *vice versa*. CVP analysis avoids the problem of having to work out the profit at the different inventory levels as it excludes fixed manufacturing costs from production costs.

The abovementioned assumptions also give rise to the biggest criticism against the technique as they give it a theoretical character, whereas it should be a practical aid for management. Despite this criticism, it is a useful management tool for short-term decision-making and profit planning.

In general, the limiting assumptions are unnecessary since the management accounting technique is not sophisticated enough to cover all the complex situations that are possible in the business world. There are more sophisticated interpretations of the technique available for non-linear relationships and uncertain circumstances, but these fall outside the scope of this book.

SUMMARY

CVP analysis is a management tool used to perform certain short-term investigations and to assist management in making short-term financial decisions. It is a relatively simple tool that is diverse and can be applied in a manufacturing or service industry. The tool is specifically designed for short-term decision-making and is not appropriate for long-term decision-making.

The basic principle of CVP is that it calculates the impact on the profit of an enterprise should the cost and/or activity level (volume) change. Cost includes selling price, variable costs, and fixed costs. The activity level is usually the quantity or volume of units produced. CVP can be used to address a variety of questions surrounding a change in one or more of these factors.

CVP remains a relatively basic tool and therefore there are a number of assumptions that are necessary. The assumptions limit the usability of the tool.

PERSPECTIVES ON COSTING

Knowledge

You should know:

- ☐ what CVP analysis is and how it assists with making short-term financial decisions;
- ☐ what a Marginal Statement of Profit or Loss is and how it is constructed;
- ☐ the basic elements that make up a Marginal Statement of Profit or Loss;
- ☐ the difference between fixed and variable costs and how it is used in CVP;
- ☐ CVP calculates the impact on profit of a change in cost factors;
- ☐ the concept of contribution;
- ☐ the different formulae and methods used to perform CVP calculations; and
- ☐ the assumptions and limitations on which CVP analysis is based.

Skills

You should be able to:

- ☐ determine the contribution (per unit and in total) and the contribution ratio;
- ☐ apply CVP analysis using both formulae and break-even graphs;
- ☐ determine the margin of safety and margin of safety ratio;
- ☐ apply CVP analysis when factors change (volume, costs, prices and product mix); and
- ☐ apply CVP analysis in different cost structures and operating leverage factors.

KEY TERMS AND CONCEPTS

Break-even graph	121	Cost structure	129
Break-even point	111	Cost-volume-profit analysis	108
Break-even quantity	111	Marginal cost ratio	112
Break-even value	112	Marginal costs	111
Change-over point	120	Margin of safety	114
Contribution	110	Operating leverage	129
Contribution ratio	112		

REVIEW PROBLEMS

Problem 4.1

Thornton Manufacturers has the following Marginal Statement of Profit or Loss for 2015:

Marginal Statement of Profit or Loss for the year ended 31 December 2015	
	R (‘000)
Sales (300 000 units × R40)	12 000
Less: Variable costs of goods sold (300 000 × R24)	(7 200)
Manufacturing profit	4 800
Less: Variable selling costs (300 000 × R2.40)	(720)
Contribution	4 080

continued

	R
	(‘000)
Less: Fixed costs	(3 536)
Manufacturing costs	2 160
Selling costs	500
Administrative costs	876
Net profit	544

Required

- Calculate the enterprise's break-even quantity in units and the sales value for 2015.
- What is the enterprise's safety margin based on the Statement of Profit or Loss as it stands?
- Use the concept of operating leverage on the 2015 Statement of Profit or Loss amounts and determine the influence on the 2016 net profit if the turnover should increase by 10% on the 2015 amount.
- Calculate the number of units that must be sold in 2016 if the enterprise wishes to earn a net profit (before tax) of 1 088 000 in 2016. Assume that the selling price, variable costs and total fixed costs are the same as those in 2015.
- Calculate the break-even point for 2016 if the fixed costs of the enterprise increase by R384 000 in order that the variable costs decrease by R0.40 cents per unit.

Solution 4.1

(a) Break-even quantity	= $\frac{\text{Total fixed costs}}{\text{Contribution per unit}}$
	= $\frac{\text{R3 536 000}}{\text{R40.00} - \text{R26.40}}$
	= $\frac{\text{R3 536 000}}{\text{R13.60}}$
	= 260 000 units
Break-even value	= Break-even in units $\times$ selling price per unit
	= 260 000 $\times$ R40
	= R10 400 000
	Or
Break-even value	= $\frac{\text{Total fixed costs}}{\text{Contribution ratio}}$
	= $\frac{\text{R3 536 000}}{0.34}$
	= R10 400 000

continued

- (b) Marginal safety = Sales – Break-even value
 = R12 000 000 – R10 400 000
 = R1 600 000 Or
 Marginal safety = Sales units – Break-even value
 = 300 000 units – 260 000 units
 = 40 000 units
- (c) Operating leverage factor = $\frac{\text{Contribution}}{\text{Net profit}}$
 = $\frac{\text{R4 080 000}}{\text{R544 000}}$
 = 7.50
 % Increase in sales $\times$ operating leverage factor = % increase in net profit
 $10\% \times 7.5 = 75\%$
 Net profit with a 10% increase in sales = R544 000 + (R544 000 $\times$ 75%)
 = R544 000 + R408 000
 = R952 000
- (d) Assume number of units = x
 Sales = Variable costs + fixed costs + net profit
 $\text{R40x} = \text{R26,40x} + \text{R3 536 000} + \text{R1 088 000}$
 $\text{R13.60x} = \text{R4 624 000}$
 $x = 340\,000 \text{ units}$
- (e) Adjusted variable costs per unit = R26.40 – R0.40 = R26.00
 Adjusted total fixed costs = R3 536 000 + R384 000 = R3 920 000
 Break-even quantity = $\frac{\text{Total fixed costs}}{\text{Contribution per unit}}$
 = $\frac{\text{R3 920 000}}{\text{R40.00} - \text{R26.00}}$
 = $\frac{\text{R3 920 000}}{\text{R14.00}}$
 = 280 000 units
 Or
 Break-even value = Break-even quantity $\times$ selling price per unit
 = 280 000 units $\times$ R40 000
 = R11 200 000
 Or
 Assume number of units = x
 Sales = Variable costs + fixed costs + net profit
 $\text{R40x} = \text{R26x} + \text{R3 920 000} + \text{R0}$
 $\text{R14x} = \text{R3 920 000}$
 $x = 280\,000 \text{ units}$

Problem 4.2

StudyScurry (Pty) Ltd operates a water purification plant. Dirty water is pumped into the plant which then filters and sanitises the water. The plant then produces four products, namely, still, sparkling, water sachets and tonic water, which are sold at factory prices. The plant processing capacity is 10 000 metric tons of water per year,

and for every 1 metric ton of dirty water that is pumped into the plant and processed, the output is as follows:

Product	Output per metric ton of water	Factory sales price per unit
Still	300 bottles	R1.50
Sparkling	600 bottles	R0.50
Water Sachet	800 sachets	R0.20
Tonic	100 bottles	R3.00
Waste	200 bottles	–

These prices were obtained during the year ended 30 June 2015 where 4 000 metric tons of water was processed, and the resulting production was sold. The costs during the previous year were as follows:

Raw materials	– R350 per metric ton
Variable processing costs	– R90 per metric ton
Fixed processing costs	– R1 080 000 per year
Variable selling costs	– 20% of sales value per metric ton
Fixed administrative costs	– R768 000

The managing director is dissatisfied with the poor capacity utilisation and the resulting low level of profitability. He requested his fellow directors to present proposals at the next board meeting to improve the situation in the following year. The following two proposals were made:

☐ Proposal 1

A 10% reduction in the price of still and tonic water will increase demand for these products so that 6 000 metric tons of water will need to be processed in order to meet the demand. Sales volumes and prices for sparkling water and water sachets will remain the same in the following year. Any excess sparkling water and water sachets will be sold as scrap for R0.05 and R0.02 per unit respectively.

☐ Proposal 2

The production director has recently read about new machinery, which if installed and used would reduce waste per metric ton of input down to 20 bottles. The additional 180 bottles produced per ton of input would be spread proportionally amongst the existing four products. Variable processing costs would increase by R5.00 per metric ton and the machinery would have to be leased at R10 000 per month. Total amount of water processed would remain at 4 000 metric tons and an amount of R180 000 would have to be spent on advertising to sell the additional products.

Required

- (a) Calculate for the year ended 30 June 2012 the following:
 - (i) contribution per metric ton of input
 - (ii) break-even point in metric ton of input
 - (iii) net profit achieved
 - (iv) margin of safety percentage.
- (b) For each of the two proposals, calculate the expected net profit for the year ended 30 June 2012.

Solution 4.2

(a)

(i)	Contribution per metric ton		
	Revenue per ton of input:		
	Still	300×1.50	R450
	Sparkling	$600 \times R0.50$	R300
	Water Sachet	$800 \times R0.20$	R160
	Tonic	$100 \times R3.00$	R300
	Total		R1 210
	Variable costs per ton of input:		
	Raw materials		R350
	Variable processing cost		R90
	Variable selling cost	$1\,210 \times 20\%$	R242
	Total		R682
	Contribution per ton of input:	$R1\,210 - R682 = R528$	
(ii)	Break-even		
	Fixed costs:		
	Fixed processing costs	R1 080 000	Fixed processing costs
	Fixed admin costs	R768 000	Fixed admin costs
	Total	R1 848 000	Total
	Break-even	$= \frac{\text{Fixed cost}}{\text{Cont. per ton}}$	$= \frac{R1\,848\,000}{R528}$
			$= 3\,500 \text{ tones}$
(iii)	Net profit achieved		
	Tons above break-even $\times$ Contribution		
	$(4\,000 - 3\,500) \times R528 = R264\,000$		
	or		
	Revenue	$R1\,210 \times 4\,000$	R4 840 000
	Less: Variable costs	$R682 \times 4\,000$	(2 728 000)
	Less: Fixed costs		(1 848 000)
	Net profit		264 000
(iv)	Margin of safety percentage		
	$\frac{4\,000 - 3\,500}{4\,000} \times 100$		$= 12.5\%$

(b)

Proposal 1

		R
Sales		5 982 000
Still	$300 \times 6\,000 \times (1.50 \times 0.9)$	2 430 000
Sparkling	$(600 \times 4\,000 \times 0.50) + (600 \times 2\,000 \times 0.05)$	1 260 000
Water Sachet	$(800 \times 4\,000 \times 0.20) + (800 \times 2\,000 \times 0.02)$	672 000
Tonic	$100 \times 6\,000 \times (3.00 \times 0.9)$	1 620 000
Less: Variable costs		(3 836 400)
Raw materials	$6\,000 \times 350$	2 100 000
Variable processing cost	$6\,000 \times 90$	540 000
Variable selling cost	$20\% \times (2\,430 + 1\,260 + 672 + 1\,620)$	1 196 400
Less: Fixed costs	$1\,080\,000 + 768\,000$	(1 848 000)
Net profit		297 600

Proposal 2

				R
Sales				1 331
Still	$3/18 \times 180$	$= 30 + 300 = 330$	$330 \times R1.50$	495
Sparkling	$6/18 \times 180$	$= 60 + 600 = 660$	$660 \times R0.50$	330
Water Sachet	$8/18 \times 180$	$= 80 + 800 = 880$	$880 \times R0.20$	176
Tonic	$1/18 \times 180$	$= 10 + 100 = 110$	$110 \times R3.00$	330
Less: Variable costs				(711.20)
Raw materials				350
Variable processing cost	$90 + 5$			95
Variable selling cost	$(1\,331 \times 20\%)$			266.20
Revised contribution				619.80
Grossed up	$R619.80 \times 4\,000$			2 479 200
Less: Fixed costs				(2 148 000)
Fixed costs	$1\,080\,000 + 768\,000$			1 848 000
Machinery lease	$10\,000 \times 12$			120 000
Advertising				180 000
Net profit				331 200

EXERCISES**4.1 Contribution approach versus conventional Statement of Profit or Loss**

Kellock Ltd buys and sells machine parts. Each component costs R3 750 and sells for a price of R6 250. The marketing and administration costs of Kellock Ltd in a typical month are as follows:

Costs	
Marketing:	
Advertising	R3 500 per month
Sales personnel's salaries and commission 8% of sales	R4 750 per month plus
Delivery costs	R150 per component sold
Other marketing costs	R1 750 per month
Depreciation on marketing equipment	R4 000 per month
Administration:	
Salaries (Management)	R12 500 per month
Insurance	R2 000 per month
Other office costs:	R5 000 per month plus R100 per component sold
Depreciation:	
Office equipment	R1 500 per month
During November 2015, Kellock Ltd delivered and sold 200 units.	

Required

- Draw up a conventional Statement of Profit or Loss of the company for November 2015.
- Draw up a Statement of Profit or Loss for the same month according to the contribution approach. Show the costs and profit on both a total and per unit basis and with the contribution figure.

4.2 Application of the Contribution approach in a health centre

Below is the Statement of Profit or Loss of January and February 2015 of the Vandu Health Centre:

	2015	
	Jan	Feb
Number of patients	4 000	4 800
	R	R
Gross patient fees	40 000	48 000
Operating costs	48 200	53 200
Medical fees	20 000	24 000
Nurses' salaries	13 000	13 000
Administrative salaries	6 400	6 400
Medical inventory	4 000	4 800
Rent	3 600	3 600
Maintenance of medical records	1 200	1 400
Net losses	(8 200)	(5 200)

The following cost payment pattern is determined through the use of the high-low method, with the assumption that 4 000 patients were treated in January and 4 800 patients in February:

Variable costs per visit		Fixed costs per month	
	R		R
Medical fees	5.00	Nurses' salaries	13 000
Medical inventory	1.00	Administrative salaries	6 400
Maintenance:		Rent	3 600
Medical records	0.25	Maintenance:	
Total	6.25	Medical record	200
		Total	23 200

The maintenance of medical records is a mixed cost item which includes fixed monthly fees of R200 and a variable charge of R0.25 per patient visit.

Required

- Draw up the Statement of Profit or Loss for February 2015 according to the contribution approach.
- Calculate the number of patients that the centre must treat to break even, assuming that there are no changes in the cost/income ratio.
- Calculate the average fee per patient that must be charged to break even, assuming that 5 000 patients can normally be treated within the existing cost structure.

4.3 Operating leverage and sensitivity analysis of two enterprises

The cost-volume structures of the two enterprises are given below:

	A		B	
	Amount	%	Amount	%
	R		R	
Sales	200 000	100	200 000	100
Less: Variable costs	(120 000)	(60)	(100 000)	(50)
Contribution	80 000	40	100 000	50
Less: Fixed costs	(50 000)	(25)	(70 000)	(35)
Net profit	30 000	15	30 000	15

Required

- Describe the concept of *operating leverage* as it is used in evaluating the sensitivity of profit to changes in sales volume.
- Determine the sensitivity of changes in sales for each of the above two enterprises by:
 - an increase in sales of R20 000; and
 - a decrease of R20 000 in the sales of each company.
- Calculate the break-even sales volume for each enterprise.
- What do the calculations in (b) and (c) illustrate to you?

4.4 Break-even point and sales mix

Kroton Ltd manufactures and sells two products, Zim and Kim. The following information pertains to the two products:

	Zim	Kim
Selling price per unit	R5.00	R6.00
Total variable costs	R2.50	R5.00
Direct fixed costs for the month	R125 000	R100 000
Unallocated company fixed costs	R55 000	

Required

- Calculate the break-even point if the two products are sold in the ratio: 4 Zim : 3 Kim.
- The management also request that you show the influence on the break-even point if the sales mix changes to 3 Zim : 4 Kim.
- Explain to the management which one of the two sales mixes should be aimed at.

4.5 Break-even point, budgeted contribution, and budgeted profit

Burke Ltd manufactures a single product. The company budgets for its fixed costs on a normal business capacity of 320 000 to 400 000 units per year. The company finds that it seldom has large changes in its inventory.

The following is the budget for the net profit on the lowest and highest normal operating level:

	Low	High
Units	320 000	400 000
	R	R
Sales	160 000	200 000
Less: Cost of sales and expenses	(156 000)	(180 000)
Net profit	4 000	20 000

Required

Calculate the following:

- The contribution per unit
- The fixed costs per year
- The break-even point in units
- Budgeted profit for 360 000 units.

4.6 Break-even point and margin of safety

Daven Ltd is a small trading enterprise, which does business from a number of sales outlets. The company also owns fixed property, which it rents to other enterprises. The rental agreement for one of these properties expires on 31 December 2015 and Daven Ltd is considering using this property itself for the marketing of electronic equipment. Daven Ltd bought the premises 15 years ago for R140 000. It is now estimated that the property could be sold for R240 000.

The financial manager made the following estimates:

- The company's requirements are such that the site can be equipped at a cost of R60 000. The amount will be paid by 31 December 2015. This expense will be written off over five years on a straight-line basis.
- All sales will be on a cash basis and the estimated turnover from January 2016 will be R80 000 per month. The Contribution will be 20%.
- The amount of operating capital will be invested exclusively in trading inventory. Enough inventory will be held to cover seven weeks' sales. The opening inventory will be purchased and paid for in December 2015 and will be kept at that level throughout the year.
- The annual fixed running costs (excluding depreciation) are estimated at R88 000.
- The company's objective is to make an annual profit of 20% (before tax) on the original investments in each of its products.

Required

- Calculate:
 - the value of the investment on 31 December 20.4
 - the sales level on which the project will break even
 - the estimated profit for the year
 - the margin of safety ratio
 - the sales level necessary to achieve a target of 20% on the value of the investment.

- (b) Give a short discussion of the project based on your calculations and the other information at your disposal.

4.7 Missing data; integration of CVP factors

The following data is available:

Dika Ltd
Statement of Profit or Loss for the month ended 31 May 2015

	Total R	Per unit R	Percentage %
Sales (? units)	?	?	100
Less: Variable costs	?	?	?
Contribution	?	?	?
Less: Fixed costs	?		
Net profit	13 500		

Break-even point:

In units: ? units
In monetary value: R90 000

Safety ratio:

In units: R?
In percentage: 20%

Operating leverage factor: ?

The above is applicable to the actual Statement of Profit or Loss for May 2015. The projected sales for June 2015 are 16 500 units or 10% higher than in May. The net profit was calculated as R20 250, whereas total fixed costs, the selling price and variable costs per unit were the same as those in May.

Required

- (a) For May 2015:
- Complete the Statement of Profit or Loss.
 - Use the contribution approach to calculate the break-even point in units and monetary value.
 - Calculate the safety ratios in monetary value and confirm the safety ratio percentage.
 - Calculate the operating leverage factor as at 31 May 2015.
- (b) For June 2015:
- Complete the projected Statement of Profit or Loss.
 - Calculate the safety margin in monetary value and as a percentage and the operating leverage factor. Why has the safety ratio increased, and the operating leverage factor decreased?
- (c) The direct labour cost per unit is R0.90. Assuming that these costs increase by one third in the following year and that the selling price and other costs remain the same: calculate how many units have to be sold monthly to make a net profit of 20% on sales.

5 Relevant information for short-term decision-making



LEARNING OUTCOMES

What is the role of cost in short-term decision-making?

How can cost be used when making short-term decisions?

What methods are available to incorporate uncertainty in the decision-making process?

- Explain the various cost concepts that apply to short-term decision-making
- Apply the relevant cost approach to a variety of short-term decision-making situations
- Calculate the optimum production plan in a limited factor environment
- Apply the linear programming technique in a situation where more than one limiting factor exists with the purpose of maximising profit.
- Calculate an expected value of an event given a probability distribution
- Calculate the standard deviation and coefficient of variation of the expected value
- Prepare a payoff table and determine the best strategy under conditions of uncertainty
- Calculate the expected value of perfect information
- Construct a decision tree when a number of alternatives and possible results exist

CHAPTER OUTLINE

There are numerous tools used to make financial decisions. For short-term financial decision-making purposes, the concept of relevant costing is the most widely used tool. Relevant costing means that only the costs that change or are impacted by a decision are considered. For short-term decision-making, the time value of money is ignored.

There are numerous short-term decisions that can be made using relevant costing as a tool, for example, price determination and special-order acceptance. Should a decision be restricted in some way, for example, there are a limited number of labour hours available, this will be described as a limiting factor. In instances where there are limiting factors, linear programming becomes the tool of choice.

A further complication that can arise is if uncertainty is involved. Uncertainty means that there are numerous alternative options that can occur, and it is not possible to

determine which one will happen. This chapter concludes by demonstrating how probability and statistical tools can be used in such cases to determine the optimal choice.

INTRODUCTION

Financial decision-making requires several inputs to be successful. In this chapter, cost is identified as the major input needed. However, the element of time remains important when it comes to finances. Because of the concept of the time value of money, there is a split between short-term and long-term financial decision-making. The difference between these two types of decisions is that for short-term decision-making, the time value of money is generally disregarded and replaced with the concept of relevancy. As soon as the consequences of a decision stretch beyond approximately two years, the time value of money can no longer be ignored.

COST CONCEPTS FOR DECISION-MAKING

The purpose for which a specific cost is used plays an important role in the business world. For example, cost information that is suitable for decision-making may not necessarily be used in the preparation of annual financial statements. Historical costs are used for preparing financial statements, while expected future costs are used for decision-making.

Short-term decision-making rests on the basic principle that the most economically viable choice between alternative (unique) short-term actions must be taken.

To understand short-term decisions more clearly the following new concepts must be explained.

Differential costs

Differential costs are the additional costs that arise from a temporary (short-term) increase in operating volume. The increase is usually aimed at employing under-utilised production capacity more fully.

Differential costs are used to establish how the total profit of an enterprise will be influenced by a change in production and sales volumes or product mix.

Differential costs not only deal with the analysis of additional units, but also have a bearing on the following:

- ☐ A decision as to whether a part should be manufactured or purchased.
- ☐ The closing down of a factory or department.
- ☐ The expansion of the plant.
- ☐ The making of pricing decisions.

Opportunity costs

Opportunity costs represent the loss in advantage to an enterprise when allocating limited resources to an alternative option.

For example, an entrepreneur has the choice of renting a part of his factory for R2 000 per month or using it for the manufacturing of an additional product. If he decides to manufacture the additional product, he will sacrifice the rental income that he would have received. This is considered an *opportunity cost* that must be added to the manufacturing costs of the additional product.

Suppose that the additional product that he can manufacture is a spare part that the enterprise currently purchases. If he manufactures the spare part, the total manufacturing costs will amount to R60 000 against a cost of R61 000 if he purchases it. Diagram 5.1 illustrates the influence that opportunity costs exercise on the final decision.

	If manufactured R	If purchased R
Total manufacturing costs	60 000	
Total cost of purchasing		61 000
Opportunity cost (rental of a part of the factory)	2 000	
Comparable cost	<u>62 000</u>	<u>61 000</u>

Diagram 5.1

Relevant costs

Relevant costs are *estimated future costs that differ between decision alternatives*, while **non-relevant costs** are *estimated future costs that will not be changed by the decision*.

Example 5.1

An existing machine that will function effectively for a further five years can be replaced now with a new machine of the capacity that will cut labour by half. It also has an economic life of five years.

Only some cost items applicable to the two machines are given below:

	Old machine R	New machine R	Difference R
Direct material: 1 000 kg × R3	3 000	3 000	—
Direct labour: 500 hours × R5	2 500		
250 hours × R5		1 250	1 250

In the above example, direct labour is the relevant cost because the decision influences it, and material is a non-relevant cost. The expected economic life and capacity of the machines are also non-relevant for decision-making.

Imputed costs

Imputed costs do not entail actual monetary expenditure and therefore are not reflected in the accounting records. Examples of such costs are interest on capital and the salary of an owner or entrepreneur. When comparative studies are carried out and whenever a decision must be reached, such costs must be taken into consideration.

Sunk costs

Sunk costs are costs that have already been incurred and cannot be changed or cancelled by any decisions now or in the future. An example of such cost is a long-term lease.

TYPES OF SHORT-TERM DECISIONS

Price determination

Costs and competitors, as well as supply and demand, are price-determining factors. Cost-volume-profit (CVP) analysis can be used with great success to set prices in the short term.

The normal economic principle determines a decrease in volume with an increase in price and *vice versa*. If the volume increases, the enterprise should determine the level to which prices can be decreased and still be profitable.

Example 5.2

The activity level of a manufacturing enterprise is currently 50% and at this capacity the manufacturing and sales of the product are as follows:

Sales:	10 000	unit @ R200 each
Variable costs:	10 000	units @ R100 each
Total fixed costs for the period:	R500 000	

A survey has revealed that because of strong competition the enterprise must reduce its selling prices drastically in the future if it is to remain competitive in the market. The estimated activity level can be increased to 75% without any change in fixed costs.

Required

Calculate the new selling price per unit if the activity level is 75% and the enterprise wants to achieve a 10% increase in net profit.

Solution 5.2

Statement of Profit or Loss at a 50% level of activity

	R	%
Sales (10 000 × R200)	2 000 000	100
Less: Variable costs (10 000 × R100)	(1 000 000)	(50)
Marginal income	1 000 000	50
Less: Fixed costs	(500 000)	
Net income	500 000	

continued

Statement of Profit or Loss at a 75% level of activity

		R
Net income (110% × R500 000)		550 000
Fixed costs		500 000
Marginal income		1 050 000
Variable costs (15 000* × R100)		1 500 000
Sales		2 550 000
Selling price per unit:	$\frac{R2\,550\,000}{15\,000}$	
	= R170	
* Level of activity:	$\frac{75}{50} \times \frac{10\,000}{1}$	
	= 15 000 units	

Acceptance of a special order

Whenever a special order is accepted at a price below cost, the non-expert may be sceptical of the whole affair. In making this type of decision, the following are prerequisites:

- ☐ production capacity must be available;
- ☐ fixed costs must remain unchanged; and
- ☐ current selling prices per unit must not be affected by the acceptance of a special order.

Example 5.3

Trapvas Ltd manufactures men's shoes. Its level of activity is currently 60%. The enterprise obtains an order from a neighbouring state several thousand kilometres away to supply 1 000 pairs of shoes, size X, within 30 days at R60 free on rail (for). Some of the enterprise's directors are sceptical of the offer since the selling price is below cost price. The cost per pair to manufacture is as follows:

	R
Variable costs:	
Direct material	12
Direct labour	24
Manufacturing overheads	12
Marketing costs	8
Fixed costs:	
Manufacturing overheads	4
Administrative costs	2
Marketing costs	2
	64

Fixed costs are based on the annual estimated (budgeted) volume. If this order is accepted, it can easily be executed with the existing capacity.

Required

Analyse the proposal for consideration by management.

Solution 5.3

An abridged Statement of Profit or Loss in respect of 1 000 pairs of shoes:

	R
Sales (1 000 × R60)	60 000
Less: Variable costs	(48 000)
Material	12 000
Labour	24 000
Manufacturing overheads	12 000
Marginal income	12 000

Recommendation: The factory is presently functioning at 60% capacity. Thus, the order can be accepted successfully, since the marginal income of R4 000 can be used to recover part of the fixed cost and the net income will increase by R4 000.

Marketing variable costs have been excluded from the decision as no marketing is required for this order.

Elimination of non-profitable products

The ability to determine the profitability for each product is important for an enterprise. Thus, non-profitable products can be eliminated, and the available capacity used to manufacture more profitable products.

Marginal (variable) costing helps management in making decisions regarding the withdrawal of non-profitable products and the introduction of new products to the product mix of an enterprise.

Example 5.4

The sales budget of Eddie's Ltd for the coming period is as follows:

Product	Sales	Variable cost	Marginal income/(loss)	Committed* fixed costs	Net income
	R	R	R	R	R
A	400 000	200 000	200 000	60 000	140 000
B	500 000	300 000	200 000	75 000	125 000
C	600 000	420 000	180 000	90 000	90 000
D	300 000	270 000	30 000	45 000	(15 000)
E	200 000	210 000	(10 000)	30 000	(40 000)
				300 000	300 000

Management intends to stop the production of products D and E since both will cause losses. The sales of the remaining products cannot be increased because the market is already saturated.

* Committed fixed costs represent fixed costs that will not decrease if production is reduced.

Required

Advise management whether going ahead with the proposed decision will be advisable.

Solution 5.4

Calculation of total profit should production of products D and E be discontinued.

	A R	B R	C R	Total R
Sales	400 000	500 000	600 000	1 500 000
Less: Variable costs	(200 000)	(300 000)	(420 000)	(920 000)
Marginal income	<u>200 000</u>	<u>200 000</u>	<u>180 000</u>	580 000
Less: Fixed costs				(300 000)
Net profit				<u>280 000</u>

Calculation of total net profit if the production of E is discontinued.

	A R	B R	C R	D R	Total R
Sales	400 000	500 000	600 000	300 000	1 800 000
Less: Variable costs	(200 000)	(300 000)	(420 000)	(270 000)	(1 190 000)
Marginal income	<u>200 000</u>	<u>200 000</u>	<u>180 000</u>	<u>30 000</u>	610 000
Less: Fixed costs					(300 000)
Net profit					<u>310 000</u>

Recommendation: The greatest benefit is achieved when the production of product E only is stopped. The marginal income that Product D yields (R30 000) can be used to cover part of the fixed cost. Producing any product in the sales mix that yields a marginal income is worthwhile.

Purchasing or manufacturing of a product/part (outsourcing)

Devoting attention to the following two aspects is important before any decisions are taken regarding this topic.

Capacity

The concept **capacity** indicates *the maximum number of product units that can be produced within a specific period with available facilities*.

If spare capacity is available within an enterprise, an opportunity to generate income will be forfeited if the capacity is not being utilised. The utilisation of spare capacity may affect the profitability of an enterprise in the short term positively.

Short-term decisions are complicated when capacity is fully utilised since the production of the part must occur at the expense of the main product. Alternatively, additional labour, equipment and space must be obtained for this purpose that will affect the total fixed cost and the capacity in the long term.

Specialisation

Some firms specialise in manufacturing certain parts on a large scale at reasonable prices, for example, globes, batteries, and tyres. It is normally not cost-effective to compete against these enterprises and it should only be considered as an option if spare capacity is available and fixed costs do not increase. Example 5.5 serves as an illustration:

Example 5.5

Specialisation Ltd manufactures a series of bicycle parts. The management must decide whether part X31 should be manufactured or purchased. The demand is 10 000 units per annum. The following cost information regarding the 10 000 units is available:

	Manufacturing R	Purchases R
Direct material	20 000	–
Direct labour	50 000	–
Variable overheads	25 000	–
Fixed overheads	10 000	10 000
Purchases of the parts	–	110 000
Leasing of the vacant capacity of the factory	–	(5 000)

Required

Advise management whether they should manufacture or purchase part X31. Show all calculations.

Solution 5.5

Details of part X31 (10 000 units)	Manu- facturing costs R	Pur- chasing costs R	Differ- ence R
Direct material	20 000	–	20 000
Direct labour	50 000	–	50 000
Variable overhead	25 000	–	25 000
Fixed overhead	10 000	10 000	–
Purchasing cost	–	110 000	(110 000)
Leasing of the vacant capacity of the factory	–	(5 000)	5 000
	<u>105 000</u>	<u>115 000</u>	<u>(10 000)</u>

Recommendation: From the above analysis the saving of R10 000 favours manufacturing part X31. Fixed costs have no influence on the decision (non-relevant costs) and can just as well be left out. If the manufacturing of the part cannot be fitted within the existing capacity, additional equipment must be purchased, and the decision becomes a capital investment decision.

Joint products

Time and again manufacturing enterprises that produce joint products must decide whether to sell the products at the split-off point or submit them to further processing.

Example 5.6

Joint Products Ltd manufactures four types of products at a total joint cost of R100 000. The products can be sold at the split-off point or processed further and then sold, as shown in the following table:

Product	Sell before split-off point	Sell after further processing	Costs after split-off point
	R	R	R
A	60 000	150 000	100 000
B	70 000	180 000	90 000
C	40 000	80 000	30 000
D	10 000	15 000	8 000

Required

Calculate the maximum profit that the enterprise can achieve.

Solution 5.6

	Product			
	A R	B R	C R	D R
Sales				
After split-off	150 000	180 000	80 000	15 000
Before split-off	(60 000)	(70 000)	(40 000)	(10 000)
	<u>90 000</u>	<u>110 000</u>	<u>40 000</u>	<u>5 000</u>
Additional income				
Costs after split-off	(100 000)	(90 000)	(30 000)	(8 000)
	<u>(10 000)</u>	<u>20 000</u>	<u>10 000</u>	<u>(3 000)</u>
Profit/(Loss)				

From the above, products A and D must obviously be sold at the split-off point and products B and C must be processed further.

	Total R	Product			
		A R	B R	C R	D R
Sales	330 000	60 000	180 000	80 000	10 000
Costs after split-off point	(120 000)	–	(90 000)	(30 000)	–
	<u>210 000</u>	<u>60 000</u>	<u>90 000</u>	<u>50 000</u>	<u>10 000</u>
Joint costs	(100 000)				
Profit	<u>110 000</u>				

Closing down a factory or continuing with production

The view that a factory should be closed temporarily when making losses in the short term (month-to-month) is not always correct. This is illustrated in Example 5.7:

Example 5.7

The level of operations of Struggle Ltd is currently 40% and at this capacity the operating results are as follows:

Abridged Statement of Profit or Loss for the year ended 30 June 2015

		R	R	%
Sales	40 000 units @	10	400 000	100
Less: Variable costs	40 000 units @	(8)	(320 000)	(80)
Contribution		<u>2</u>	<u>80 000</u>	<u>20</u>
Less: Fixed costs			(160 000)	
Net loss			<u>(80 000)</u>	

Management expects that, because of intensifying competition and rising costs, the sales volume will fall further but the selling price per unit will remain constant. Management intends to reorganise the production layout to bring a cheaper product onto the market. This will take 12 months to complete. The enterprise can save 10% in fixed costs should it cease its activities.

Required

Calculate the sales volume at which point the enterprise must cease its operations. Verify your answer by preparing an abridged Statement of Profit or Loss.

Solution 5.7

	R
Total fixed costs	160 000
Less: Savings if stop immediately (10%)	<u>(16 000)</u>
Total loss if production is ceased	<u>144 000</u>

Calculation of lowest sales volume:

$$\begin{aligned}
 & \frac{\text{Saving if activities ceased}}{\text{Contribution per unit}} \\
 &= \frac{\text{R16 000}}{\text{R2}} \\
 &= 8\,000 \text{ units}
 \end{aligned}$$

Abridged Statement of Profit or Loss

		R
Sales	8 000 × R10	80 000
Less: Variable costs	8 000 × R8	<u>(64 000)</u>
Contribution		16 000
Less: Fixed costs		<u>(160 000)</u>
Net loss		<u>(144 000)</u>

From the above calculations, continuing with production in the short term is clearly profitable for management until the sales volume reaches the 8 000 notch. At this level, the net loss is equal to the total fixed costs less the 10% saving. If the sales volume falls below the 8 000 notch, the activities must stop immediately.

Capital investment decisions

Capital investment decisions normally involve long-term planning, but comparative cost analysis can contribute to this regard, as illustrated in the following example:

Example 5.8

The management of a manufacturing enterprise is considering replacing an old machine that is still productive with a new one that is cost-efficient. The following information about the two machines is available:

	Old machine	New machine
Machine hours per annum	1 500	1 500
Unit production per hour	50	60
Economic life (total years)	10	10
	R	R
Purchase price	22 000	30 000
Production costs:		
Variable overheads per unit	0.04	0.013
Material costs per unit	0.10	0.10
Labour cost per machine hour	2.00	2.50
Selling price per unit	0.30	0.30
Residual value	2 000	–

If the enterprise invests its funds, it can earn 15% per annum and the interest rate on long-term loans is 20% per annum.

Required

Prepare a comparative statement that shows whether the new machine should be purchased, if the full production can be sold and depreciation is written off according to the fixed instalment method.

Solution 5.8: Variable/Marginal income approach

	Old machine	New machine
Production:		
1 500 hours × 50 units	75 000	
1 500 hours × 60 units		90 000
	R	R
Sales:		
75 000 units × R0.30	22 500	
90 000 units × R0.30		27 000
Less: Variable costs	(13 500)	(13 920)
Overheads (75 000 × R0.04; 90 000 × R0.013)	3 000	1 170
Material (75 000 × R0.10; 90 000 × R0.10)	7 500	9 000
Labour:		
1 500 hours × R2.00	3 000	
1 500 hours × R2.50		3 750
Budgeted marginal income per annum	9 000	13 080

continued

Payback period:

The increase of R4 080 per annum (R13 080 – R9 000) is adequate to finance the purchase of the new machine within seven years:

$$\frac{\text{R30 000} - \text{R2 000}}{\text{R4 050}}$$

$$\text{R4 050}$$

= approximately seven years

Solution 5.8: Relevant cost approach

	Old machine R	New machine R
Budgeted marginal income	9 000	13 080
Depreciation: (R22 000 ÷ 10)	2 200	
[(R30 000 – R2 000) ÷ 10]		2 800
Interest (20% – 15%) × (R30 000 – R2 000)		1 400
Budgeted net profit per annum	<u>11 200</u>	<u>17 280</u>
Cost per unit	R	R
R11 200 ÷ 75 000	0.149	
R17 280 ÷ 90 000		0.192

Recommendation: Buying the new machine is more profitable for management.

Note that those investment decisions which use marginal costing are flawed because they ignore the time value of money.

THE INFLUENCE OF LIMITING FACTORS

Often the demand for products is more than an enterprise's production capacity. *Scarce resources may restrict output.* For example, an enterprise has a limited number of machine hours and a limited number of direct labour hours at its disposal. These scarce resources are known as **limiting factors**.

If an enterprise, for example, has only 200 machine hours available to produce two types of products, it is important that the machine hours must be used on the product generating the larger marginal income.

Where limiting factors apply, profit is maximised when the greatest possible marginal income is obtained each time the scarce resources (limiting factors) are used. If no limiting factors exist, only the product generating the larger marginal income must then be produced. Example 5.9 helps to explain the topic more clearly:

Example 5.9

	Products		
	A R	B R	C R
Sales price (per unit)	10	12	15
Less: Variable costs	<u>(6)</u>	<u>(5)</u>	<u>(10)</u>
Contribution	<u>4</u>	<u>7</u>	<u>5</u>
Contribution ratio	40%	58%	33%

From the above example, it appears that Product B is the most profitable, with a marginal income of R7 per unit. If the example is expanded further to include the number of machine hours required to manufacture the products, the position changes as follows should machine hours be a limiting factor:

Solution 5.9

	A	Products B	C
Marginal income per unit	R4.00	R7.00	R5.00
Machine hours per unit	1	3	2
Marginal income per machine hour	R4.00	R2.33	R2.50
Rank	1	3	2

Product A, giving a contribution of R4 per machine hour, which is the limiting factor, is the most profitable product to manufacture.

Where more than one limiting factor is present, resorting to mathematical equations or graphical solutions is necessary. This situation is discussed in the topic on linear programming.

LINEAR PROGRAMMING (LP)

Where more than one limiting factor is present, the method previously outlined cannot easily establish the optimum production programme. In such circumstances the optimal output programme must be established by resorting to a mathematical technique, such as linear programming.

Linear programming models (*LP models*) assume that all costs can be divided into fixed and variable components and that linear relationships exist between certain variables.

The application of linear programming is illustrated in Example 5.10:

Example 5.10: One limiting factor

An organisation currently manufactures two products, namely P and Q. The following information regarding the two products is as follows:

	P R	Q R
Selling price per unit	285	315
Less: Variable costs	(180)	(195)
Direct material	60	30
Direct labour	90	120
Manufacturing overhead	30	45
Contribution per unit	105	120

Additional information is as follows:

	P	Q
Direct material	4 kg	2 kg
Direct labour	3 hours	4 hours
Machine hours	2	3

The enterprise has 4 320 hours per annum available. Material is freely available and enough machine hours will be available to provide for the demand of the enterprise. The demand for the products is unlimited.

Required

Calculate the number of units P and Q that must be manufactured to earn the optimal marginal income.

Solution 5.10

	P	Q
Contribution per unit	R105	R120
Direct labour hours per unit	3 hours	4 hours
Contribution per hour		
$\frac{R105}{3 \text{ hours}} \div \frac{R120}{4 \text{ hours}}$	R35	R30
Ranking according to contribution per labour hour	1	2
Since the demand for the products is unlimited, all available labour hours are utilised to manufacture product P.		
Maximum available labour hours:		4 320 hours
Number of labour hours needed per product P:		3 hours
Number of units of product P that must be manufactured:	$\frac{4\,320 \text{ hours}}{3 \text{ hours}} = 1\,440 \text{ units}$	

Example 5.11: Two limiting factors

Based on the information that applies in example 5.10 assume the following limitations:

Maximum direct labour hours available:	4 320 hours
Maximum sales regarding product P:	1 260 units

Required

Calculate the optimum product mix.

Arithmetic solution 5.11

Since product P generates the largest marginal income per machine hour, the available machine hours will be used to manufacture product P.

$$\begin{aligned} \text{Product P} &= \frac{4\,320 \text{ machine hours}}{3 \text{ machine hours}} \\ &= 1\,440 \text{ units} \end{aligned}$$

The maximum demand for product P is 1 260 units.

Machine hours needed to manufacture product P:

$$1\,260 \text{ units} \times 3 \text{ hours} = 3\,780 \text{ hours}$$

Product composition:

$$\text{Product P} = 1\,260 \text{ units}$$

$$\text{Product Q} = \frac{4\,320 \text{ hours} - 3\,780 \text{ hours}}{4 \text{ hours}} = 135 \text{ units}$$

Graphical solution 5.11

If all the available labour hours will be used only to manufacture product P, then:

$$P = 1\,440 \text{ units } (4\,320 \text{ labour hours} \div 3 \text{ labour hours})$$

$$Q = 0 \text{ units}$$

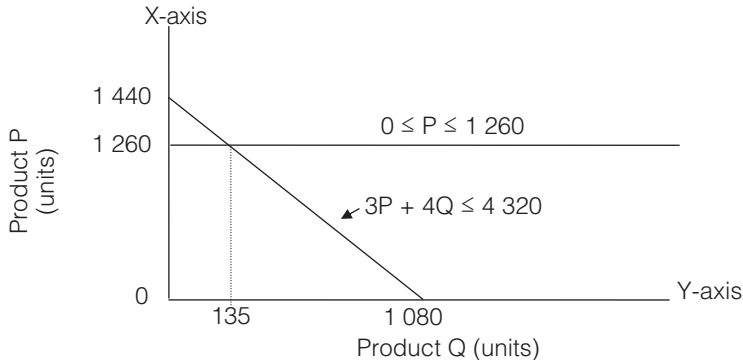
If all the available labour hours will be used only to manufacture product Q, then:

$$Q = 1\,080 \text{ units } (4\,320 \text{ labour hours} \div 4 \text{ labour hours})$$

$$P = 0 \text{ units}$$

The enterprise can manufacture either 1 440 units of product P or 1 080 units of product Q, or any linear composition of P and Q in a fixed relationship of $3P = 4Q$.

The graphical solution is as follows:



The answers from both the arithmetical and graphical solutions are the same, namely:

Product P = 1 260 units (X-axis)

Product Q = 135 units (Y-axis)

The influence of limiting factors in the previous example is of such a nature that the problem can be solved with a simple calculation. Example 5.12 is a problem with at least three limiting factors and therefore it can only be solved algebraically or graphically:

Example 5.12

Based on the information that applies in examples 5.10 and 5.11 assume the following constraints:

Maximum machine capacity	4 140 hours
Maximum direct labour hours available	4 320 hours
Maximum direct material	5 160 kg
Maximum sales regarding product P	1 260 units

Required

- Formulate the objective function that will give the maximum marginal income and also the linear programming model.
- Calculate the optimum product composition by applying the algebraic method.
- Calculate the optimum product composition by applying the graphical method. Verify the correctness of your answer.

continued

Solution 5.12: Linear programming model

Objective functions (optimum marginal income):

$105P + 120Q = M$ subjective to the following constraints:

Labour constraint	$3P + 4Q \leq 4\,320$
Material constraint	$4P + 2Q \leq 5\,160$
Machine capacity constraint	$2P + 3Q \leq 4\,140$
Maximum and minimum sales constraints	$0 \leq P \leq 1\,260$
Minimum sales constraints	$Q \geq 0$

The objective function is the most important equation that must be formulated during the formulation of the linear programming model. The marginal income of R105 of P multiplied by the number of units of P (assume the units = x on the X-axis) plus the marginal income of R120 of Q multiplied by the number of units of Q (assume the units = y on the Y-axis) will yield the optimal marginal income.

The labour constraint means that three hours per product for the manufacturing of P and four hours per product for the manufacturing of Q can be used with a maximum of 4 320 labour hours. The $\leq$ sign suggests that only 4 320 or fewer labour hours can be used.

The same principles apply for the material and machine inputs.

The maximum and minimum inputs of product P ($0 \leq P \leq 1\,260$) mean that only a positive number of units of product P can be manufactured and that 1 260 units or fewer of product P can be manufactured and sold. Likewise, no less than nil ($Q \leq 0$) units of product Q can be manufactured.

Solution 5.12: Algebraic method

(The solution that will satisfy all restraints is a point in the area ABCDE in Diagram 5.6 and therefore machine capacity is not relevant in the determination of the optimal production programme.)

$3P + 4Q$	$= 4\,320$		(1)
$4P + 2Q$	$= 5\,160$		(2)
$8P + 4Q$	$= 10\,320$		(3) (2) $\times 2$
$3P + 4Q$	$= 4\,320$		(1)
$5P$	$= 6\,000$		(3) – (1)
P	$= 1\,200$		

Substitute the value of P with 1 200 in (1)

$3P$	$+ 4Q$	$= 4\,320$
$3(1\,200)$	$+ 4Q$	$= 4\,320$
	$4Q$	$= 4\,320 - 3\,600$
	Q	$= 180$

The optimum production composition can be determined graphically as follows:

Material constraint

The input $4P + 2Q \leq 5\,160$ means that a maximum of 1 290 units ($5\,160 \text{ kg} \div 4 \text{ kg}$) of product P can be manufactured if no units of Q are manufactured. Alternatively, 2 580 units ($5\,160 \text{ kg} \div 2 \text{ kg}$) of product Q can be manufactured if no units of P are manufactured. Thus, the following conclusion can be drawn:

When $Q = 0$, $P = 1\,290$

When $P = 0$, $Q = 2\,580$

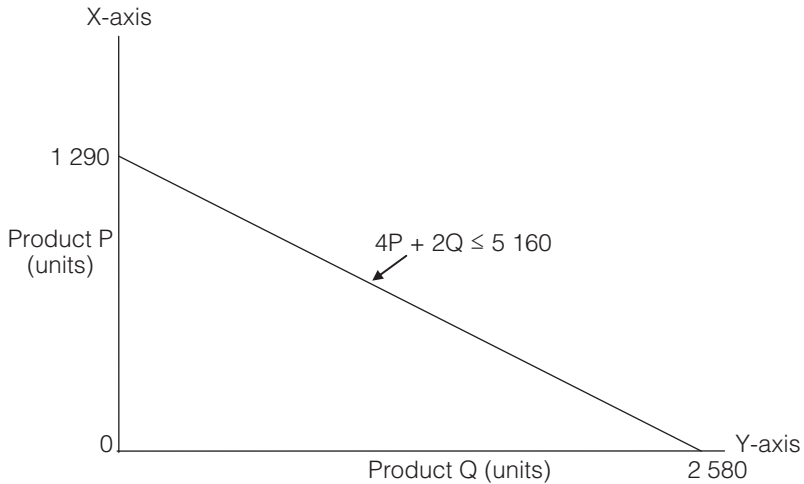


Diagram 5.2

Labour constraint

The input $3P + 4Q \leq 4\,320$ means that a maximum of 1 440 units (4 320 hours $\div$ 3 hours) of product P can be manufactured if no products of Q are manufactured. Alternatively, 1 080 units (4 320 hours $\div$ 4 hours) of product Q can be manufactured providing no production for P takes place. Thus, the following conclusion can be drawn:

When $Q = 0$, $P = 1\,440$

When $P = 0$, $Q = 1\,080$

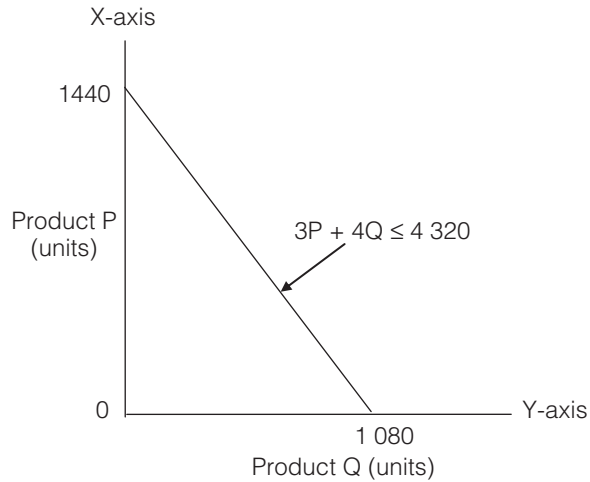


Diagram 5.3

Machine capacity constraint

The input $2P + 3Q \leq 4\,140$ means that a maximum of 2 070 units (4 140 hours $\div$ 2 hours) of P can be manufactured if no production of Q takes place. Alternatively, 1 380 units (4 140 hours $\div$ 3 hours) of Q can be manufactured if no production of P takes place. Thus, the following conclusion can be drawn:

When $Q = 0$, $P = 2\,070$

When $P = 0$, $Q = 1\,380$

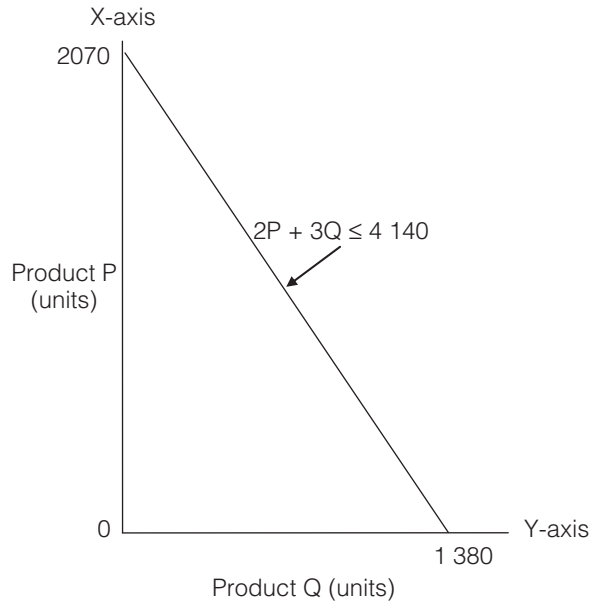


Diagram 5.4

Sales constraint

The sales of product P ($0 \leq P \leq 1\,260$) cannot exceed 1 260 units and cannot be fewer than no units.

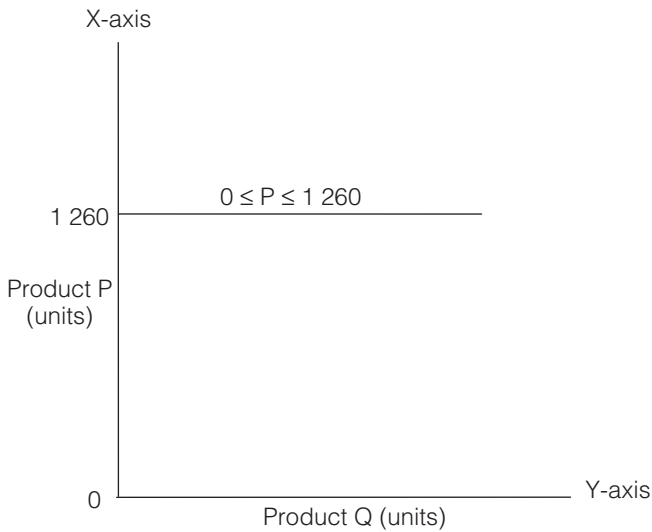


Diagram 5.5

Graphical solution

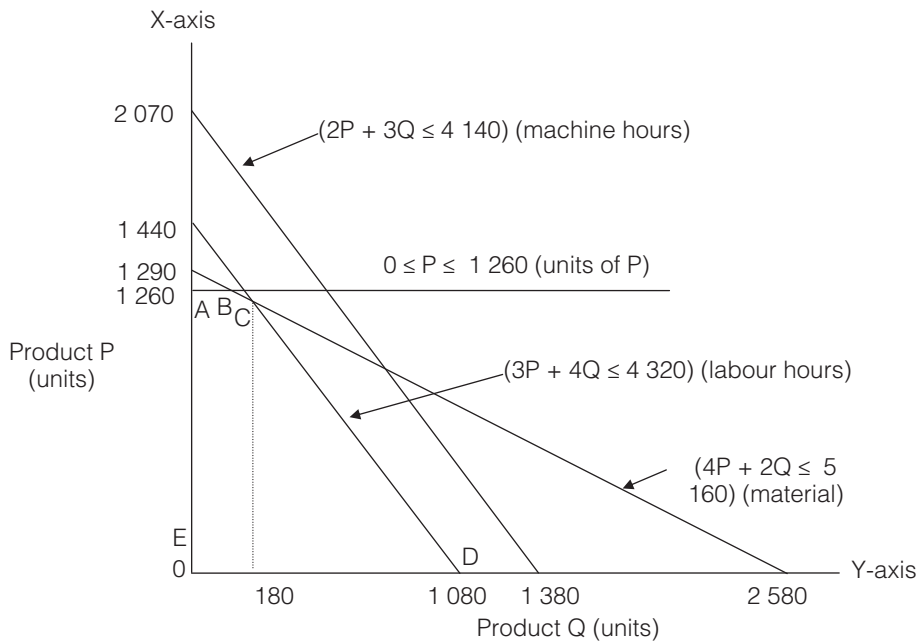


Diagram 5.6

Verification of the results in the preceding graph:

Point on graph	Product P	Product Q	Objective function: 105P + 120Q		R
A	1 260	0	(1 260 × R105) +	(0 × R120) =	132 300
B	1 260	90	(1 260 × R105) +	(90 × R120) =	143 100
C	1 200	180	(1 200 × R105) +	(180 × R120) =	147 600*
D	0	1 080	(0 × R105) +	(1 080 × R120) =	129 600
E	0	0	(0 × R105) +	(0 × R120) =	0

* Point C with 1 200 units of product P and 180 units of product Q shows the production composition with the maximum marginal income of R147 600.

UNCERTAINTY IN DECISION-MAKING

The uncertainty of the future often affects management decisions. The business environment we live in is full of uncertainties and it is difficult to predict the future. Technological advances take place at a swift rate with the result that an enterprise never knows when a competitor will introduce a better product than its own brand.

Uncertainty is a situation that prevents decision-makers from predicting the future with certainty because several results are possible. Planning in these circumstances should therefore be thorough and the enterprise must be prepared to take timely alternative action should expectations not be met.

A model is normally compiled to help management during the planning process. A model is usually a representation of a specific situation and should take uncertainty into account. Various alternative actions can be simulated with the model to make management aware of the results and consequences of each alternative action.

Historical information is mostly used to help the decision-maker in the projection of estimations. The compilation of a decision model should be approached as follows:

Criterion of the decision-maker: Normally the important criterion is to maximise profits or to minimise costs.

Number of actions that must be executed: *Actions* are the number of alternatives from which management can choose.

Number of events that may occur: *Events* are the number of possible incidents and are normally associated with probability.

Determination of the probability of events: This indicates the probability of an event occurring (normally expressed as a decimal number between 0 and 1 – an explanation will follow under the relevant topic).

Determination of the possible results: This indicates the results that are possible, based on the criteria of the decision-maker, actions, and events.

This unit will discuss probability analysis, payoff tables and decision trees as management accounting techniques.

PROBABILITY IN DECISION-MAKING

Probability is an indication of a possibility or chance that certain recurring events may happen again. It is expressed as a decimal figure between 0 and 1. If a certain event is definitely going to occur, the probability will be equal to 1 and if it is impossible the probability will be equal to 0.

If the probability that a specific event might occur is between 0 and 1 (not exactly 0 and 1) then the decision-maker is not sure whether the event is going to occur, and a decision is based on uncertainty. If the probability of rain is 0.4, it means that the prospect of rain is 40%.

When the probability of an event is based on historical data, for example, sales and production statistics, and the circumstances can be repeated, it is known as **objective probability**. Personal prejudice does not influence it.

If no historical information is available and probability is based on management opinion, it is known as **subjective probability**. Subjective probability is based on personal experience, premonition, and prejudice. It is unlikely that subjective probability will be correctly estimated as a rule.

The use of *probabilities* in decision-making is illustrated as follows:

Example 5.13

Red Rooster's marginal income on hamburgers is R3 per unit. The following table shows the estimated monthly demand for hamburgers and the probability that the demand will be realised.

Quantity	Probability
1 000	0.20
2 000	0.25
3 000	0.30
4 000	0.15
5 000	0.10

Required

Calculate the estimated average monthly marginal income for hamburgers.

Solution 5.13

(1) Demand (month)	(2) MI* unit R	(3) Conditional value Ax (1) × (2) R	(4) Probability Px	(5) Expected value A (3) × (4) R
1 000	3	3 000	0.20	600
2 000	3	6 000	0.25	1 500
3 000	3	9 000	0.30	2 700
4 000	3	12 000	0.15	1 800
5 000	3	15 000	0.10	1 500
			<u>1.00</u>	<u>8 100</u>

* Marginal income

The **expected value** is *the arithmetic mean of the result of a range of probabilities*. The expected value of R8 100 calculated above considers a range of possible results to connect to the outcome a conditional value.

During decision-making the enterprise must consider both profitability and risk. The most common method to measure risk is to apply the standard deviation method.

The **standard deviation** is *the dispersion of the conditional values around the expected value*, in other words, the difference between the conditional values and the expected value. The standard deviation is calculated as follows:

$$\delta = \sqrt{(Ax - A)^2 Px}$$

Where:

- δ = standard deviation
- Ax = conditional value
- A = expected value
- Px = probability of each result

The computation for the standard deviation of the expected value in the previous example is as follows:

Standard deviation				
(1) Conditional value Ax R	(2) Deviation from expected value Ax – A R	(3) Squared deviation (Ax – A)² R	(4) Probability Px	(5) Variance (3) × (4) R
3 000	(5 100)	26 010 000	0.20	5 202 000
6 000	(2 100)	4 410 000	0.25	1 102 500
9 000	900	810 000	0.30	243 000
12 000	3 900	15 210 000	0.15	2 281 500
15 000	6 900	47 610 000	0.10	4 761 000
Variance (δ^2)				13 590 000
Standard deviation (δ) = $\sqrt{13\,590\,000}$ = R3 686				

The greater the standard deviation (dispersion), the greater the risk will be that the actual value will differ from the expected value (marginal income). This will not cause problems if the deviation realises above the expected marginal income, but it will if the deviation realises beneath the expected marginal income.

Comparing alternatives by simply comparing standard deviations (comparing absolute values) will not result in a relative comparison. Alternatives with larger expected values are expected to have larger standard deviations than alternatives with smaller expected values. Comparing absolute values means that standard deviations are compared directly with each other. Comparing relative values means that standard deviations are compared with each other in relationship to their expected values.

Comparing the coefficient of variation between alternatives can solve this problem. The **coefficient of variation** is *the ratio of the standard deviation to its expected value*

and is calculated by dividing the standard deviation by the expected value. Red Rooster can calculate its coefficient of variation as follows:

Coefficient of variation

$$\begin{aligned}
 \text{CV} &= \frac{\text{Standard deviation}}{\text{Expected value}} \\
 &= \frac{\text{R3 686}}{\text{R8 100}} \\
 &= 0.46
 \end{aligned}$$

The risk of a product with a marginal income of R70 000 and a standard deviation of R7 000 is less ($\text{R7 000} \div \text{R70 000} = 0.10$) than the risk for the hamburgers with a marginal income of R8 100 and a standard deviation of R3 686 ($\text{R3 686} \div \text{R8 100} = 0.46$).

PAYOFF TABLES AND DECISION TREES

Situations where single decisions are taken have been emphasised until now. Payoff tables and decision trees are useful tools in helping the decision-maker when he must make a series of decisions at different stages and where one decision induces the next.

Payoff tables

A **payoff table** is a summary of the expected actions, results and probabilities of an event during decision-making. Example 5.14 illustrates the application of payoff tables as follows:

Example 5.14

An enterprise manufactures and sells a perishable product. The following costing information and maximum daily demand are available:

	R
Selling price per unit	20
Less: Variable costs	(10)
Marginal income per unit	<u>10</u>

Products that the enterprise does not sell during the day must be removed at R0,10 per unit. A survey of sales during the previous 150 days shows the following:

Demand units	Number of days	Probability
100	10	0.07
200	30	0.20
300	50	0.33
400	40	0.27
500	20	0.13
	<u>150</u>	<u>1.00</u>

Required

Calculate the number of units to be manufactured daily to provide maximum profits by using a payoff table.

Solution 5.14

Daily production (units)	Daily sales conditional value					Expected value of alternative
	100 R	200 R	300 R	400 R	500 R	
100	1 000*	1 000	1 000	1 000	1 000	1 000
200	(10)**	2 000	2 000	2 000	2 000	1 859
300	(1 020)	990	3 000	3 000	3 000	2 317
400	(2 030)	(20)	1 990	4 000	4 000	2 111
500	(3 040)	(1 030)	980	2 990	5 000	1 362***
Probabilities	0.07	0.20	0.33	0.27	0.13	

* 100 units × R10 marginal income per unit = R1 000 conditional value.

** (100 units × R10 marginal income) – [100 units × (R10 variable cost + R0.10 removal cost)] = R10 loss on the day's transactions.

*** (0.07 × R(3 040)) + (0.20 × R(1 030)) + (0.33 × R980) + (0.27 × R2 990) + (0.13 × R5 000) = R1 362 expected value.

The standard deviation and coefficient of variation can also be calculated for each alternative in this example. The standard deviation and coefficient of variation with the largest expected value (300 units) will be calculated as an example as follows:

Conditional value	Deviation from expected value	Squared deviation	Probability	Weighted value
Ax R	(Ax – A) R	(Ax – A) ² R	Px	(Ax – A) ² Px R
(1 020)	(3 337)	11 135 569	0.07	779 490
990	(1 327)	1 760 929	0.20	352 186
3 000	683	466 489	0.33	153 941
3 000	683	466 489	0.27	125 952
3 000	683	466 489	0.13	60 644
				(Ax – A) ² Px = <u>1 472 213</u>
Standard deviation (δ) = $\sqrt{1\,472\,213} = \text{R}1\,213$				
Coefficient of variance = $\frac{\text{Standard deviation}}{\text{Expected value}}$				
= $\frac{\text{R}1\,213}{\text{R}2\,317}$				
= 0.52				

Additional information is sometimes necessary to ensure that the best alternative is identified. For example, the enterprise can conduct a market survey that may improve the prediction of customer demand, but a market survey may be very expensive. The cost of the additional information must be weighed against the result of the more accurate information.

The **expected value of perfect information** is the difference between the expected value with perfect certainty and the expected value of the best strategy under uncertainty.

Using the information of the previous example, the calculation of the expected value of perfect information is as follows:

Solution				
Unit sales (per day)	Marginal income per unit R	Conditional value R	Probability	Expected value R
100	10	1 000	0.07	70
200	10	2 000	0.20	400
300	10	3 000	0.33	990
400	10	4 000	0.27	1 080
500	10	5 000	0.13	650
Expected value with perfect certainty				3 190
Less: the expected value of the best strategy under uncertainty				(2 317)
Expected value of perfect information				<u>873</u>

Decision trees

A **decision tree** is a diagrammatic representation of the alternative action plans available and the possible results from each alternative. The legend of decision trees is as follows:

- ☐ a point when a choice must be made between alternatives; or
- ☐ a point when different events may occur.

A decision tree can be constructed as follows:

Example 5.15

Venture Ltd maintained an activity level of 80% in the past. Currently the enterprise is using only 60% of its factory potential that results in a utilisation loss of R100 000 per annum.

To recover the loss to some extent, the enterprise is planning the manufacturing and marketing of either Product M or Product N. This effort will not result in any further fixed costs.

The planning process provided the following information:

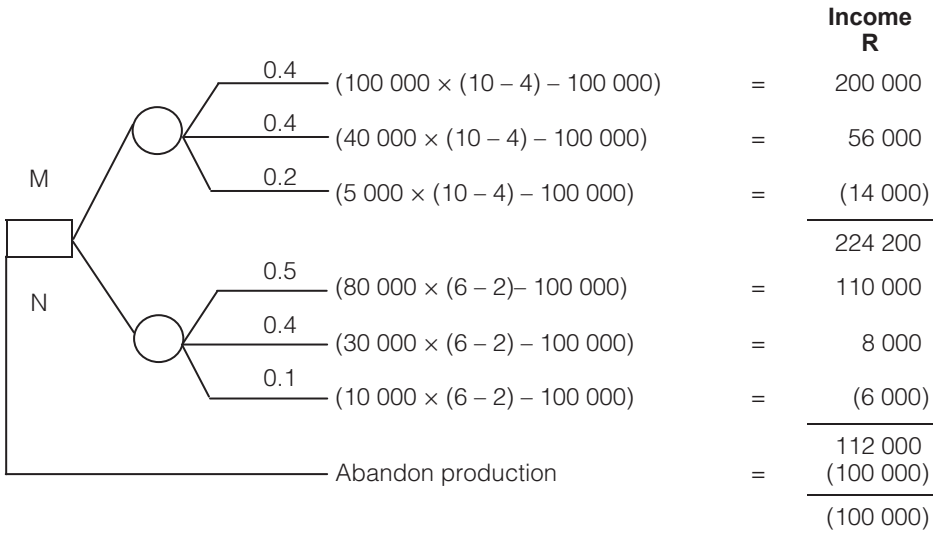
	Number of units	Probability
Sales of product M:	100 000	0.4
	40 000	0.4
	5 000	0.2
		<u>1.0</u>
	Number of units	Probability
Sales of product N:	80 000	0.5
	30 000	0.4
	10 000	0.1
		<u>1.0</u>
	Product M R	Product N R
Selling price per unit	10	6
Production cost per unit (variable)	4	2

Required

Draw a decision tree and determine the expected values.

Solution 5:15

Decision tree



The event that will show the greatest expected value is the choice. Considering the above, product M will obviously be the right product.

SUMMARY

In this chapter differential costs, opportunity costs, relevant costs, imputed costs and sunk costs were defined in terms of their importance for short-term decision-making. We also discussed various types of short-term decisions which enterprises will be confronted with. These include the determination of prices, accepting a special order or non-elimination of non-profitable products, purchasing, or manufacturing a product, decisions on joint products, closing down or continuing production and capital investment decisions.

The influence of limiting factors was also illustrated. Finally, linear programming as a short-term decision-making tool was also discussed.

When considering probabilities, the expected value considers a range of possible results rather than using a conditional value. Standard deviation is used as a measure of risk. The coefficient of variation is useful when comparing the risk of different alternatives.

Payoff tables and decision trees are useful tools in determining the best strategy in uncertain conditions.

PERSPECTIVES ON COSTING

Knowledge

You should know:

- ☐ Explain the cost concepts involved in the theory of short-term decision-making.
- ☐ Understand the different types of short-term decisions that can be made using relevant costing.

- ☐ Short-term decision-making depends on the concept of relevant costing. Relevant costing means future cash flows will vary depending on the decision that is made now.
- ☐ When accepting a special order, factors such as available production capacity, possible changes in fixed costs and current selling prices that may affect the acceptance of a special order, must be taken into consideration.
- ☐ Marginal costing helps management to take decisions regarding the withdrawal of non-profitable products and the introduction of new products, the purchasing or manufacturing of a product, the closing down or continuation of production processes and capital investment decisions.
- ☐ When more than one limiting factor is present, the optimal production combination must be established by resorting to a mathematical technique, such as linear programming.
- ☐ Historical information is mostly used to help the decision-maker in the projections of estimations.
- ☐ The probability of an event is based on historical data that is known as objective probability.
- ☐ Probability is only based on management opinion and not on historical or other available information. This is known as subjective probability.
- ☐ Comparing absolute values means that standard deviations are directly compared to each other.
- ☐ Comparing relative values means that standard deviations are compared to each other in relationship to their expected values.
- ☐ Payoff tables and decision trees are useful tools in helping the decision-maker when a series of decisions at different stages must be made, where one decision induces the next.

Skills

You should be able to:

- ☐ calculate the differential costs between alternatives;
- ☐ analyse special order proposals;
- ☐ advise management regarding the elimination of possible non-profitable products or the introduction of new products;
- ☐ advise management regarding production or outsourcing decisions;
- ☐ determine the optimal marginal income in an environment where one, two, three or four limiting factors exist;
- ☐ formulate the objective function;
- ☐ calculate the optimum product composition by applying the algebraic and graphical methods;
- ☐ verify the results in graphical solutions;
- ☐ calculate expected values, standard deviations and coefficients of variation; and
- ☐ prepare decision trees and decision tables to assist decision-makers.

KEY TERMS AND CONCEPTS

Capacity	149	Objective probability	164
Decision tree	168	Opportunity cost	145
Differential cost	144	Payoff tables	166
Expected value	165	Probability	164
Expected value of perfect information	167	Relevant cost	145
Imputed costs	146	Standard deviation	165
Limiting factors	154	Subjective probability	164
Linear programming	155	Sunk cost	146
Non-relevant cost	145	Uncertainty	163

REVIEW PROBLEMS

Problem 5.1

You are the financial manager of Rip-Current (Pty) Ltd a highly successful company manufacturing a wide range of casual beach dresses. The company's success has largely been attributed to reliable supply and service to their retail customers. The company operates an absorption costing system.

A special order has been received from CramBook (Pty) Ltd, a new, fast growing retail shop. CramBook require 2 500 surf dresses, a new design for their summer range. They are prepared to pay R80 per dress and require delivery of the dresses within one month. In order to manufacture these dresses in terms of CramBook's requirements, the production manager of Rip-Current has estimated the following resources per dress:

	Per dress
Direct materials	
Cotton A – Metres	1.5
Cotton B – Metres	0.5
Direct skilled labour hours	0.5
Machine hours	1.5

Diagram 5.6

	Per dress
Selling price	R150
Direct material	R80
Direct skilled labour (Variable)	R60
Fixed manufacturing overheads	R90

Fixed manufacturing overheads are absorbed on a machine hour basis at a rate of R45 per machine hour. Should the order be accepted, a special dye machine will be rented for the month at a cost of R15 000. No other additional fixed manufacturing or selling and administration overhead costs will be incurred if the special order is accepted.

Required

Evaluate whether the special order would deliver a positive cash flow to the company

Solution 5.1

Revenue	(2 500 × R80)	R 200 000.00
Direct Material – Cotton A		
Metres required after shrinkage	$2\,500 \times (1.5 \div 0.9) = 4\,166.67$	
Sales proceeds - Wastage	10 Opportunity cost	
Additional dye cost	<u>3</u> Differential cost	
Relevant cost per metre	<u>13</u>	
Less: Total relevant cost for Cotton A	$4\,166.67 \times 13$	(54 166.71)
Purchase cost of R25 is a sunk cost		
Direct Material – Cotton B		
Metres required	$2\,500 \times 0.5 = 1\,250$	
Less: Total relevant cost for Cotton A	$1\,250 \times 50$	(62 500.00)
Purchase cost of R45 is a sunk cost		
Skilled labour cost		
Hours needed from production	$2\,500 \times 0.5 = 1\,250$	
Option 1		
Overtime labour cost	$2\,500 \times 0.5 \times 45 = 56\,250$	
Option 2		
Contribution per dress	$(150 - 80 - 60) = R10$	
Add: skilled labour	$10 + 60 = R70$	
Skilled labour hours per dress	$60 \div 30 = 2$	
Cost per hour	$R70 \div 2 = R35$	
Opportunity cost of giving up dresses	$1\,250 \times R35 = R43\,750$	
Giving up dresses is cheaper than using overtime labour		
Less: Opportunity cost of giving up dresses		(43 750.00)
Fixed manufacturing costs is irrelevant		
Less: Rent of special dye machine		(15 000.00)
Net cash inflow / (outflow)		24 583.29

Problem 5.2

Scurry (Pty) Ltd has been offered a contract which, if accepted, would significantly increase next year's activity levels. The contract requires the production of 20 000 kg of product XX and specifies a contract price of R100 per kg. The resources used in the production of each kg of XX include:

	Resources per kg of XX		Cost per hour
Labour:	Grade 1	2 hours	R4
	Grade 2	6 hours	R2
Material:	A	2 units	
	B	1 litre	

Grade 1 labour is highly skilled and is currently under utilised in the firm. It is Scurry's policy to continue to pay Grade 1 labour in full. Acceptance of the contract would reduce the idle time of Grade 1 labour. Idle time payments are treated as non-production overheads.

Grade 2 is unskilled labour, with a high turnover, and may be considered a variable cost.

The materials required to fulfil the contract would be drawn from those materials already in stock. Material A is widely used within the firm and any usage for this contract will necessitate replacement. Material B was purchased to fulfil an expected order which was not received; if material B is not used for the contract, it will be sold. For accounting purposes, FIFO is used. The various values and costs for A and B are:

	A R per unit	B R per unit
Carrying value	8	30
Replacement cost	10	32
Net realisable value	9	25

A single recovery rate for fixed factory overheads is used throughout the firm, even though some fixed production overheads could be attributed to single products or departments. The overhead is recovered per productive labour hour, and initial estimates of next year's activity, which excludes the contract, show fixed production overheads to be R600 000, with productive labour hours of 300 000. Acceptance of the contract would increase fixed production overheads by R228 000. Variable production overheads are accurately estimated at R3 per productive labour hour on all products.

Acceptance of the contract would be expected to encroach on the sales and production of another product, YY, which is also made by Scurry. It is estimated that sales of YY would then decrease by 5 000 units in the next year only. However, this forecast reduction in sales of YY would enable fixed factory overheads of R58 000 to be avoided. Information on YY is as follows:

	Per unit
Sales	R70
Labour – Grade 2	4 hours
Materials – relevant variable costs	R12

Required

Advise Scurry (Pty) Ltd if the contract should be accepted or rejected. Support your answer with suitable calculations.

Solution 5.2

		R	R
Sales revenue	20 000 × 100		2 000 000
Less: Relevant costs			(1 980 000)
Grade 1 labour	Irrelevant	—	
Grade 2 labour	20 000 × 6 × 2	240 000	
Material A	20 000 × 2 × 10	400 000	
Material B	20 000 × 1 × 25	500 000	
Variable overheads	20 000 × (6 + 2) × 3	480 000	
Less: Increase fixed costs		228 000	
Contribution of YY	70 – (4 × 2) – 12 – (4 × 3) = R38		
Less: Lost contribution	(5 000 × 38)	(190 000)	
Add: Fixed cost saving		58 000	
Relevant income			20 000

Scurry (Pty) Ltd should accepted the contract

Problem 5.3

KwaZulu Cheeses Ltd produces a variety of homemade cheeses. Management has established that, due to the drought currently experienced throughout the country, the milk supply for the coming year will be limited to 80 000 litres. Budgeted sales prices, variable production cost and demand are as follows:

Flavours	Sales price per litre (R)	Variable production cost per litre (R)	Litres of milk required to produce 1 kg	Total demand (kg)
Gouda (G)	18	8	4	9 000
Mozzarella (M)	20	9	5	6 000
Blue cheese (B)	24	12	4	7 000
Fetta (F)	25	12	3	4 000
Cheddar (C)	20	12	2	2 000

Required

Advise the management of KwaZulu Cheeses on the optimal production mix for the coming year.

Solution 5.3

Contribution per limiting factor calculation

	G	M	B	F	C
Sales price	R18	R20	R24	R25	R20
Less: Variable production cost	(8)	(9)	(12)	(12)	(12)
	10	11	12	13	8
Contribution per unit					
Limiting factor	4	5	4	3	2
Contribution per limiting factor	R2.50	R2.20	R3.00	R4.33	R4.00
Ranking	4	5	3	1	2

Product schedule

Milk available		=	80 000
1 Fetta	3 × 4 000	=	(12 000)
		Litres left	68 000
2 Cheddar	2 × 2 000	=	(4 000)
		Litres left	64 000
3 Blue cheese	4 × 7 000	=	(28 000)
		Litres left	36 000
4 Gouda	4 × 9 000	=	(36 000)
			0
5 Mozzarella	Cannot be produced due to the milk shortage		

Problem 5.4

Leopard Brands Ltd, which produces and sells a variety of household consumables, has decided to expand its product range.

Several products have been developed but only one new product will be introduced for the coming summer. The product selected is a new anti-aging cream which will be packaged in a portable tube. The anti-aging cream, called Forever-Young, will be sold to wholesalers in boxes of 24 tubes for R9 000 per box.

No additional fixed cost will be incurred to produce the anti-aging cream, but R100 000 of the company's fixed cost will be absorbed by the product.

The following information is available:

Estimated sales and production is	10 000 boxes
Total production cost of MOIST LIPS per box (including the cost of tubes and lip balm):	
Direct labour	R25 per box
Direct materials	R35 per box
Manufacturing overheads (variable and fixed)	R15 per box
Tubes purchased from an external supplier	R11 per box

Purchasing tubes from an external supplier will decrease direct labour and variable overheads by 9% and direct material cost by 15%.

Required

Advise management, based on quantitative factors, on whether Leopard Brands should make or buy the tubes. Show all workings.

Solution 5.5

Relevant cost to make

	R
Direct material	35
Direct labour	25
Manufacturing overhead – Variable	5
Manufacturing overhead – Fixed (irrelevant)	–
Total	65

Relevant cost if tubes are purchased

	R
Direct material (35 × 85%)	28.00
Direct labour (25 × 91%)	22.75
Manufacturing overhead – Variable (5 × 91%)	4.55
Manufacturing overhead – Fixed (irrelevant)	–
Tubes	11.00
Total	<u>66.30</u>

Thus, make tubes internally as it will cost less.

EXERCISES

5.1 Special mail order

Protea Ltd's current activity level is 55%. The operating results for the past accounting period at a capacity of 55% show the following:

	R
Sales 200 000 @ R4.95	990 000
Less: Total cost	(994 000)
Variable manufacturing costs	450 000
Fixed manufacturing costs	200 000
Less: Selling and distribution costs:	
Variable	(80 000)
Fixed	(110 000)
Less: Administrative costs:	
Variable	(64 000)
Fixed	(90 000)
Net loss	<u>(4 000)</u>

A mail-order organisation offers to purchase 20 000 units at R3.50 each. If the order is accepted, variable administration costs will increase by only R5 000 and packaging costs by R6 000.

Some members of the board believe that if the selling price were reduced by 5% and R10 000 spent on advertising, the activity level would increase to 66%. The precarious position of the company would then improve so that using the mail-order organisation's offer would not be necessary.

Required

Calculate the result of the following two alternatives and submit the matter for consideration by management:

- At present capacity *plus* mail-orders.
- At 66% capacity *without* mail-orders.

5.2 Cost-volume-profit analysis

A manufacturing company manufactures and sells three types of products. The following information is available:

	Product A R	Product B R	Product C R
Sales:			
25 000 @ R2.00	50 000		
35 000 @ R1.50		52 500	
40 000 @ R1.25			50 000
Variable costs	20 000	26 250	30 000

The fixed cost for the period amounts to R30 000.

Required

- Calculate the value of break-even sales.
- Calculate the value of sales if a profit of R50 000 is to be made (the sales mix ratio will remain the same).
- Calculate the profit, if total sales amount to R200 000 and the sales mix ratio remains the same.
- Calculate the maximum profit if the product volume of the most profitable of the three products was increased by 10% without any change in fixed costs.

5.3 Calculation of maximum profit – shortage of raw material

A manufacturing enterprise manufactures ball-bearings using a special type of metal as raw material. The following budget was compiled for the coming year:

	Ball-bearings		
	SP4 R	SP5 R	SP6 R
Raw materials	12 000	8 000	15 000
Labour	5 000	3 000	6 000
Variable overheads	1 000	600	1 200
Fixed overheads	2 000	1 200	2 400
Selling value	24 000	16 000	30 000
Units sold	<u>2 000</u>	<u>2 000</u>	<u>2 000</u>

After the budget had been compiled, the full demand for raw materials could not be met. Due to the shortage of raw materials only 75% of the raw materials required could be supplied. However, despite the shortage, the unit price of raw materials remains unaltered.

Required

Calculate the product mix that will result in the maximum profit for the enterprise given the shortage of raw materials. The value of raw material and work-in-process opening and closing inventory can be ignored.

5.4 Joint products, most profitable plan of action

Mini Ltd manufactures three joint products in the same production process. All three products can be sold either at or after the split-off point. If the products were to be processed further, no additional fixed costs would result. The following information has been collected for the budget for the coming financial period:

Product	Units	At split-off point		After split-off point	
		Joint costs	Sales value	Costs	Sales value
		R	R	R	R
Z1	1 000	?	40 000	10 000	50 000
Z2	2 500	?	80 000	25 000	115 000
Z3	1 500	?	50 000	15 000	60 000
		<u>100 000</u>	<u>170 000</u>	<u>50 000</u>	<u>225 000</u>

Required

Submit a statement to the management of Mini Ltd that suggests the most profitable plan of action.

5.5 Make or buy decision

Taffie Ltd used components TA and AF, which are purchased from suppliers, in the manufacturing of product TAF. Because the enterprise does not function at full capacity and has 15 000 unutilised machine hours available during the year, the possibility of manufacturing components TA and AF are investigated. An investigation of costs revealed the following:

	TA R	AF R
Production costs:		
Variable	16	5
Fixed	2	1
Total per unit	<u>18</u>	<u>6</u>
Units required during the period	3 000	5 000
Machine hours per unit	3	2
Costs if components are purchased	R20	R6

Machine hours are used as the basis for the application of overheads to production. The purchase of components does not influence fixed overheads.

Required

Advise management whether using the unutilised capacity for the intended purpose would be worthwhile or whether the components should rather be purchased. Motivate your answer by means of calculations.

5.6 Cease or continue production

A manufacturing enterprise is presently operating at 50% capacity, at which level the company is manufacturing 60 000 units at R3 each. The operating results for the past year were as follows:

	R
Sales 60 000 @ R3	180 000
Less: Cost of sales	(190 000)
Variable	120 000
Fixed	70 000
Net loss	(10 000)

Due to competition it is expected that the volume will decrease even further and that the selling price per unit will be decreased to resist the competition. Management intends to reorganise production over a period of 12 months to manufacture at a lower production cost per unit after the reorganisation.

Before the reorganisation programme can be implemented, it must be determined whether to continue working at a loss or to close down completely until the commencement of the new activities.

If manufacturing were to cease immediately, fixed costs would be reduced by R15 000.

Required

Provide management with a statement suggesting whether it would be desirable to continue production or to cease it completely for 12 months.

5.7 Replacement of machinery

An enterprise is considering the replacement of an existing machine with a new machine. The following information about the two machines is available:

	Old machine	New machine
Purchase price	R3 000	R12 000
Machine hours per annum	2 400	2 400
Labour costs per machine hour	R2	R3
Unit production per hour	10	15
Repairs and maintenance	R160	R200
Indirect material per annum	R300	R360
Power per annum	R400	R350

The old machine's total life (total life that is partly expired) is estimated at ten years with no salvage value. Depreciation, written off for five years, currently amounts to R1 500. The cost of the new machine must also be written off over ten years. An offer of a R500 trade-in allowance has been made on the old machine.

Required

Draw up a comparative statement in which you recommend whether or not the new machine should be purchased.

5.8 Limiting factor decision-making

The following standard data are available:

	Product	
	Alpha	Beta
	R15	R45
Direct materials per unit		
Direct labour:		
Grinding (R7,50 per hour)	10 hours	5 hours
Finishing (R10 per hour)	20 hours	15 hours
Selling price per unit	R310	R250
Budgeted production	1 800 units	900 units

Notes

1. No closing inventories are anticipated.
2. After the enterprise has compiled its budget for the following period, it discovers it has insufficient labour hours to meet the budget. The finishing department uses highly skilled labour making it impossible to have more than 41 240 hours available.

Required

- (a) Calculate the marginal income per unit from each product.
- (b) Prepare a statement showing the total marginal income that could be obtained if skilled labour is utilised optimally.

5.9 Expected value and coefficient of variation

In planning its budget for the coming year, the cost accountant of Palessa Building Contractors (PBC) Ltd obtained the following data concerning net profit for the enterprise for the most recent 60 months:

Net profit R	Frequency
10 000	9
11 000	15
12 000	18
13 000	9
14 000	6
15 000	3

Required

- (a) Calculate the expected value of the monthly profit.
- (b) Calculate the coefficient of variation of the profit.

5.10 Make-or-buy decision under uncertainty

ABC Ltd manufactures closed circuit television sets that will help commercial banks in the combat of robberies. The television sets require special transformers, purchased from PQR Ltd at R15 each. For the past two years an average of 10% of the purchased transformers have not met quality requirements. However, the rejection rate is within the range agreed upon in the purchase contract.

The enterprise has most of the facilities and equipment needed to produce the transformers. Additional annual fixed costs will amount to R32 500. The engineering department has designed a manufacturing system that would hold the defective rate to 4%. At an annual capacity of 18 000 units, the variable cost estimates, and probabilities, including allowance for defective units, are as follows:

Estimated variable cost per unit R	Probability
10	0.1
12	0.3
14	0.4
16	0.2

Required

Prepare a make-or-buy decision analysis.

5.11 Payoff tables and the expected value of perfect information

Msimang & Sons operate various kiosks at the FNB stadium. Hosting the annual Soweto Derby and various other sports and music events have been successful for many years and, as a result, mean a packed stadium in many cases. Sometimes Msimang & Sons have found their supply of soft drinks inadequate, while at other times they have had a surplus. The sales records of Msimang & Sons for soft drinks over the past five years show the following trends:

Quantity of soft drinks sold	Number of events
10 000	5
20 000	10
30 000	20
40 000	15
Total	50

Soft drinks that sell for R2.50 a unit cost R2.00 each. Unsold soft drinks are donated to a local orphanage.

Required

- Prepare a payoff table depicting the expected value of each of the four possible strategies of ordering 10 000, 20 000, 30 000, or 40 000 soft drinks.
- Calculate the expected value of the perfect information.

5.12 Decision trees

A manufacturing enterprise plans to sell a new product at a selling price of R10 per unit. The marketing manager calculates the sales probability as follows:

100 000 units (40%)

50 000 units (60%)

The management accountant calculates the manufacturing costs as follows:

	R	(%)
Variable cost per unit:	5	(30)
	8	(70)
Total fixed cost:	150 000	(60)
	200 000	(40)

Required

Calculate the estimated net profit. Draw up a decision tree to support your calculations.

6 The flow of cost information



LEARNING OUTCOMES

How does a manufacturing business operate?

- Explain the basic factors which influence the planning function
- Describe the elementary principles of a factory lay-out
- Briefly explain the manufacturing process
- Explain the flow of activities in a manufacturing business

How do costs match the manufacturing process?

- Explain the flow of costs in a manufacturing concern and how they are recorded at the various stages

How is the manufacturing process accounted for?

- Draw up the inventory accounts of a manufacturing business

What external reporting statements can be used for a manufacturing business?

- Compile and interpret a Statement of Profit and Loss for a manufacturing concern

CHAPTER OUTLINE

Every business has a particular flow or process that is followed to produce a product or deliver a service. The product or service is designed to meet the needs of a consumer or group of consumers and in exchange, the consumer would then compensate the business. In this chapter the spotlight is put on the manufacturing concern that produces a product for sale to external customers.

The chapter highlights the elements involved in setting up a business along with the process followed to produce products. As discussed in chapter 3, the basic elements are material, labour and overheads. These are combined in an innovative way by entrepreneurs to produce. Once production has started, management needs to exercise control over the operations and to this end the flow of cost information is essential.

Every stage of the production process has a corresponding accounting entry. Accounting entries record where products are in the manufacturing process, from the beginning where it is still raw materials, to the end where it is finished goods and assigns a monetary value to them. This chapter concludes by demonstrating how the

accounting records can disclose the financial performance and position of an enterprise through the Statement of Profit and Loss and the Statement of Financial Position.

INTRODUCTION

Now that the various cost elements to be found in a manufacturing situation have been introduced, it is time to pay attention to the manufacturing process itself and more specifically, how costs flow through the manufacturing process.

Before manufacturing can be discussed, it is necessary that the four **production factors**, namely, *capital, labour, raw materials, and entrepreneurship*, are yoked together to form a harmonious whole which aims at carrying out an economic activity.

Raw materials and labour were discussed in chapter 3. An **entrepreneur** is a *person or organisation who takes the initiative to plan and bring about the manufacturing facilities and set them in motion*. In short, we can view entrepreneurship as the driving force behind the creation of manufacturing facilities.

Capital refers to *the funds required, firstly, to bring about the manufacturing facilities and secondly, to set these facilities in motion*. It includes, *inter alia*, the following:

Initiating capital:	Research Patents Manufacturing rights Set-up costs
Investment of capital:	Land and buildings Machinery and equipment
Working capital:	Inventory Cash resources

Only when all four of these production factors are present and yoked together to form a harmonious whole can the manufacturing process begin.

PLANNING

Combining the four production factors into an economically viable unit requires considerable research and planning, including, *inter alia*, the following:

Establishment

The very important decision as to where the facility is to be established must be taken right at the beginning of the planning phase, and should take the following factors into consideration:

- ☐ The existing and surrounding infrastructure of the area. For example, transport network, roads, telephone, and internet lines and possibly supporting business and/or subcontractors.
- ☐ The availability of and logistics involved in the receiving of raw materials. This includes but not limited to, distance the raw materials have to be transported to the premises, the method of transport, and the cost thereof.

- ☐ The manufactory plant and/or production line. Consideration must be given to items such as: Will the product line be built on site or sourced and installed, how will the machinery and equipment be maintained in future?
- ☐ The availability of required manpower (skilled, semi-skilled or unskilled), especially if the enterprise is to be labour intensive.
- ☐ The market. For example, how far and by what method will the finished product be transported to the market.

Seen from the management accountant's point of view, the cost aspects of the decision regarding the location of the manufacturing facility are very important. Already at this early stage, thought must be given to the cost-effectiveness of the enterprise and an attempt must be made to create an atmosphere in which this can be maximised.

Factory layout

The initial planning of the layout of the factory is very important, especially since later changes are usually associated with higher costs and inefficient planning gives rise to unnecessary working costs. In particular, the unnecessary transporting to and fro of material and products, the time wasted if employees have to move around too much, and the time taken whenever there is a delay between processes must be kept to a minimum.

Diagram 6.1 shows a schematic representation of a properly planned factory layout:

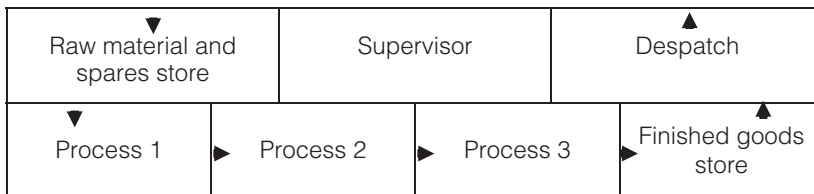


Diagram 6.1

The production line

Proper research must be done to determine which machines are best suited to the purpose for which the enterprise requires them. Especially important are the capacity and the working costs of each machine, as well as the quality of work that can be done by the machines. Further attention is given to these aspects in later chapters.

The production line must be designed so that the capacities of the machines in successive processes are synchronised, so that no idle capacity exists, or it is kept to a minimum.

The schematic explanation in Diagram 6.2 gives an indication of how machines can be arranged to give a synchronised production line capable of manufacturing up to 200 units per hour. Four processes are assumed and the figures in the blocks, which represent the machines, indicate the capacity of each machine.

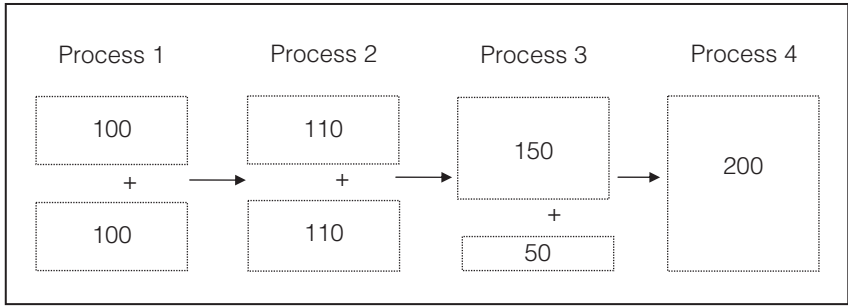


Diagram 6.2

The required capacity that must be maintained is 200 units per hour, of which each process is capable. Process 2 has a capacity of 220 units per hour, which means that an idle capacity of 20 units per hour exists. If the costs in respect of this idle capacity are unavoidable, for example, because there is no machine on the market that can produce exactly 200 units more economically, it must be accepted and not shown as a waste.

Labour

While still in the planning phase, attention must be given to the labour factor. Important questions for which answers must be obtained include the number of employees required, the degree of skill required of the employees and the training of employees. It is very important that in planning the labour force management always takes into consideration the fact that it is dealing with the human factor and that it cannot be treated in the same manner as, for example, machines. Therefore, rest breaks, change of work, recreation amenities and human needs, among others, must be investigated.

Just as the machines on the production line are synchronised, the number of employees (or rather machine operators who serve the production line) must also be synchronised to limit the idle capacity of the operators to a minimum. The possibilities are unlimited, but once again the human factor must be considered. For example, one operator could be given the task of serving two machines provided that the fatigue factor is not too high. Or, as an alternative, the operator could carry out another less fatiguing task, for example, a quality control check, at the same time. However, the question remains whether a better-trained operator could not take care of both machines simultaneously.

Seen from a management accountant's point of view, the efficient employment of labour is of great importance. Is every employee employed to his fullest potential and does every employee work to the best of his ability?

It must also be remembered that, to a large extent, the output of the employee is dependent on the machinery and equipment with which he is working, and the raw materials being used. If something goes wrong with the machine, it usually means that the employee is also not able to function. Poor quality raw materials could mean that the employee is delayed in doing his job.

Thus, management must ensure that the machinery and equipment are properly maintained and that good controls are exercised over the quality of raw materials.

Material (Raw material)

The availability of materials is important, but attention must also be given to the types of materials that are going to be used. Especially important are the quality of the material, the stage of processing, the choice between alternative raw materials, and so on. The quality of the end product produced depends to a large extent on the type of raw material used.

THE MANUFACTURING PROCESS

If proper planning is done about the foregoing aspects a production facility capable of the effective manufacturing of a product or products should exist.

One of the important management functions is the **scheduling** of the production process. In summary this can be described as *the bringing together of the raw material, the employee, and the machine, in sufficient quantities and at the required stage, with the necessary controls, so that each one of the factors is utilised to its fullest potential and a full-fledged final product is manufactured.*

A further important aspect is that no manufacturing process is static. There is constant development, either internally in an effort to make the process more economical, or externally in the form of new developments in machinery or other production aids, or techniques. Management must guard against stagnating when a workable combination is found and try to keep at the forefront of new developments and techniques.

There are various techniques that management can use in its endeavour not to stagnate. Time and motion studies can be carried out to ensure the effective employment of labour, research into raw materials can be done to determine whether alternative raw materials which can lead to better products and/or production methods are available.

CONTROL

Notwithstanding the planning and scheduling functions of management, control forms an important facet of the overall management function. In the previous as well as the following chapters this aspect is discussed at length. Here it is merely emphasised that it is a very important management function.

From the management accountant's point of view, it is especially important that all costs incurred are incurred for a purpose. Any expense or waste that is avoidable and not necessary for the continuation of the manufacturing process must be classified as a waste and should be shown directly in the Statement of Profit and Loss as a loss rather than being classified as a cost and appearing in the cost statement as such.

Therefore, it is also important that the management accountant exercises continuous control over the manufacturing process to ensure that any waste, whether material, man hours or any other item, is kept to a minimum if it cannot be eliminated completely.

One form of control that management can hardly neglect to carry out properly is over the quality of the products that are manufactured. It is preferable that an independent person or a division not directly concerned with manufacturing performs quality control.

Quality control is especially important for two reasons; firstly, to prevent production factors being wasted in the manufacturing of an inferior product, and secondly, to prevent an inferior product from being marketed and damaging the enterprise's reputation.

Quality control should be carried out on a continuous basis and findings should be made known to all levels of management, as well as to the employees themselves where the findings affect them. Preventative action must be instituted as quickly as possible to avoid the repetition of poor results.

THE FLOW OF COSTS

To determine the cost of manufactured goods (or finished goods) you must:

- ☐ have a knowledge of what product costs in a manufacturing enterprise consist of; and
- ☐ gain some understanding of the flow of costs through such an enterprise.

The elements of product costs, namely, direct material, direct labour, and manufacturing overheads, have been dealt with in chapter 3. In this chapter, the basic accounting procedures necessary for recording the costs are explained.

A manufacturing enterprise's cost calculation system and product cost accounting should be logical and run parallel to the sequence of the activities in the enterprise.

The following activities are typical of any manufacturing enterprise:

- ☐ *Procurement*: Raw materials (direct material) and consumable inventories (indirect material) necessary for the manufacturing process are ordered, received, and stored.
- ☐ *Direct and indirect labour* is obtained.
- ☐ *Production* (processing or manufacturing): Raw materials are transferred from the storage room to the production process and are transformed into finished goods by means of the employment of labour, machinery, and equipment.
- ☐ *Storage*: Finished goods are transferred from the production floor to storage areas in the expectation of the sale thereof.
- ☐ *Sales*: The finishing goods are sold to clients and dispatched to them. In the accounting section, the client is invoiced for the goods at the selling price.

ACCOUNTING FOR A MANUFACTURING ENTERPRISE

As costs are incurred in each of the above activities in a manufacturing enterprise the costs of the particular activities are recorded and transferred to the next section in accordance with the progression of the manufacturing activities. Provision must therefore be made for recording the costs in appropriate accounts.

Procurement: Accounts aim to place on record the purchasing and costs of material, labour, and overheads. The relevant costs are accumulated in these accounts until they are transferred to the production or assimilation process. Accounts typically employed for this purpose are raw material (material) control accounts, direct labour, and manufacturing overheads control accounts.

Production: A production account is used to accumulate the manufacturing costs as they enter the manufacturing process.

Storage: A finished goods account is used to collect the costs of the goods that have been completed.

Sales: A cost of goods sold account (cost of sales account) is used to place on record the costs of the goods that are sold. The usual accounts, trade receivables and sales are used in the last instance to place on record the selling price of the same goods.

COST FLOWS

The establishment of the above cost accounts makes it possible to place on record the costs corresponding to the successive activities of procurement, production, storage, and sales. In this regard there is reference to the flow of costs through the system in the following diagram:

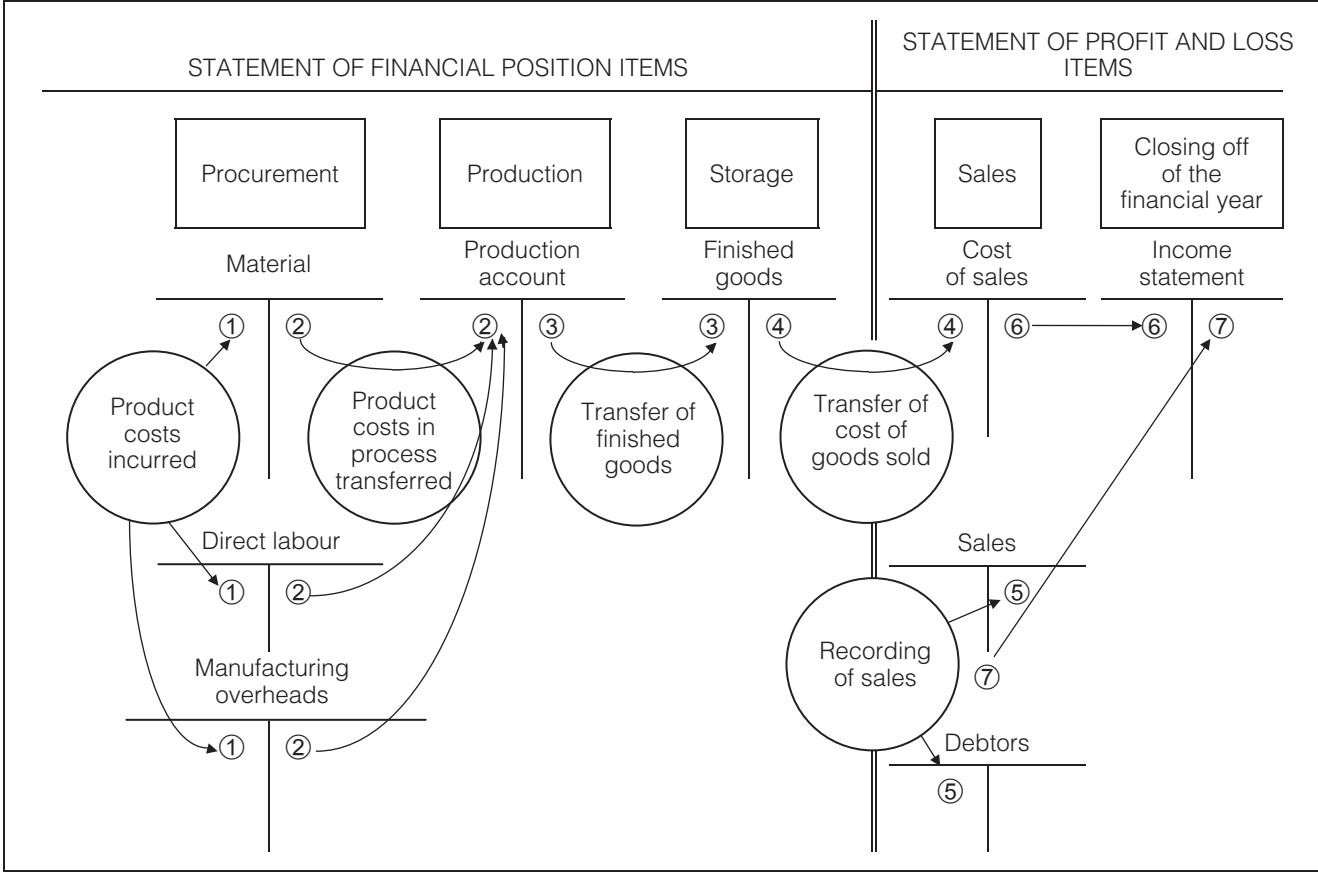


Diagram 6.3 The link between cost flow and activity flow

Reference to Diagram 6.3	
1	<i>Procurement:</i> The cost of material purchased, direct labour and manufacturing overheads are debited to the various control accounts.
2	<i>Manufacturing:</i> As material enters the manufacturing process and labour and overheads are utilised, the costs are debited to the production account and the various procurement control accounts in 1 are credited.
3	<i>Storage:</i> As the manufacturing of the products is completed and they are transferred to the inventory locations the costs are debited to the finished goods account and credited to the production account.
4	<i>Sales:</i> As finished goods are sold the costs thereof are debited to the cost of sales account and credited to the finished goods account.
5	At the same time the selling price of the goods sold is recorded in the trade receivables account (debit) and the sales account (credit).
6 & 7	At the end of the financial period the debit balance in the cost of sales account is debited to the Statement of Profit and Loss and the balance of the sales account is credited to the same account to determine the gross profit on sales.

The link between the cost and activity flows is illustrated in Diagram 6.3 with corresponding references given in the table above.

INVENTORY ACCOUNTS IN A MANUFACTURING ENTERPRISE

In a commercial enterprise there is characteristically only one account in which the cost of unsold merchandise is reflected, namely, the trading inventory account.

However, from Diagram 6.3, it is obvious that in a manufacturing enterprise there is more than one *inventory* account, namely:

- ☐ material (unused raw material);
- ☐ incomplete products (production account); and
- ☐ finished goods.

Thus, the relevant cost accounts are also inventory accounts, or, in the case of labour and overheads, cost control accounts. To the extent that the amounts in these various accounts are debited and not yet transferred to the next account in the cost flow, they represent assets which are shown in the Statement of Financial Position at cost.

The Statement of Financial Position and the Statement of Profit and Loss items are also identified in Diagram 6.3.

The elements that were identified in the previous paragraphs are clearly illustrated in the following example:

Example 6.1

On 1 January 2015 MATHE Manufacturers, a local soft drink manufacture in KwaZulu-Natal, had opening inventory valued at R40 000, R20 000 and R60 000 in their material control, production and finished goods accounts respectively. There were no trade receivables or trade payables on that date.

The following is a summary of the transactions and activities of the firm during January 2015.

- 1 Direct material costing R100 000 was purchased on credit.
- 2 Direct material costing R120 000 was issued to the production division.
- 3 The salaries and wages of the factory personnel amounted to R50 000 for the month and consisted of the following:

Direct labour	R30 000
Indirect labour	R20 000
- 4 Depreciation of machinery and equipment for January 2015 was R20 000.
- 5 Other indirect manufacturing expenses amounted to R30 000 and were settled in cash.
- 6 The total manufacturing overheads and direct labour costs incurred were absorbed in the production process.
- 7 Products with a manufacturing cost of R200 000 were transferred to finished goods.
- 8 Products with a cost of sales which amounted to R130 000 were sold during the month on credit for R280 000 (journal entries 8 and 9).

Journalisation of the above transactions

	Dr R	Cr R
1 Dr Direct material (control account)	100 000	
Cr Trade payables		100 000
2 Dr Production account	120 000	
Cr Direct material (control account)		120 000
3 Dr Direct labour	30 000	
Dr Manufacturing overheads (control account) (indirect labour)	20 000	
Cr Wages		50 000
Dr Wages	50 000	
Cr Bank		50 000
4 Dr Manufacturing overheads (control account) (depreciation)	20 000	
Cr Accumulated depreciation		20 000
5 Dr Manufacturing overheads (control account) (indirect production costs)	30 000	
Cr Bank		30 000
6 Dr Production account	100 000	
Cr Direct labour		30 000
Cr Manufacturing overheads (control account) (20 000 + 20 000 + 30 000)		70 000
7 Dr Finished goods account	200 000	
Cr Production account		200 000
8 Dr Cost of sales	130 000	
Cr Finished goods		130 000
9 Dr Trade receivables	280 000	
Cr Sales		280 000

continued

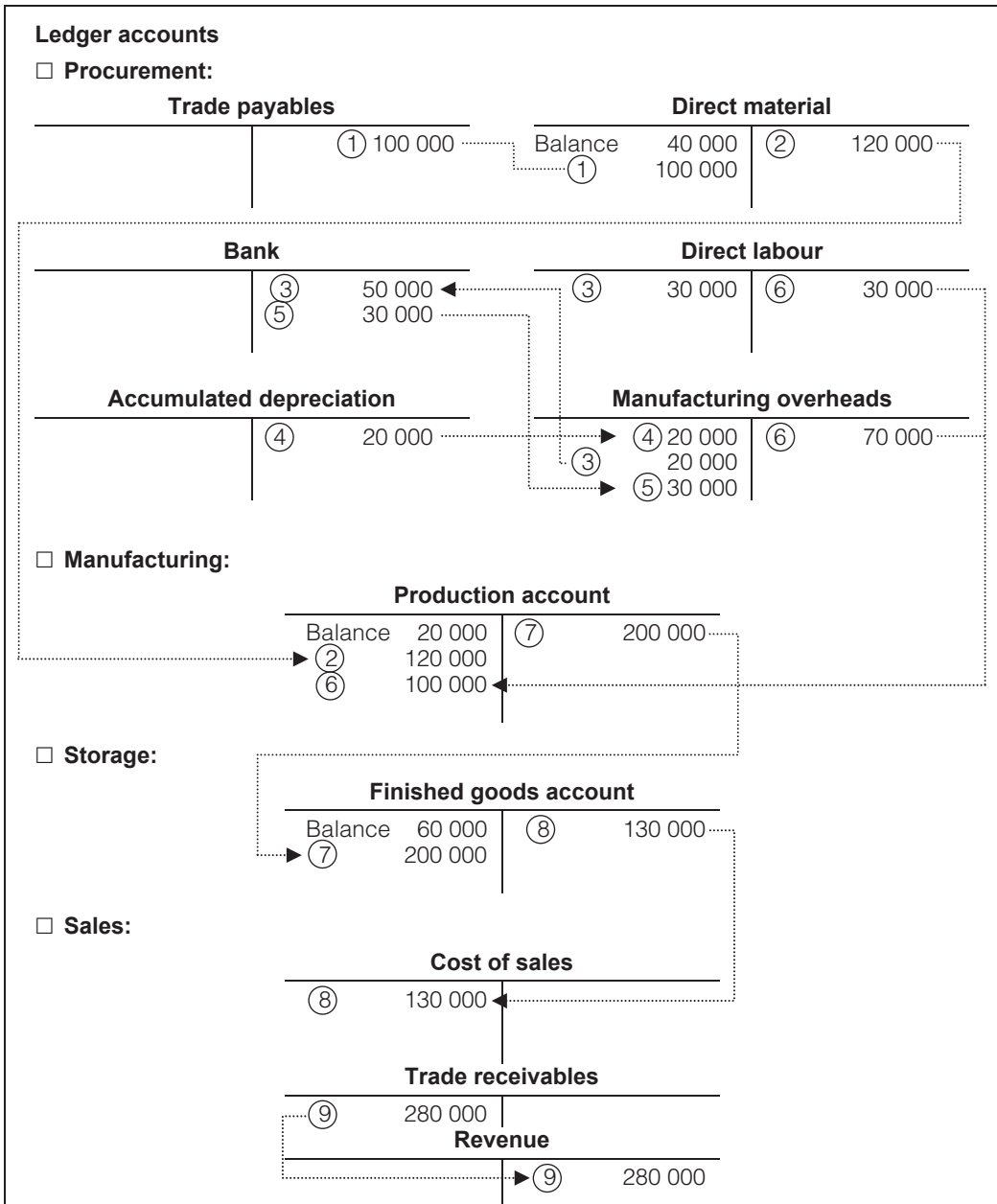


Diagram 6.4

From the above, it is evident that the balances on the various inventory accounts will be as follows:

		R
Direct material	R(40 000 + 100 000 – 120 000)	= 20 000
Incomplete work	R(20 000 + 120 000 + 30 000 + 70 000 – 200 000)	= 40 000
Finished goods	R(60 000 + 200 000 – 130 000)	= 130 000

The inventory will be shown on the Statement of Financial Position of the enterprise on 31 January 2015 as closing inventory on hand.

THE STATEMENT OF PROFIT AND LOSS OF A MANUFACTURING ENTERPRISE

Whereas a trading enterprise purchases completed goods for resale, in a manufacturing concern material and other sources are used to convert raw materials to finished goods. Therefore, the Statement of Profit and Loss of the manufacturing enterprise must, as a matter of course, contain all the details of the manufacturing costs and the inventory accounts. With reference to Example 6.1, the Statement of Profit and Loss of MATHE Manufacturers can be compiled as shown:

MATHE MANUFACTURERS STATEMENT OF PROFIT AND LOSS FOR THE MONTH ENDED 31 JANUARY 2015	
	R
Revenue	280 000
Less: Cost of sales	(130 000)
Inventory of incomplete work (beginning)	20 000
Cost of material used	120 000
Material on hand (beginning)	40 000
Purchases	100 000
Cost of material available	140 000
Less: Material on hand (closing)	(20 000)
Direct labour	30 000
Manufacturing overheads	70 000
Indirect labour	20 000
Depreciation	20 000
Indirect production costs	30 000
Total manufacturing costs	240 000
Less: Inventory of incomplete work (closing)	(40 000)
Cost of goods transferred to finished goods	200 000
Add: Inventory of finished goods (beginning)	60 000
Finished products available for sale	260 000
Less: Inventory of finished goods (closing)	(130 000)
Gross profit	150 000
Less: Administrative revenue expenses	?
Net profit before taxation	?

Care must be taken in the presentation of the information, which should be such that it is easy to read and analyse. Unnecessary information must be kept to the minimum, but no essential data must be left out.

The information given must be logical and understandable, prepared with the needs of the users thereof in mind. Information that can be given to one user might not be suitable for the next user.

Seeing that cost statements are often prepared for interim periods – especially for control purposes – it will inevitably happen that the manufacturing overheads allocated must sometimes be used because the actual manufacturing overheads for the period are not yet known.

The use of the term '*at normal*' for example, *manufacturing costs at normal*, indicates that allocated manufacturing overheads and not the actual overheads are used for the calculation of the total manufacturing costs.

Whenever '*actual manufacturing overheads*' are used this is indicated by coupling the terms '*at actual*' with the cost.

Marketing and administrative overheads are still shown directly in the Statement of Profit and Loss.

COLUMNAR FORM OF COST AND STATEMENT OF PROFIT AND LOSS

Example 6.2 illustrates the use of applied and actual manufacturing overheads on a columnar form cost worksheet.

Example 6.2

The following information is available:

	1 July 2015 R	31 Dec 2015 R
Inventory levels:		
Material	28 000	34 000
Incomplete work	21 000	27 000
Finished goods	35 000	43 000
Costs for the period:		
Material purchased (including indirect material)		120 000
Direct labour		150 000
Indirect labour		15 000
Indirect material used		6 000
Administrative costs		40 000
Marketing costs		30 000
Supervisory wages		12 000
Hire of factory premises		24 000
Depreciation of machinery		38 000
Revenue for the period		469 000

Manufacturing overheads are applied at 60% of direct labour.

Required

Prepare a Cost Statement and Statement of Profit and Loss for the period.

Solution 6.2**Cost statement for the six months ended 31 December 2015**

	Calcu- lation R	Cost R	Incom- plete work R	Finished goods R
Opening inventory:				
Finished goods				35 000
Incomplete work			21 000	
Direct material:		108 000		
Opening inventory	28 000			
Add: Purchases	<u>120 000</u>			
Available	148 000			
Less: Closing inventory	<u>(34 000)</u>			
Total usage	114 000			
Less: Indirect material*	<u>(6 000)</u>			
Direct labour		150 000		
Applied overheads (calculation 1)		<u>90 000</u>		
Manufacturing overheads @ normal			<u>348 000</u>	
			369 000	
Less: Closing inventory of incomplete work			<u>27 000</u>	
Cost of units completed during the period @ normal				<u>342 000</u>
Available for sale @ normal				377 000
Less: Closing inventory of finished goods				<u>(43 000)</u>
Cost of sales @ normal				334 000
Add: Under-applied overheads (Calculation 1)				<u>5 000</u>
Cost of sales @ actual				<u>339 000</u>

* Including indirect material purchased

Calculation 1

	R
Actual manufacturing overheads	
Indirect labour	15 000
Indirect material	6 000
Supervisory wages	12 000
Hire of factory premises	24 000
Depreciation of machines	<u>38 000</u>
Actual manufacturing overheads	95 000
Less: Applied manufacturing overheads	<u>(90 000)</u>
Under-applied manufacturing overheads	<u>5 000</u>

Statement of Profit and Loss for the six months ended 31 December 2015

	R
Revenue	469 000
Less: Cost of sales	(339 000)
Gross profit	130 000
Less: Sundry expenses	(70 000)
Administrative cost	40 000
Marketing costs	30 000
Net profit	60 000

SUMMARY

In summary, it can be said that the manufacturing process is the core process in any manufacturing enterprise. Further, it spreads to all sectors such as the trading enterprises which market the product and the users who ultimately purchase the product. Thus, the importance thereof cannot be over-emphasised and must not be neglected by any enterprise.

The link between cost flows and activity flows in a manufacturing enterprise exist in the areas of procurement, manufacturing, storage and revenue.

In a manufacturing enterprise, there are normally inventory accounts for material, work in progress (WIP) and finished goods, while in a commercial enterprise there is only a trading inventory account.

In a manufacturing enterprise materials and other resources are used to convert raw materials into finished goods, while a trading enterprise purchases complete goods for resale.

PERSPECTIVES ON COSTING

Knowledge

You should know:

- ☐ the four production factors are capital, labour, raw materials, and entrepreneurship;
- ☐ capital refers to the funds needed to establish the production facility and to start production;
- ☐ the term 'capital' refers to initiating capital, investment capital and working capital;
- ☐ planning to set up a production facility involves among others the following factors, namely, establishment of the facility, factory layout, equipment for the production lines, and the availability of labour and raw materials;
- ☐ controlling the manufacturing processes is mainly to prevent wastage and to promote quality;
- ☐ the cost flows of a manufacturing enterprise include procurement, direct and indirect labour, production, storage, and revenue entries;
- ☐ trading enterprises only use trading inventory accounts that reflect unsold merchandise whereas in manufacturing enterprises, raw materials, work in progress and finished goods inventory accounts are used;

- ☐ the Statement of Profit and Loss of an enterprise contains all manufacturing costs or products purchased and the inventory account(s); and
- ☐ the term 'normal overheads' means that allocated manufacturing overheads and not the actual overheads were used in the calculation.

Skills

You should be able to:

- ☐ prepare journal entries and ledger accounts regarding all transactions of activity flows of a manufacturing enterprise; and
- ☐ prepare an Statement of Profit and Loss of a manufacturing enterprise.

KEY TERMS AND CONCEPTS

Capital	184	Production factors	184
Entrepreneur	184	Scheduling	187

REVIEW PROBLEMS

Problem 6.1

Tinkwane (Pty) Ltd manufactures cough medicine that is locally distributed. The medicine is packaged into a small brown bottle, labelled and distributed to retailers. On average, the demand for the cough medicine is 1 200 bottles per month. Currently Tinkwane only has capacity to produce 800 bottles per month; actual production was also 800 units.

During the month of February 2015, they experienced a small fire in their offices which partially destroyed their computers. The accounting data for the month was destroyed. The sales director and the operations director have supplied their supporting documentation for February in an effort to reconstruct the records. Details are as follows:

			R
Revenue (cash):	700 units at a selling price of R22 per bottle		15 400
Materials purchased on credit (half paid off in Feb):	For 800 units		4 800
Production labour paid:	× 1 worker @ R6 per bottle		4 800
Bottles:	For 800 units		800
Labeling:	For 800 units		400
Overhead allocation:	800 units @ R4 per bottle		3 200
50 units remained in Work in progress and 700 were sold. The remaining units are finished.			

Required

- (a) Reconstruct the journal entries for the month of February 2015.
- (b) Prepare a Statement of Profit and Loss for the month of February 2015.

Solution 6.1

(a) Journal entries for the month of February 2015

Journalisation of the above transactions		Dr R	Cr R
1	Dr Material control account Cr Trade payables <i>Recording the purchase of materials</i>	4 800	4 800
2	Dr Trade payables Cr Bank <i>Paying off half of the trade receivables during February</i>	2 400	2 400
3	Dr Labour control account Cr Bank <i>Labour expense for February</i>	4 800	4 800
4	Dr Sundry materials control account (800 + 400) Cr Bank <i>Recording the purchase of sundry materials¹</i>	1 200	1 200
5	Dr Overhead control account Cr Bank <i>Payment of fixed overheads²</i>	3 200	3 200
6	Dr Work in progress Cr Material control account Cr Labour control account Cr Sundry materials control account Cr Overhead control account <i>Issuance of all material, sundries, labour and overheads to the production process</i>	14 000	4 800 4 800 1 200 3 200
7	Dr Finished goods Cr Work in progress ³ <i>Transfer of completed goods out of WIP</i>	13 125	13 125
8	Dr Cost of Sales ⁴ Cr Finished goods <i>Recognise cost of sales on 700 units sold</i>	12 250	12 250
9	Dr Bank Cr Revenue ⁵ <i>Recognise sales income for 700 units</i>	15 400	15 400

1 In some instances sundry material or consumables may be treated as part of material and simply added as one lump sum. This is however not advised because it is important to keep items separated for decision-making purposes.

2 Fixed overheads may consist of a variety of items such as rent, insurance and utilities. Some may be paid cash while others may be settled on credit. For the purposes of this question we assume all overheads were cash settled.

3 The unit production cost is $14\,000 \div 800 = R17.50$ total cost per unit. Therefore 750 units were finished, resulting in $750 \times R17.50 = R13\,125$.

4 Only 700 units were sold. Therefore Cost of Sales is $700 \times R17.50 = R12\,250$. The 700 units are eliminated from finished goods.

5 Revenue is $700 \times R22 = R15\,400$.

(b) Statement of Profit and Loss for the period ending February 2015

TINKWANE (PTY) LTD	
STATEMENT OF PROFIT AND LOSS FOR THE MONTH ENDED 28 FEBRUARY 2015	
	R
Revenue	15 400
Less: Cost of sales	(12 250)
Materials	4 800
Labour	4 800
Sundry materials	1 200
Overheads	3 200
	14 000
Less: Work in progress	(875)
	13 125
Less: Finished goods on hand	(875)
	12 250
Net profit before taxation ¹	3 150

1 Closing finished goods and closing WIP on the Statement of Financial Position will be R875 each.

EXERCISES

Exercise 6.1

Bula (Pty) Ltd opened a factory that manufactures chainsaws. They received orders for 200 units per month. Budgeted labour hours amounted to 2 000 for the period. As Nero has just started the business, no opening balances exist. The following information for the period is available:

	R	R
Revenue		400 000
Materials purchased on credit		40 000
Direct labour paid (1 920 hours × R50)		96 000
Materials transferred to work in progress		24 000
Budgeted manufacturing overheads		153 600
Overheads paid:		152 400
Rent	120 000	
Utilities	8 000	
Depreciation on equipment	16 000	
Indirect labour	8 400	
Cost of goods completed		250 000
Cost of sales		200 000
Administrative and marketing expenses:		200 000
Advertising	50 000	
Revenue commission	40 000	
Office salaries	100 000	
Depreciation: Office equipment	10 000	

Overheads are allocated on the direct labour-hour method. Overheads over- or under-applied must be recovered against cost of sales.

Required

- (a) Prepare the necessary journal entries.
- (b) Prepare the ledger accounts.

7 Manufacturing overhead calculation and allocation: A traditional approach



LEARNING OUTCOMES

What is the role of manufacturing overheads in a production statement?

How are manufacturing overheads controlled?

How are manufacturing overheads calculated and allocated?

- Distinguish between budgeted, applied and actual overheads, and identify when their uses are relevant
- Calculate under- or over-applied overheads
- Construct the primary and secondary allocation stages of overheads
- Calculate an overhead allocation rate and allocate the cost to its cost object

CHAPTER OUTLINE

Chapter 3 introduced the concept of including manufacturing overheads in a production statement. There are two options for treating such overheads, depending on users' needs. For internal cost reporting, overheads are typically reported separately, while for external financial reporting, overheads are absorbed into cost objects. Both approaches have advantages and disadvantages.

As discussed in chapter 2, certain manufacturing costs are difficult to trace directly to cost objects and are termed indirect manufacturing costs or manufacturing overheads. This chapter focuses on calculating an overhead allocation rate and selecting an appropriate allocation driver.

A well-constructed allocation method is essential to facilitate the correct calculation and allocation of manufacturing overheads. An allocation method consists of two steps. The first step is to assign manufacturing overheads to a cost centre, and the second step is to allocate the costs in the cost centre to cost objects. This is done through the use of an allocation rate that is driven by an appropriate allocation basis.

These allocation bases are identified and discussed as budgeted, applied, and actual. The difference in applied and actual manufacturing overheads can be reconciled, and

the reconciliation process produces an under- or over-application of manufacturing overheads in the production statement.

INTRODUCTION

To eliminate confusion later, a clear distinction must be made between the concepts 'budgeted manufacturing overheads', 'applied manufacturing overheads', and 'actual manufacturing overheads'.

Budgeted manufacturing overheads represent *an estimated amount of future overheads*, whereas **applied manufacturing overheads** refer to *the amount of overheads applied to the production process during a specific period*.

Actual manufacturing overheads are the *actual manufacturing overhead cost, which can only be known once it has been incurred*. This information is only available after the last transaction for a specific financial period has been recorded. Because the actual cost is only known at the end of the period, it has limited value making pricing and other decisions.

BUDGETED MANUFACTURING OVERHEADS

The allocation of manufacturing overheads to the various products or jobs presents a problem for cost determination. Since actual overheads are only of historical importance in cost determination and price determination, a scientific forecast of the manufacturing overheads for the future period must be prepared to serve as a basis for calculating allocation tariffs.

The budgeted manufacturing overheads must be calculated with caution to reflect the actual situation as closely as possible. Nevertheless, they must also be prepared in such a way that they can serve as a guideline for expenditure without concealing any wastage and spillage.

Budgeted manufacturing overheads must not be confused with applied manufacturing overheads. While the budgeted manufacturing overheads are a scientific forecast of the overheads for a future period, the applied manufacturing overheads are the amount of overheads applied to the production process during the period according to a predetermined rate based on the budgeted overheads. Briefly, applied overheads represent the amount of overheads recovered during the year and brought into account in determining the cost price and the total production costs.

Direct material	XXX
Direct labour	XXX
Applied manufacturing overheads	XXX
Total manufacturing costs	<u>XXX</u>

Budgets and the preparation of the manufacturing overheads budget are discussed in detail in chapter 13.

By dividing each overhead item into its fixed and variable elements, accurately determining the expected production volume, and paying attention to economic trends, a reasonably reliable estimate of the overheads for a future period can be made.

Comparing this estimate with the previous year's actual overheads can ascertain whether or not it is realistic.

The projection of the expected production volume, or capacity utilisation, is particularly important, especially in calculating the allocation tariff (discussed later) and in calculating budgeted fixed and variable overheads. (The various capacity levels are discussed in chapter 14.)

APPLIED MANUFACTURING OVERHEADS

Applied manufacturing overheads are the overheads allocated to the production process and/or products manufactured during the manufacturing period according to a **predetermined rate (or tariff)**, based on the budgeted overheads (cost) and expected capacity utilisation (volume).

When calculating the predetermined overhead allocation rate (**POAR**), it is necessary to find a suitable basis for this rate.

The following bases may be considered:

- ☐ product unit basis
- ☐ labour hour basis
- ☐ labour cost basis
- ☐ machine hour basis
- ☐ material cost basis
- ☐ primary cost basis, and
- ☐ combinations of the bases mentioned.

The formula for the calculation of the predetermined rate is as follows:

Predetermined overhead allocation rate (POAR) = $\frac{\text{Budgeted manufacturing overheads}}{\text{Suitable basis}}$

The calculation of predetermined overhead rates is illustrated in the following example:

Example 7.1

The following is the budget of a manufacturing enterprise that produces only one type of product:

Total		Per unit
Budgeted production (units)	1 000	
Budgeted direct material cost	R15 000	R15
Budgeted direct labour cost	R20 000	R20
Budgeted manufacturing overheads:	R12 000	
Fixed	R8 000	
Variable	R4 000	
Budgeted direct labour hours	4 000	4
Budgeted machine hours	3 000	3

Required

Calculate the predetermined overhead rate according to each of the bases mentioned.

Solution 7.1: Product unit basis

$$\begin{aligned}
 \text{POAR} &= \frac{\text{Budgeted manufacturing overheads}}{\text{Budgeted number of units produced}} \\
 &= \frac{\text{R12 000}}{1\,000} \\
 &= \text{R12.00 per unit}
 \end{aligned}$$

For each unit that is produced during the year, R12 of overheads is allocated to the manufacturing process. As soon as 1 000 units are produced during the year, the total budgeted overheads will have been recovered.

Calculation of the manufacturing cost per unit:

	R
Direct material	15.00
Direct labour	20.00
Applied overheads	12.00
Total manufacturing cost	<u>47.00</u>

This basis for allocating overheads can be used fruitfully in enterprises that produce only a single type of product. It is a simple and synoptic method which can be applied without much administration.

Solution 7.1: Labour hour basis

$$\begin{aligned}
 \text{POAR} &= \frac{\text{Budgeted manufacturing overheads}}{\text{Budgeted labour hours}} \\
 &= \frac{\text{R12 000}}{4\,000} \\
 &= \text{R3.00 per labour hour}
 \end{aligned}$$

Manufacturing overheads are allocated at a rate of R3 per labour hour. Four labour hours are expended on one product; thus, R12 per unit is recovered.

This allocation basis is perhaps used most generally, along with the machine-hour basis. Administratively, the rates and the allocated amount are easily calculated, since the total available hours and the time expended on each product or task are usually already available. It can also be used fruitfully in very labour-intensive enterprises and/or to produce a wide range of products.

Solution 7.1: Labour cost basis

$$\begin{aligned}
 \text{POAR} &= \frac{\text{Budgeted manufacturing overheads}}{\text{Budgeted labour costs}} \times \frac{100}{1} \\
 &= \frac{\text{R12 000}}{\text{R20 000}} \times \frac{100}{1} \\
 &= 60\% \text{ of labour cost}
 \end{aligned}$$

The rate is usually expressed as a percentage of direct labour costs. This is a simple method of allocating overheads.

Manufacturing costs per unit:	
	R
Direct material	15.00
Direct labour	20.00
Applied overheads (60% of R20)	<u>12.00</u>
Total manufacturing costs	<u>47.00</u>

One limitation of this allocation method is that a labour-intensive or highly remunerated section might have a higher labour cost, yet use little or no machinery. The overheads (which comprise depreciation and the maintenance of machinery and equipment principally) allocated to this department based on labour costs will then be relatively higher than they should be.

Solution 7.1: Machine hour basis

$$\begin{aligned}
 \text{POAR} &= \frac{\text{Budgeted manufacturing overheads}}{\text{Budgeted machine hours}} \\
 &= \frac{\text{R12 000}}{3\,000} \\
 &= \text{R4.00 per machine hour}
 \end{aligned}$$

This is a relatively easy method to use in enterprises which are mechanised to a large extent. An additional advantage is that management's attention is drawn to the machine's output.

Provision must be made for the maintenance, repair and adjustment of machinery and idle time and under-utilisation must be eliminated.

Solution 7.1: Material cost basis

$$\begin{aligned}
 \text{POAR} &= \frac{\text{Budgeted manufacturing overheads}}{\text{Budgeted material cost}} \times \frac{100}{1} \\
 &= \frac{\text{R12 000}}{\text{R15 000}} \times \frac{100}{1} \\
 &= 80\% \text{ of material costs}
 \end{aligned}$$

This is not an accurate method because there is usually no direct connection between material costs and overheads. A product made from expensive materials without much processing will carry a greater portion of overheads than, for example, a product made from cheap materials that requires more processing.

Solution 7.1: Primary cost basis

POAR	=	$\frac{\text{Budgeted manufacturing overheads}}{\text{Budgeted material costs + Budgeted labour costs}} \times \frac{100}{1}$
	=	$\frac{R12\,000 \times 100}{R15\,000 + R20\,000} \times \frac{100}{1}$
	=	34.30% of primary costs

The same limitations for the material cost basis are also applicable here, although to a minor degree. The product's composition and manufacturing will largely determine the basis for calculating the predetermined overhead rate. The most logical and accurate method with the most significant causal connection between costs and product must be used as the basis for the allocation.

As already mentioned, the total actual manufacturing overheads are known after the product is finished and sold and have little or no influence on the allocation rate.

ACTUAL MANUFACTURING OVERHEADS

Actual manufacturing overheads are the amounts spent during a given period, as shown by the financial statements and records of the enterprise at the end of the period.

The various overhead items are usually aggregated in the manufacturing overheads control account. They are obtained from several subsidiary books which include, *inter alia*, the cash book, purchases journal and fixed assets register.

The most important types of cost items found under manufacturing overheads are the following:

- ☐ depreciation of machinery and equipment,
- ☐ interest on capital/investment,
- ☐ indirect material,
- ☐ indirect labour,
- ☐ rental and maintenance of factory buildings.

Depreciation

Depreciation is an important overhead item, especially in capital-intensive enterprises, which are mechanised to a large extent.

Two methods used in South Africa to calculate depreciation are the **reducing balance method** and the **straight-line method**. *In the former method, the depreciation is calculated annually on the book value, while in the latter method, a fixed amount, calculated on the cost price, is written off.*

The two methods are illustrated in Example 7.2.

Example 7.2	
Cost of machinery	R10 000
Date purchased	1 September 2013
Depreciation	20% per annum
Financial year-end	28 February

Solution 7.2

	Reducing balance method	Straight- line method
	R	R
01/09/2013 Cost	10 000	10 000
28/02/2014 Less: Depreciation @ 20% for six months	(1 000)	(1 000)
01/03/2014 Book value	9 000	9 000
28/02/2015 Less: Depreciation for one year @ 20%		
20% of R9 000 (book value)	(1 800)	
Less: 20% of R10 000 (cost)		(2 000)
01/03/2015 Book value	7 200	7 000

A third method, the **fixed instalment method**, is used primarily in contracts, *when the value of the machinery is written off over its expected useful economic life.*

Cost	R10 000
Economic life	4 years
Depreciation per annum	R2 500

The scrap value at the end of the economic life can also be considered, which means that the annual depreciation charge will decrease accordingly.

Economic life is *the period for which an asset can be profitably employed.* When a new development can perform the same task more economically, the old machine is deemed economically obsolete, although technically, it may still be in good condition.

Technical life is *the period for which an asset can perform a specified task, after which it is usually written off as scrap or sold.*

Interest on capital/investment

South Africa largely ignores this aspect, especially when a machine is purchased for cash and interest is not paid. When a machine is purchased on credit, the interest paid is usually capitalised and recovered as depreciation. Whether the machine is purchased for cash or on credit, interest is a sacrifice made to obtain the machine and should, as such, be classified as an overhead.

Indirect material and indirect labour

Although direct material and direct labour form separate cost elements, indirect material and indirect labour are classified as manufacturing overheads.

Rental and maintenance of factory buildings

Over the past few years, this cost has increased in importance, because of the applicable high interest rates. It usually forms a fixed manufacturing overhead.

OVER- OR UNDER-APPLIED MANUFACTURING OVERHEADS

Over- or under-applied manufacturing overheads represent the difference between applied and actual manufacturing overheads.

Over-applied overheads arise whenever the applied manufacturing overheads exceed the actual manufacturing overheads. **Under-applied overheads** occur in the converse situation where the actual manufacturing overheads exceed the applied manufacturing overheads.

The calculation of under- and over-applied overheads can be summarised as follows:

Over- or under-applied overheads	=	Actual overheads	–	Applied overheads
If actual overheads	>	Applied overheads	=	Under-applied
If actual overheads	<	Applied overheads	=	Over-applied

The procedure to determine over- or under-applied overheads is as follows:

Step 1:	Determine the predetermined overhead rate at the beginning of the period <i>Budgeted manufacturing overheads ÷ Estimated (or budgeted) units = Predetermined overhead rate</i>
Step 2:	Apply the manufacturing overhead during the period <i>Predetermined overhead rate × Actual units = Manufacturing overhead applied</i>
Step 3:	Determine over- or under-applied overhead at the end of the period <i>Manufacturing overhead applied – Actual overheads = Under- or over-applied overhead</i>

The following are possible causes for the existence of over- or under-applied overheads:

- ☐ incorrect predetermined overhead rates
- ☐ actual overheads which are more/less than budgeted
- ☐ more/less activity in the base according to which overheads are applied.

In a situation where insufficient overheads are applied during the year (under-applied), all the overheads are not recovered, and at the end of the year, there is a remaining balance. This balance (under-applied overheads) must be applied at the end of the year. This is done by debiting cost of sales, consequently increasing the cost of sales by the amount that was under-applied during the year.

A portion of the under-applied overheads should, rightly, be debited to the finished goods account and incomplete work, which is in inventory at that date, but because it is challenging to implement, it is not usually done in practice.

When overheads are over-applied during the period, the same procedures are followed, except that the cost of sales is credited.

The accounting entries for over-applied overheads are explained in Example 7.3

Example 7.3

	R
Applied overheads	10 000
Actual overheads	8 000
Cost of sales	100 000
Over-applied overheads	2 000
Material used	70 000
Labour employed	20 000

Solution 7.3

Applied overheads			
Overheads control account	<u>10 000</u>	Production account	<u>10 000</u>
		①	
Production account			
→ Applied overheads	10 000	Finished goods/ Cost of sales	100 000
Material	70 000		
Labour	20 000		
		②	
Manufacturing overheads control account			
Actual costs	8 000	Applied overheads	10 000 ←
Cost of sales	<u>2 000</u>		
		③	
Cost of sales			
Finished goods	100 000	Manufacturing overheads control account	2 000 ←

In the above example, too large an amount of overheads was applied (R10 000), compared to the actual amount incurred (R8 000). The manufacturing overheads control account thus has a credit balance of R2 000 as an over-application of overheads to production. To close the manufacturing overheads account off, the balance of R2 000 is credited to cost of sales.

Under-applied overheads are treated similarly, except that the cost of sales is eventually debited with the amount.

DEPARTMENTALISATION OF MANUFACTURING OVERHEADS

Using only one overhead recovery rate for all factory branches is usually not feasible. Some divisions generate more overheads than others, and if only one tariff is used, the result will be an unfair and inaccurate recovery rate.

Briefly, **departmentalisation of overheads** means the division of overheads among the various sections of the factory so that, eventually, a more accurate allocation rate can be established for each department separately.

Departmentalisation implies that the factory must be divided into **cost centres**. The various departments can usually be viewed as separate cost centres because of the grouping of related activities in departments. Two or more departments can, however, be combined into one cost centre, or one department can be divided into two or more cost centres.

The requirement for a cost centre is that all the activities performed in the particular cost centre must have more or less the same degree of exposure to overheads. In short, the activities must show a degree of uniformity, and they must use more or less the same machinery and share proportionately in the overheads of the cost centre. A small manufacturer can be taken as an example – in one department, the parts are cut out of metal, and in the following department, they are assembled. As a result of the diversity of activities, a separate allocation rate must be determined for each department (or cost centre).

A **cost carrier** is a product or job in the process of being manufactured, accumulating costs as it nears completion and against which overheads can be allocated according to a predetermined tariff.

The departmentalisation of overheads can be divided into two actions, namely:

- ☐ **primary departmentalisation**, also called *primary allocation or apportionment*, where the manufacturing overheads are divided among all the departments/cost centres (including service departments), and
- ☐ **secondary allocation**, where the costs of the service departments are allocated to the production departments.

A department/cost centre is classified as a service department if it does not directly contribute to the cost carrier's transformation process. Still, it provides a service to the other departments/cost centres involved in the transformation of the cost carrier, for example, quality control, which only monitors whether the cost carrier complies with specific standards and does not do any transformation itself.

Diagram 7.1 is a diagrammatic representation of the primary and secondary allocation of manufacturing overheads:

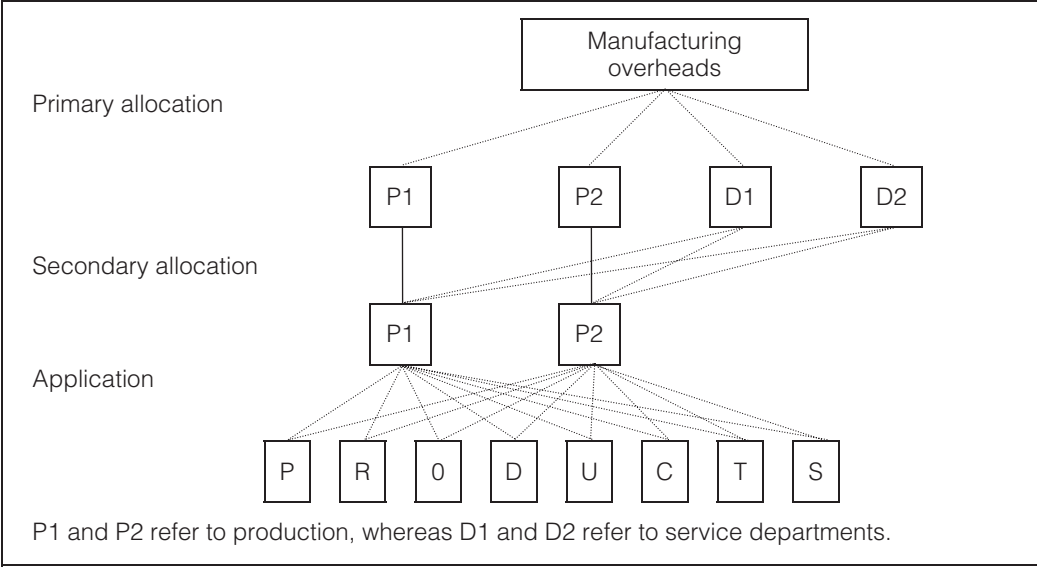


Diagram 7.1

PRIMARY ALLOCATION OF MANUFACTURING OVERHEADS

Primary allocation of overheads, as the name indicates, is the first and perhaps the most important allocation of overheads, where every overhead item is apportioned to all the production and service departments of the enterprise.

For primary allocation, a suitable basis must be found for dividing the individual cost items among the various departments according to the causal relationship between the cost and the ultimate product. Thus, for example, it could be found that the number of employees employed by each department is the fairest basis for the division of the cost of protective overalls among the various departments.

An in-depth study must be made of all aspects of the enterprise in its entirety to find various bases for allocating overheads. Diagram 7.2 gives some examples of the bases that can be used and what they can be used for:

Basis	Cost
Area utilised by each cost centre	Hire of location Property tax Maintenance of buildings Insurance on buildings Heating/cooling of buildings

continued

Basis	Cost
<i>Value of machinery and equipment</i>	Depreciation Maintenance Insurance
<i>Number of workers in each cost centre</i>	Personnel administration Protective overalls Cafeteria Security Transport subsidy Supervision Indirect labour
<i>Material usage</i>	Cost of inventory piling Indirect material Insurance
<i>Requisitions</i>	Indirect material
<i>Time sheets</i>	Indirect labour
<i>Kilowatt hours</i>	Electricity
<i>Machine hours</i>	Maintenance of machines Power usage Indirect labour

Diagram 7.2

Each cost item must be analysed separately to determine which basis will provide the most significant causal relationship between the cost and the department for that specific cost item. When an appropriate basis is found, the costs are divided and allocated to all the separate departments/cost centres.

SECONDARY ALLOCATION OF MANUFACTURING OVERHEADS

There is no way that the costs of service departments can be allocated directly to the final product and/or job. The only method is first to divide the costs of the service departments among the production departments and, from there, to divide them among the final products and/or tasks.

This second phase of allocation, *where the costs of the service departments are divided among the production departments*, known as **secondary allocation**, also requires a reasonable basis for allocation based on the causal relationship between the service rendered and the department that makes use of the service. The table in Diagram 7.3 shows a few of the bases that can be used:

Service department	Allocation basis
<i>Purchases</i>	Number of orders Material cost
<i>Inventory piling</i>	Material cost Number of issues Number of units
<i>Personnel</i>	Number of employees Man hours Labour costs

continued

Service department	Allocation basis
<i>Repairs and maintenance</i>	Machine hours Services rendered Value of machines
<i>Quality control</i>	Number of units Man hours Services rendered

Diagram 7.3

Some service departments render an independent service, for example, repair work or maintenance. The cost can be divided between the various production departments according to time-sheets or work-sheets.

The nature of the enterprise, the type of products manufactured, and the composition of the production process will ultimately determine which basis is the fairest for the allotment of a specific service department's costs.

When there is more than one service department in an enterprise, the costs of the smallest service department are usually allocated first and to other service departments so that each department receives its rightful portion. In the process, the smallest department is closed off. After that, the second smallest service department is apportioned and closed off, and then the next one, and so on. Eventually, after all the service departments have been allocated and closed off, costs will be shown against the production departments only.

APPLICATION TO THE PRODUCTS AND/OR JOBS

At this stage, the rate at which the overheads of the production departments are applied to the various products and/or jobs are calculated. Section 3, 'Applied Manufacturing Overheads' discussed the different bases that can be used to calculate the rates. Generally, labour hours and machine hours are used.

It is important to note that the budgeted overheads must be departmentalised to calculate the predetermined overhead rates. At the end of the period, the actual manufacturing overheads must also be departmentalised to determine whether the overheads recovered during the period by means of the predetermined overhead rates were sufficient to cover the actual overheads. If the applied or recovered overheads are more than the actual overheads, an over-recovery exists, and *vice versa*.

Example 7.4 illustrates the primary and secondary allocation of overheads (departmentalisation of overheads), as well as the determination of the allocation rate whereby the overheads are allocated to the various products that are manufactured.

Example 7.4

An enterprise has gathered the following information with the aim of departmentalising its manufacturing overheads:

	Departments			
	Cutting	Assembling	Administra- tion	Recreation
Direct labour hours	6 500	7 100	1 500	375
Machine hours	950	850	400	65
Number of employees	21	27	4	2
Value of machinery	R31 000	R28 000	R4 000	R15 000
Floor area	1 300 m ²	1 100 m ²	200 m ²	100 m ²
Material usage	R74 000	R29 000	R3 000	R10 000

The following amounts represent the budgeted manufacturing overheads for 2015:

R

Insurance:	
Buildings	10 800
Machinery	3 120
Cafeteria	4 698
Depreciation on machinery	11 700
Maintenance of buildings	9 450
Cost of inventory piling	4 640
Protective overalls	1 458
Heating of factory building	2 025
Indirect material:	
Cutting	731
Assembling	1 966
Administration	500
Recreation	311

Secondary allocation: The number of employees is used as a basis for the recreation department and the machine hours as basis for the administration department.

Product X spends 10 labour hours in the cutting department and six labour hours in the assembly department.

Required

- Based on direct labour hours, calculate the allocation rate for each of the production departments.
- Calculate the overheads applied to product X.

Solution 7.4

(a) Overhead allocation statement

			Departments			
Cost item	Basis	Total	Cutting	Assem- bling	Adminis- tration	Recre- ation
		R	R	R	R	R
Primary allocation:						
Building insurance (note 1)	Area	10 800	5 200	4 400	800	400
Machinery insurance	Value	3 120	1 240	1 120	160	600
Cafeteria	Employees	4 698	1 827	2 349	348	174
Depreciation	Value	11 700	4 650	4 200	600	2 250
Building maintenance	Area	9 450	4 550	3 850	700	350
Inventory piling	Material	4 640	2 960	1 160	120	400
Protective overalls	Employees	1 458	567	729	108	54
Heating – factory	Area	2 025	975	825	150	75
Indirect material	Given	3 508	731	1 966	500	311
		51 399	22 700	20 599	3 486	4 614
Secondary allocation:						
	Employees	–	1 863	2 396	355	(4 614)
	Machine hours	–	2 027	1 814	(3 841)	–
Total allocated overheads		51 399	26 590	24 809	–	–

Calculation of application rate

Cutting:
$$= \frac{\text{Allocated overheads}}{\text{Labour hours}}$$
$$= \frac{R26\,590}{6\,500}$$
$$= R4.09 \text{ per labour hour}$$

Assembling:
$$= \frac{\text{Allocated overheads}}{\text{Labour hours}}$$
$$= \frac{R24\,809}{7\,100}$$
$$= R3.49 \text{ per labour hour}$$

(b) Calculation of overhead applied to product X

Cutting department:

Direct labour hours: 10 hours $\times$ $R4.09 = R40.90$

Assembly department:

Direct labour hours: 6 hours $\times$ $R3.49 = R20.94$

Total applied overhead $R61.84$

Note 1: Division of insurance costs in respect of buildings

Basis: Floor area	
Ratio: 1 300 m ² : 1 100 m ² : 200 m ² : 100 m ²	
Cutting:	$= \frac{1\,300}{1\,300 + 1\,100 + 200 + 100} \times \text{R } 10\,800$ $= \frac{1\,300}{2\,700} \times \text{R } 10\,800$ $= \text{R}5\,200$
Assembling:	$= \frac{1\,100}{1\,300 + 1\,100 + 200 + 100} \times \text{R } 10\,800$ $= \frac{1\,100}{2\,700} \times \text{R } 10\,800$ $= \text{R}4\,400$
Administration:	$= \frac{200}{1\,300 + 1\,100 + 200 + 100} \times \text{R } 10\,800$ $= \frac{200}{2\,700} \times \text{R } 10\,800$ $= \text{R}800$
Recreation:	$= \frac{100}{1\,300 + 1\,100 + 200 + 100} \times \text{R } 10\,800$ $= \frac{100}{2\,700} \times \text{R } 10\,800$ $= \text{R}400$

Note: The exact method used to allocate the budgeted building insurance overhead is also applied to machinery insurance, cafeteria, depreciation, building maintenance, inventory piling, protective overalls, and the heating of the factory building.

REPEATED ALLOCATION METHOD

An alternative method for the secondary allocation of the costs of the service departments, called the **repeated allocation method**, is still acknowledged by some European writers but is seldom applied in South Africa.

The method implies that the costs of each service department are also allocated to all the other service departments. The service departments are thus not immediately closed off in this allocation method because the costs of the other service departments are again divided among the relevant service departments. Because a large portion of the costs are also allocated to the production departments each time, the costs of the service departments reduce with each allocation until eventually a paltry amount, which can be ignored, remains.

Example 7.5 illustrates the application of the secondary allocation using the repeated allocation method:

Example 7.5

Primary allocation of overheads:

	R
Production departments	
P1	6 408
P2	7 125
P3	4 895
Service departments	
D1	4 405
D2	4 690
Secondary allocation basis:	
P1	35%
P2	30%
P3	20%
D1	10%
D2	5%

Solution 7.5

	P1	P2	P3	D1	D2
Allocation basis	35%	30%	20%	10%	5%
Primary allocation (given):	6 408	7 125	4 895	4 405	4 690
Secondary allocation:					
First allocation (note 1)	1 728	1 481	987	494	(4 690)
	1 905	1 633	1 089	(4 899)	272
First repetition	100	86	57	29	(272)
	11	10	6	(29)	2
Second repetition	1	1			(2)
	10 153	10 336	7 034		

Note 1: First allocation of D2

							R	
35%	35%	/	95%	=	36.84%	×	4 690	1 728 P1
30%	30%	/	95%	=	31.58%	×	4 690	1 481 P2
20%	20%	/	95%	=	21.05%	×	4 690	987 P3
10%	10%	/	95%	=	10.53%	×	4 690	494 D1
95%					100%			4 690

Note: The exact method used to allocate the first allocation of D2 is also applied to every repetition after that.

ACTIVITY-BASED COSTING (ABC)

Activity-based costing is a relatively new way of thinking, developed to bridge the shortcomings of traditional cost-calculating methods.

Traditionally, fixed costs are allocated to the production process by linking them to a variable element, such as a fixed rate per labour hour, or as a percentage of direct labour costs.

Activity-based costing *assumes that activities cause cost and that activities create products. Costs are therefore allocated based on the utilisation of activities.*

Activity-based costing uses four steps to allocate costs to the final product, namely:

- Step 1:** Identify the most important activities of the company.
- Step 2:** Identify the factors that influence the cost of the activities. The factors that determine the extent of the activities' cost are called *cost drivers*.
- Step 3:** Create a *cost centre* for each activity, where the cost of each activity is accumulated.
- Step 4:** Allocate the cost of each activity (cost centre) to the products according to the extent that the products used the activities. Cost drivers are used to determine the extent to which the activities were used.

The process of allocating costs is done in two stages, namely:

- ☐ allocating of cost to the cost centres, and
- ☐ allocating of the cost centres to the products with the cost drivers as the basis.

Activity-based costing is therefore aimed at relating the cause of the cost (cost driver) of each activity that is part of the total production process to the end product. For example, the number of kilometres covered determines the extent of the transport costs, and is used as a cost driver to allocate the transport costs to the end product.

Three categories of activities are distinguished, namely:

- ☐ *unit level activities* or activities each product is subjected to, for example, the machining. Costs are therefore allocated to the individual product;
- ☐ *batch level activities* or activities each batch is subjected to, for example, the machinery setting for a production run. The costs are not allocated to the individual product, but to the production line as such; and
- ☐ *product support activities* or activities aimed at supporting the different products that are part of the product range, for example, administration, financial services, management, or factory lighting. These are considered general costs and written off against the income of all the production lines.

This implies that a contribution per product, a contribution for each production line and a contribution for the whole product range that is being manufactured, are determined.

Although activity-based costing is a new approach in management accounting, it provides a fair allocating basis and is increasingly used in practice. We review activity-based costing in detail in chapter 9.

SUMMARY

A clear distinction between the concepts of budgeted overheads, applied overheads and actual overheads is necessary because, if it is not made, a great deal of confusion may arise. The accurate establishment of the predetermined allocation rate for overheads can mean the difference between success and failure for an enterprise. Too often, in times of high inflation, it happens that the predetermined overhead rates do not keep pace with increases in costs and that the selling price, which is based thereon, does not provide sufficient income to cover all the costs. Nothing is more burdensome for management than to discover at the end of what was expected to be a successful year that there has been a substantial under-recovery of overheads which must be indirectly written off against the profits and which turns the potentially good results into a loss.

PERSPECTIVES ON COSTING

Knowledge

You should know:

- ☐ the difference between budgeted, applied, and actual overheads, and at which different stages of budgeting and reporting they are used;
- ☐ over- or under-applied overheads represent the difference between applied and actual manufacturing overheads;
- ☐ departmentalisation of overheads is the division of overheads among the various sections of the factory so that an allocation rate for each manufacturing department can eventually be established;
- ☐ primary allocation is the first allocation of overheads apportioned to the production and service departments of the enterprise, using an appropriate allocation basis;
- ☐ secondary allocation of overheads is where the costs of service departments are divided among the production departments by using an appropriate allocation basis; and
- ☐ the determination of an overhead rate is performed by dividing the total overheads of the manufacturing department by a suitable basis.

Skills

You should be able to:

- ☐ calculate under- or over-applied overheads;
- ☐ record all accounting entries in respect of overheads;
- ☐ perform a primary and secondary allocation of manufacturing overheads to manufacturing departments;
- ☐ calculate overhead allocation rate per production department; and
- ☐ calculate the overhead cost per product.

KEY TERMS AND CONCEPTS

Actual manufacturing overheads	204	Over-applied overheads	210
Applied manufacturing overheads	205	Predetermined rate	205
Budgeted manufacturing overheads	204	Secondary allocation	212
Cost carrier	212	Technical life	209
Fixed instalment method	209	Under-applied overheads	210

REVIEW PROBLEMS

Problem 7.1

Afri Law provide two types of services, namely, legal cases and property registrations. Their supporting departments are administration, cleaning services, and personnel. Information regarding the five departments is as follows:

	Service departments		Supporting departments		
	Legal cases	Registrations	Adminis- trative	Cleaning	Personnel
Floor area (m ²)	800	600	200	200	200
Value of equipment	R12 500	R12 500	R7 500	R12 500	R5 000
Kilowatt hours	6 000	5 000	4 000	3 000	2 000
Service hours	1 200	800	–	–	–
Cleaning hours	500	500	300	500	200

The costing information for the period is as follows:

		R
Depreciation		10 000
Rent		20 000
Electricity		5 000
Cleaning services		15 000
Indirect labour	Legal cases dept	5 000
Indirect labour	Registration dept	10 000
Indirect material	Legal cases dept	15 000
Indirect material	Registration dept	10 000
Required		
Perform both the primary and secondary allocation of overheads. For the secondary allocation of overheads, the floor area is the allocation basis.		

Solution 7.1

Cost	Basis	Total	Department					
			Legal	Regis- trations	Adminis- tration	Clean- ing	Per- sonnel	
Primary allocation:		R	R	R	R	R	R	
	Depreciation	Value of equip	10 000	2 500	2 500	1 500	2 500	1 000
	Rent	Floor space	20 000	8 000	6 000	2 000	2 000	2 000
	Electricity	kW hours	5 000	1 500	1 250	1 000	750	500
	Cleaning	Maint hours	15 000	3 750	3 750	2 250	3 750	1 500
	Indirect labour	Direct	15 000	5 000	10 000			
	Indirect material	Direct	25 000	15 000	10 000			
Secondary allocation:		90 000	35 750	33 500	6 750	9 000	5 000	
			2 222	1 667	556	556	(5 000)	
			4 778	3 584	1 195	9 556 (9 556)	0	
					8 501	0		
			4 858	3 643	(8 501)			
		90 000	47 608	42 394	0			

Problem 7.2

NAMCO uses departmental overhead rates to apply overheads. The company has two production departments and one service department. You have been provided with the following budgeted information for the three departments:

	Production A	Production B	Service department
Fixed overheads	R120 000	R340 000	R30 000
Labour hours	10 000 hours	2 000 hours	160 hours
Machine hours	3 500 hours	20 000 hours	0 hours

Service department cost is reallocated on the basis of labour hours. The following actual data has been collected at year-end:

	Production A	Production B
Fixed overheads	R120 000	R320 000
Labour hours	11 000 hours	2 500 hours
Machine hours	1 500 hours	18 500 hours

Required

Calculate the appropriate over-/under-applied overhead per department.

Solution 7.2

	Production A	Production B	Service department
Fixed overheads	R120 000	R340 000	R30 000
Reallocation	R25 000	R5 000	(R30 000)
Total fixed overheads	<u>R145 000</u>	<u>R345 000</u>	
	145 000/10 000	345 000/20 000	
Overhead rate	=R14.50 per labour hour	=R17.25 per machine hour	
Applied:			
(11 000 × 14.50)/(18 500 × 17.25)	R159 500	R319 125	
Less: Actual	<u>(R120 000)</u>	<u>(R320 000)</u>	
	<u>R39 500</u>	<u>(R875)</u>	
	Over-applied	Under-applied	

EXERCISES**7.1**

Discuss the following concepts in detail:

- ☐ Budgeted manufacturing overheads.
- ☐ Applied manufacturing overheads.
- ☐ Actual manufacturing overheads.
- ☐ Over- and under-applied overheads.

7.2

Explain the difference between fixed, variable, and semi-variable overheads.

7.3

Explain why the scatter graph and simple regression are considered to be more accurate than the high-low method when dividing overheads in fixed and variable components.

7.4

The Aba Company purchased a vehicle for R200 000 on 1 October 2013. The Company's financial year-end is 28 February and depreciation is written off at 20% per annum.

Required

- (a) Calculate the book value of the vehicle on 28 February 2015 if depreciation is written off according to the reducing balance method.
- (b) Calculate the book value of the vehicle on 28 February 2015 if depreciation is written off according to the straight-line method.

7.5

Transcor Ltd collected the following statistics in order to allocate their overheads among the various departments:

	Production department A	Production department B	Service department C
Value of equipment	R15 000	R9 000	R6 000
Number of employees	36	24	20
Floor space	400m ²	300m ²	200m ²
Material used	R40 000	R30 000	R5 000
Direct labour hours	1 300	700	905
Machine hours	450	305	195

The following amounts represent the budgeted overheads for 2013:

	R
Depreciation on equipment	900
Rent of factory buildings	2 250
Electricity	900
Protective clothing	800
Cafeteria	720
Insurance:	
Buildings	450
Equipment	750

Overhead allocation tariffs/rates are based on labour hours, while the secondary apportionment of the service department takes place according to machine hours.

Required

Calculate the overhead allocation rates of each of the two production departments for 2013 using the stepped method of allocation.

7.6

Explain the difference between activity-based costing and the traditional costing systems.

8 Variable and absorption costing



LEARNING OUTCOMES

What are the two different methods of cost accumulation?

How do we disclose costs under the different methods?

- Explain the difference between variable and absorption costing
- Prepare a Statement of Profit or Loss according to the variable costing method
- Prepare a Statement of Profit or Loss according to the absorption costing method
- Reconcile the variable costing net profit with the absorption costing net profit

CHAPTER OUTLINE

Chapter 2 introduced the various cost classifications, including the different costing elements needed to complete a full production statement. Furthermore, it was identified that certain costs are difficult to trace to cost objects and these were classified as indirect manufacturing overheads. In chapter 7, we reviewed the traditional approach that can be used to allocate these overheads to cost objects. We now combine all the cost elements, direct and indirect, into a single production statement and demonstrate the two different methods that can be followed in constructing such a statement.

This chapter introduces the variable costing approach and then moves on to the absorption costing approach. A variable costing approach does not allocate fixed costs to cost objects, but rather expenses these as a period cost in the Statement of Profit or Loss. The variable costing approach facilitates internal financial decision-making as it excludes costs that cannot change in the short term. The absorption costing approach is typically used for external financial reporting to facilitate a general overview of the financial situation. This approach allocates fixed costs to cost objects using the traditional method.

The main difference between the two production statements is the treatment of fixed costs, which can also be described as fixed manufacturing overheads. Finally, it demonstrates how the two types of statements can be reconciled to validate their differences.

INTRODUCTION

Management must decide on a method of fixed cost recovery, which must consider the implications and usages of the different techniques. Variable costing (marginal or direct costing) and absorption costing are commonly used methods.

In the **variable costing method**, *the total fixed costs are written off against the income of the number of units sold during the period. Therefore, no fixed costs are allocated to the units still in inventory.*

The **absorption costing method** differs from the variable costing method in that *the fixed costs are allocated to the number of units manufactured (units sold plus units in inventory).* The portion of the fixed costs allocated to the units in inventory is therefore transferred to inventory to be sold in the next financial period. It is therefore included in the opening inventory of the next period.

When the variable costing method is used, inventory is only valued at variable costs (direct materials, direct labour, and variable manufacturing overheads). When the absorption costing method is used, namely, variable costs plus fixed manufacturing costs, inventory is valued as product costs. The difference between variable and absorption costing is that absorption costing recognises fixed manufacturing overheads as product costs, while variable costing treats them as period costs.

The decision of how to recover fixed manufacturing costs is critical, because it can influence the enterprise's net profit, especially in the short term.

It must be emphasised that the way fixed costs are recovered does not influence the amount of the fixed costs, but only how and when they are reflected in the financial statements. It does influence net income in the short term, but because all fixed costs must be recovered in the long term, this effect will eventually be neutralised.

THE APPLICATION OF VARIABLE AND ABSORPTION COSTING

Variable costing emphasises the difference between fixed and variable costs. Variable costing allocates only variable manufacturing costs to the product, in other words, direct materials, direct labour, and variable manufacturing overheads. The reasoning supporting this argument is that a fixed overhead is a capacity cost. As soon as the period has expired, any benefits received in capacity expire, and should not be included in the inventory. Components of variable costing view fixed manufacturing overhead costs for the period as expired costs and write them off in the Statement of Profit or Loss.

Absorption costing allocates all manufacturing costs to the product: direct materials, direct labour, variable overheads, and fixed overheads (regarded as product costs). Thus, fixed manufacturing overheads are classified according to the absorption costing method as a product cost, not a period cost.

To recap, the difference is:

- ☐ variable costing is a product-costing approach that treats variable manufacturing costs as product costs and fixed manufacturing costs as period costs (expired costs in the period incurred); and
- ☐ absorption costing is a product-costing approach that treats both variable and fixed manufacturing costs as product costs. According to the matching principle (income matched against cost of sales), fixed costs will only be released from the

Statement of Financial Position (finished goods inventory account) and recovered during the revenue period, as the fixed costs form part of cost of sales (expired costs).

Consequently, fixed manufacturing overheads are allocated to the product using a predetermined fixed overhead rate (as discussed in chapter 7) and are only expensed when the product is sold. All other costs under absorption and variable costing are illustrated in Diagram 8.1:

	Variable costing	Absorption costing
Product costs	Direct materials Direct labour Variable overhead (Manufacturing and Non-manufacturing)	Direct materials Direct labour Variable overhead (Only Manufacturing) Fixed overhead
Period costs	Fixed overheads Selling expenses (Fixed) Administrative expenses (Fixed)	Selling expenses (Fixed and Variable) Administrative expenses (Fixed and variable)

Diagram 8.1

Inventory valuation

It is obvious that the net profit for a certain period can differ for the two methods because there is usually a time difference between the manufacturing action and the selling action of the product or production. A logical conclusion is that if the full production is manufactured and sold in the same period, there will be no difference in the net profit obtained by the two methods. Only if the full production is not sold during the same reporting period will there be a difference, but the difference between the two methods is still reconcilable if closing inventory is brought into account.

The difference between the inventory valuations can be illustrated in the following simple example 8.1:

Example 8.1

During the current year, Walsh (Pty) Ltd had the following information related to its product:

Opening balance:

Finished goods (units)	Nil
Units manufactured	9 000
Units sold (R270 per unit)	7 200
Normal volume (units)	9 000

Costs:

R

Variable cost per unit:

Direct materials	45
Direct labour	90
Variable manufacturing overheads	45
Variable selling	9

Fixed costs:

Fixed manufacturing overheads	225 000
Fixed selling and administrative	90 000

The unit cost value will depend on the costing approach applied. Inventories based on the variable costing method consist only of variable manufacturing costs. The unit cost will be R180 (R45 + R90 + R45). Inventories based on the absorption costing method include all manufacturing costs. The unit cost will be R205 {R180 + (R225 000 fixed manufacturing overhead ÷ 9 000 units)}. The calculations are as follows:

Solution: 8.1

	Variable costing R	Absorption costing R
Direct materials	45	45
Direct labour	90	90
Variable manufacturing overheads	45	45
Fixed overheads (R225 000 ÷ 9 000 units)	0	25
Total unit cost	<u>180</u>	<u>205</u>

The difference in unit costs affects the amount invested in inventory. Walsh started with no opening balance of finished goods and manufactured 1 800 units more than it sold. As a result, the closing balance of finished goods is 1 800 units (9 000 units manufactured – 7 200 units sold). The value of the closing balance of the finished goods inventory is R324 000 (R180 × 1 800 units) under the variable costing method and R369 000 (R205 × 1 800 units) under the absorption costing method.

Statement of Profit or Loss: Comparing variable costing to absorption costing

Since unit costs are the basis for cost of goods sold, the variable and absorption costing methods can lead to different net income figures. The difference arises because of the fixed overheads recognised under the two methods. Let us see how it affects the Walsh example (8.1 above):

Variable costing

	R
Revenue (R270 × 7 200 units)	1 944 000
Less: Variable cost of goods sold	(1 296 000)
Opening inventory	0
Add: Variable manufacturing costs (R180 × 9 000)	1 620 000
Goods available for sale	1 620 000
Less: Closing balance: Finished goods (R180 × 1 800 units)	(324 000)
Less: Selling variable expenses (R9 × 7 200 units)	(64 800)
Contribution	583 200
Less: Fixed costs	(315 000)
Fixed manufacturing overheads (R25 × 9 000 units)	225 000
Fixed selling and administrative (R10 × 9 000 units)	90 000
Net income	<u>268 200</u>

Absorption costing

	R
Revenue ($R270 \times 7\,200$ units)	1 944 000
Less: Cost of goods sold	(1 476 000)
Opening balance: Finished goods inventory	0
Add: Cost of goods manufactured ($R205 \times 9\,000$ units)	1 845 000
Goods available for sale	1 845 000
Less: Closing balance: Finished goods ($R205 \times 1\,800$ units)	(369 000)
Gross income	468 000
Less: Selling and administrative expenses	(154 800)
Variable selling expenses ($R9 \times 7\,200$ units)	64 800
Fixed selling and administrative expenses	90 000
Net income	313 200

The income according to the absorption costing method is R45 000 ($313\,200 - 268\,200$) more than the income of the variable costing method. The fixed manufacturing overhead for the period, absorbed into the finished goods inventory under the absorption costing method, causes the difference.

The differences between the two methods can be explained as follows:

	Variable cost R	Absorption cost R	Differences R
Net income	268 200	313 200	(45 000)
Closing inventory	324 000	369 000	45 000

To establish what information is the same, the two Statements of Profit or Loss must be compared. The variable cost of goods sold and selling and administrative expenses are always the same. Fixed manufacturing overheads are the only factor that causes the difference. Therefore, income determined with the absorption costing method is R45 000 more than income determined with the variable costing method.

What happened to the R45 000 fixed manufacturing overheads? Using the absorption costing method, R25 fixed manufacturing overheads were allocated to each product. Of the 9 000 units manufactured, only 7 200 units were sold. The 1 800 unsold units went into the finished goods inventory, carrying an amount of R45 000 ($R25 \times 1\,800$ units) of fixed manufacturing overheads. When these 1 800 units are sold, the R45 000 of fixed manufacturing overheads will be written off against revenue in the Statement of Profit or Loss. Therefore, according to the absorption costing method, R45 000 of fixed manufacturing overheads of the period are absorbed into inventory and are transferred to a future period.

Closing inventory has a higher value because it includes fixed costs.

	R
Variable costs	$1\,800 \times R180$ 324 000
Fixed costs	$1\,800 \times R25$ 45 000 Difference
Closing inventory	369 000

Comparison	Variable costing R	Absorption costing R	Difference R
Revenue (R270 × 7 200 units)	1 944 000	1 944 000	0
Less: Cost of goods sold	(1 296 000)	(1 476 000)	180 000
Variable (R180 × 7 200 units)	1 296 000	1 296 000	0
Fixed (R25 × 7 200 units)	0	180 000	180 000
Gross income		468 000	
Less: Variable selling expenses (R9 × 7 200 units)	(64 800)	(64 800)	0
Contribution	583 200		
Subtotal			(180 000)
Less: Fixed expenses	(315 000)	(90 000)	(225 000)
Manufacturing (R25 × 9 000 units)	225 000	0	(225 000)
Selling and administrative (R10 × 9 000 units)	90 000	90 000	0
Net income	268 200	313 200	45 000

None of the fixed selling and administrative costs is allocated to the product under either method. Both methods regard fixed selling and administrative costs as period costs, and therefore they will undoubtedly not be absorbed into inventories.

Revenue, production and income relationships

A change in the relationship between production and revenue causes a difference in the relationship between variable-costing income and absorption-costing income. Variable-costing income is greater than absorption-costing income if more products are sold than manufactured. If revenue is higher than production, more products flow out of finished goods inventory than the inflow.

With absorption costing, units from the finished goods inventory may have fixed manufacturing overheads assigned to them from a previous period. Additionally, production units and units sold have all the fixed overheads of the current period attached to them.

Therefore, the fixed manufacturing overheads in the cost of sales are higher than the amount of the fixed manufacturing overheads moving out of inventory. On the other hand, absorption-costing income is lower than variable-costing income by the amount of the fixed overheads flowing out of finished goods inventory amount.

When revenue and production are the same, no difference will be reported between the two incomes. Because the production units are all sold, both absorption costing and variable costing will accept fixed manufacturing overheads as a period cost, because no fixed manufacturing overheads were absorbed into or flowed out of inventory.

The following table summarises the relationships between revenue, production, and the two reported incomes:

If	Then
1. Production > Revenue	Absorption net income > Variable net income
2. Production < Revenue	Absorption net income < Variable net income
3. Production = Revenue	Absorption net income = Variable net income

1. When the production is greater than the revenue, the inventory increases.
2. When the production is lower than the revenue, the inventory decreases.
3. When the production and revenue are the same, the opening inventory balance is the same as the closing inventory balance.

Example 8.2 illustrates these relationships:

Example 8.2

The following information of African Steel (Pty) Ltd for the periods 2011 to 2015 is available:

	R
Selling price per unit	15
Variable cost per unit	9
Fixed manufacturing overheads per annum	270
Fixed administrative costs per annum	75
Variable selling cost per unit	0.50
Revenue and production units per annum are as follows:	

	2011	2012	2013	2014	2015
Sold units	90	72	108	84	96
Units manufactured	90	90	90	102	84

There was no opening inventory in the beginning of 2011. Normal activity is 90 units per annum.

Required

Prepare the variable and absorption Statements of Profit or Loss for periods 2011–2015.

Solution 8.2: Variable costing Statement of Profit or Loss

	2011 R	2012 R	2013 R	2014 R	2015 R
Revenue	1 350	1 080	1 620	1 260	1 440
Less: Cost of sales	(810)	(648)	(972)	(756)	(864)
Opening inventory	0	0	162	0	162
Add: Production costs	810	810	810	918	864
Less: Closing inventory	0	(162)	0	(162)	(54)
Less: Selling variable cost	(45)	(36)	(54)	(42)	(48)
Contribution	495	396	594	462	528
Less: Fixed costs	(345)	(345)	(345)	(345)	(345)
Manufacturing	270	270	270	270	270
Administrative	75	75	75	75	75
Net income	150	51	249	117	183

The production cost per unit is R9 and includes variable manufacturing costs only. Variable selling costs are R0.50 per sold unit. In 2011, 90 units were manufactured at a variable cost of R9 per unit. Both the fixed manufacturing and the administrative costs are deducted from the contribution to determine the net income. Observe that the manufacturing fixed costs of R270 are classified as a period cost and are written off in the period they are incurred.

During 2012, 72 units were sold while 90 units were manufactured. Therefore, the closing inventory balance was 18 units at the end of that year. To match revenues with costs, the revenue amount of 90 units should be matched with the costs for 90 units. Since 90 units were manufactured, the 18 units in inventory needed to be valued and that amount must be deducted from the production costs. Employing a variable costing system, the closing inventory of 18 units are valued at R9 per unit, resulting in an inventory amount of R162 which will then be deducted from the production costs giving a cost of sales amount of R648. The closing inventory valuation does not include any fixed manufacturing overheads.

The 18 units classified as the closing inventory in 2012 comprise the opening inventories for 2013, and therefore an expense for that period. The manufacturing cost for the 90 units produced in 2013 is added to the value of the opening inventory. The entire result is that the cost of sales for 108 units is matched against revenue for 108 units. The income for 2014–2015 is determined in the same manner.

The calculations for closing inventories and income are now deemed to be using the absorption costing approach:

Solution 8.2: Absorption costing Statement of Profit or Loss					
	2011 R	2012 R	2013 R	2014 R	2015 R
Revenue	1 350	1 080	1 620	1 260	1 440
Less: Cost of sales	(1 080)	(864)	(1 296)	(1 008)	(1 152)
Opening inventory	0	0	216	0	216
Add: Production costs	1 080	1 080	1 080	1 224	1 008
Less: Closing inventory	0	(216)	0	(216)	(72)
Adjustments:					
Add: Over-recovery				36	
Less: Under-recovery					(18)
Gross income	270	216	324	288	270
Less: Fixed administrative costs	(75)	(75)	(75)	(75)	(75)
Less: Variable selling costs	(45)	(36)	(54)	(42)	(48)
Net income	150	105	195	171	147

The fixed overheads in Example 8.2 are R270 per annum and the normal activity is 90 products. Fixed overheads are, therefore, allocated at R3 ($R270 \div 90$ units) per product. The product cost at this point consists of a variable manufacturing cost (R9) plus a fixed manufacturing cost (R3), totalling R12 per product. The production cost for 2011 is R1 080 ($90 \text{ units} \times R12$).

When comparing the absorption costing Statement of Profit or Loss with the variable costing Statement of Profit or Loss for 2011, the fixed cost is absorbed in the production cost, while only the variable cost is included with variable costing. With variable costing, the fixed manufacturing cost is not included in the cost of sales but is written off against the Statement of Profit or Loss as a period cost. In the absorption costing Statement of Profit or Loss, one should also be aware that the closing inventory of 18 units for 2012 is valued at R12 per unit, while in the variable Statement of Profit or Loss, the closing inventory is valued at only R9 per unit.

When profits are determined, the matching principle is applied in the absorption costing Statement of Profit or Loss. Nevertheless, problems developed in 2014 and 2015 because, in 2014, 102 products were manufactured. This resulted in the fixed overheads of R306 (102 units at R3) being included in the production cost of R1 224. The total fixed overheads incurred for the period is only R270. This would mean that R36 was **over-recovered**. This over-recovery of fixed overhead is recorded as a period cost adjustment.

Eighty-four units were manufactured in 2015 at the cost of R1 008, which included fixed manufacturing overheads of only R252. Consequently, an **under-recovery** of R18 is written off as a period cost. An under- or over-recovery of fixed manufacturing overheads is the result of actual production constantly differing from the normal activity level of 90 products, because the calculation of the fixed overhead rate of R3 per unit was based on an estimate of 90 production units per annum.

Production equals revenue

During 2011, production equalled the revenue, resulting in the profit being the same for both costing methods and inventories neither increased nor decreased. Thus, when the opening inventory balances are established, the same fixed overheads amount will be forwarded as an expense in the current period, which will be deducted in the closing inventory valuation from the production cost amount. The general effect of an absorption costing system is that the amount of fixed overheads incurred for the period will be the only fixed overheads that will be included as an expense. Therefore, each time the revenue quantity is the same as the production quantity, the profits will be identical for both costing methods.

Production exceeds revenue

In both 2012 and 2014, production exceeded revenue, resulting in the absorption costing system producing higher profits than the variable costing system. The higher profits for the absorption costing system are due to the production being higher than the revenue causing inventories to increase. This is due to a higher amount of fixed manufacturing overheads in the closing balance of the inventory than in the one brought forward as the opening inventory for the period. In 2014 there was no opening inventory and, therefore, no fixed manufacturing overheads from the previous period were brought forward. However, a closing inventory balance of 18 units suggested that from the production cost for the period, a R54 fixed manufacturing overhead had to be deducted. As a result, only R216 is being expensed for fixed manufacturing overheads with the absorption costing system. In contrast, in the case of using the variable costing system, the R270 fixed manufacturing overheads incurred would be written off as a period cost. This results in profits being R54 higher when using an absorption costing system. Therefore, when production exceeds revenue, the absorption costing system will calculate a higher profit than the variable costing system.

Revenue exceeds production

In both 2013 and 2015, revenue exceeded production, resulting in the variable costing system calculating higher profits than the absorption costing system. When this happens, inventory decreases. This means that more fixed overheads will be brought forward in opening inventory than in the closing balance of inventory. For instance, with the absorption costing system in 2015, 18 units of opening inventory were brought forward, so a R54 manufacturing overhead was included in the inventory valuation.

Then again, a closing inventory of six units calls for a deduction of R18 fixed manufacturing overheads from the production costs. This result in a total of R306 fixed manufacturing overheads being charged for the period since an additional R36 fixed manufacturing overheads is included as an expense within the inventory movements. In contrast, the variable costing system would charge only R270 fixed manufacturing overheads for the period. So, the variable costing system's calculated profits are R36 higher than the absorption costing system. Therefore, when revenue exceeds production, the absorption costing system will calculate a lower profit than the variable costing system.

Impact of revenue fluctuations

An absorption costing system can produce some strange profit calculations. During 2015 the profits declined, but the revenue volume increased, notwithstanding that both the cost structure and selling price have remained unchanged. In contrast, during 2014, the profit increased while the revenue volume declined. These phenomena happened because of the under- or over-recovery of fixed overheads that were treated as period costs. Those adjustments often lead to the misinterpretation of profits.

On the contrary, with the variable costing profit calculations, profit increases when revenue volume increases, and profit decreases when revenue volume decreases. These relationships apply, providing that the cost structure and selling price remain the same. Considering the variable costing profit calculations, it is noteworthy that profit decreased in 2014 since the revenue volume decreased and increased in 2015 because the revenue volume increases. An explanation for these phenomena is that, with a variable costing system, profit is only a function of revenue volume when the cost structure and selling price remain constant. Conversely, with an absorption costing system, profit is a function of the revenue and the production volumes.

Reconciliation of the variable costing profit with the absorption costing profit

The steps to reconcile the variable cost net income with the absorption costing net income are as follows:

Step one: Record the variable costing net incomes.

Step two: Calculate the fixed manufacturing cost by multiplying the number of production units by the fixed manufacturing overheads rate per unit (R3). The number of production units is given. The fixed manufacturing rate is calculated as follows:

Fixed manufacturing overhead $\div$ normal activity = $R270 \div 90 \text{ units} = R3 \text{ per unit}$

Step three: Calculate the fixed manufacturing part of the absorption cost of sales by multiplying the sold units (given) with the fixed manufacturing overheads rate per unit (R3).

Step four: The results of step 1 *plus* step 2 *minus* the result of step 3 = absorption costing net income.

An illustration of the reconciliation of variable costing profit and absorption costing profit follows. It is based on the information and results emanating from Example 8.2

Reconciliation					
	2011 R	2012 R	2013 R	2014 R	2015 R
Variable costing net income	150	51	249	117	183
<i>Add:</i> Fixed manufacturing costs of production units to inventory under absorption costing (no. of production units × R3)	270	270	270	306	252
<i>Less:</i> Fixed manufacturing overheads released from inventory under absorption costing (sold units × R3)	(270)	(216)	(324)	(252)	(288)
Absorption costing net income	150	105	195	171	147

SUMMARY

The profit of an enterprise can be calculated in two ways, namely, according to the absorption costing method, or the variable costing method. These costing methods are used to determine product costs which are the bases whereby product costs are absorbed into the finished goods inventory. Period costs are also written off against the Statement of Profit or Loss in the period it was incurred. The treatment of fixed manufacturing overheads is the difference between variable and absorption costing.

PERSPECTIVES ON COSTING

Knowledge

You should know:

- ☐ the two methods for recovering costs, namely the absorption costing method and the variable costing method;
- ☐ that variable costing allocates only variable manufacturing costs to products and considers fixed costs as period costs, as it regards fixed overheads as a cost of capacity;
- ☐ that absorption costing allocates all manufacturing costs to the product;
- ☐ that if more production units were produced than sold, then the net income according to the absorption costing system will be less than the net income as calculated according to the variable costing system;
- ☐ that if less production units were produced than sold, then the net income according to the absorption costing system will be less than the net income as calculated according to the variable costing system; and
- ☐ that if the production units manufactured equals the number of units sold, then the net income according to the absorption costing will equal the net income as calculated according to the variable costing system.

Skills

You should be able to:

- ☐ prepare a Statement of Profit or Loss according to the variable costing method;
- ☐ prepare a Statement of Profit or Loss according to the absorption costing methods; and.
- ☐ reconcile the variable costing profit with the absorption costing profit.

KEY TERMS AND CONCEPTS

Absorption costing method	228
Over-recovery	235
Under-recovery	235
Variable costing method	228

REVIEW PROBLEMS

Problem 8.1

Information supplied by Big Five (Pty) Ltd is as follows:

	Period 1	Period 2
Opening inventory	0	0
Manufactured	100 units	100 units
Sold	60 units	140 units
Selling price	R100 per unit	R100 per units
Variable costs per unit		
Manufacturing	R30	R30
Selling and administrative costs	R5	R5
Fixed costs		
Manufacturing	R4 000	R4 000
Selling and administrative costs	R1 200	R1 200

Required

- (a) Prepare a variable and an absorption Statement of Profit or Loss for the two periods.
- (b) Reconcile the variable costing profit with the absorption costing profit.

Solution 8.1**(a)****Variable costing Statement of Profit or Loss for periods 1 and 2**

	Period 1 R	Period 2 R
Revenue (60 units/140 units × R100)	6 000	14 000
Less: Cost of goods sold	(1 800)	(4 200)
Opening inventory	0	1 200
Add: Cost of goods manufactured (100 units × R30)	3 000	3 000
Less: Closing inventory (40 units × R30)	(1 200)	0
Less: Variable selling and administrative costs (no. of units sold × R5)	(300)	(700)
Contribution	3 900	9 100
Fixed costs:	(5 200)	(5 200)
Manufacturing	4 000	4 000
Selling and administrative costs	1 200	1 200
Net income/(loss)	(1 300)	3 900

Absorption costing Statement of Profit or Loss for periods 1 and 2

	Period 1 R	Period 2 R
Revenue (no. of units sold × R100)	6 000	14 000
Less: Cost of goods sold	(4 200)	(9 800)
Opening inventory	0	2 800
Add: Cost of goods manufactured (100 units × R70)	7 000	7 000
Less: Closing inventory (40 units/0 units × R70)	(2 800)	0
Gross income	1 800	4 200
Less: Selling and administrative costs	(1 500)	(1 900)
Variable (60 units/140 units × R5)	300	700
Fixed	1 200	1 200
Net income/(loss)	300	2 300

Reconciliation

	Period 1 R	Period 2 R
Variable costing net income/(loss)	(1 300)	3 900
Add: Fixed manufacturing costs of production units to inventory under absorption costing (100 units × R40)	4 000	4 000
Less: Fixed manufacturing overheads released (sold) from inventory under absorption costing (60 units/140 units × R40)	(2 400)	(5 600)
Absorption costing net income	300	2 300

Reconciliation (alternative method)		
	Period 1 R	Period 2 R
Variable costing net income/(loss)	(1 300)	3 900
Add: Change in inventory levels:		
Closing balance – opening balance		
(40 units – 0 units) × R40	1 600	
(0 units – 40 units) × R40		(1 600)
Absorption costing net income	300	2 300

Problem 8.2

Sondi (Pty) Ltd manufactures writing pads and has provided you with the details of the budget for the following year:

Budgeted quantities:	Writing pads In Units
Sales	11 500
Opening stock	1 000
Closing stock (at end of budget year)	1 500
Budgeted unit data:	R per Unit
Selling price	140
Variable production costs:	
Materials	14
Labour	38
Overhead	23
Variable selling, admin, and distribution costs:	
For each product: 10% of sales revenue	
Budgeted fixed annual overheads:	R
Production	360 000
Selling, admin, and distribution	116 000
Total	476 000

The company values stock and reports profit monthly using an absorption costing system and any over- or under-absorbed overheads are treated as period items in the income statement. The relevant overheads for each product are absorbed at pre-determined rates per unit of output.

The actual results for the year were entirely in accordance with the budget, except for the following items:

Actual Units Produced:

- Writing Pads – 1 000 units more than budget

As a result of the change in production, actual closing stock also differed from budget.

Fixed selling, administration, and distribution overheads:

- Writing Pads – an increase of R5 500

Opening stock is valued at the same unit cost per product as would be calculated using the budgeted data.

Required

- Prepare a Statement of Profit or Loss for the 'writing pads' product showing the actual results of trading for the year, using the company's method of costing.
- Prepare a Statement of Profit or Loss for the 'writing pads' product showing the actual results of trading for the year, using a variable costing approach.
- Reconcile the net profit calculated in (a) with the net profit calculated in (b) above.

Solution 8.2

(a)

		R
Sales (11 500 × 140)		1 610 000
Less: cost of sales		(1 207 500)
Opening stock (1 000 × 105 W2)	105 000	
Add: Production (13 000 W3 × 105 W2)	1 365 000	
	1 470 000	
Less: Closing stock (2 500 W4 × 105 W2)	(262 500)	
Normal gross profit		402 500
Adjust for over-/-(under)-recovery of fixed production overhead W5		30 000
Adjusted gross profit		432 500
Less: Selling, admin, and distribution costs		(282 500)
Variable (10% × sales revenue)	161 000	
Fixed (116 000 + 5 500)	121 500	
Net profit		150 000

Workings

W1	Budgeted production in units:		R
	Sales		11 500
	Add: Closing Balance		1 500
	Less: Opening Balance		(1 000)
	Units produced (budgeted)		12 000
W2	Variable production cost	14 + 38 + 23	75
	Add: Fixed absorption rate	360 000 / 12 000	30
	Total cost per unit		105
W3	Actual production		Writing Pads
	Budgeted production	Calculated in W1	12 000
	Actual over-produced	given	1 000
	Actual production		13 000
W4	Closing stock		Writing Pads
	Budgeted Closing Stock		1 500
	Actual over-produced	given	1 000
	Actual closing stock		2 500
W5	Budgeted overhead		R
	Absorbed	13 000 × 30	360 000
	Over-absorption		390 000
			30 000

(b)

		R
Sales ($11\,500 \times 140$)		1 610 000
Less: variable costs:		(862 500)
Opening stock ($1\,000 \times 75$)	75 000	
Production ($13\,000 \times 75$)	975 000	
	1 050 000	
Less: Closing stock ($2\,500 \times 75$)	(187 500)	
Less: Variable selling, admin, and distribution ($10\% \times \text{sales}$)		(161 000)
Contribution		586 500
Less: fixed costs		(481 500)
Production	360 000	
Selling, admin, and distribution costs ($116\,000 + 5\,500$)	121 500	
Net profit		105 000

(c)

	R
Per absorption costing (a)	150 000
Less: Fixed production overhead included in stock increase ($1\,500 \times R30$)	(45 000)
Per variable costing (b)	<u>105 000</u>

EXERCISES

8.1

Explain the difference between the variable costing approach and the absorption costing approach.

8.2

The following information was obtained from the books of Chetty Ltd:

	R
Manufacturing cost per unit:	
Fixed	3.50
Variable	5.50
Selling and administrative cost per unit:	
Fixed	0.50
Variable	1.50
Selling price per unit	12.00
Normal capacity (per month)	8 000 units

The company manufactured 7 500 units, and sold 7 000 of them during March 2015. During April 2015, 8 500 units were manufactured, and 9 000 units sold.

Required

- (a) Compile separate Statements of Profit or Loss for each month according to:
- ☐ the absorption costing method; and
 - ☐ the variable costing method.
- (b) Reconcile the net profit obtained, using the two methods.

8.3

Labola (Pty) Ltd manufactures a single product. The following information is available:

	R
Direct materials	2.00
Direct labour	3.00
Variable overheads	1.00
Fixed overheads	1.00
Unit cost	<u>7.00</u>

The estimated activity level is 90 000 units, and the budgeted fixed overheads are R90 000 per quarter. The budgeted fixed selling and administration overheads are R90 000 per quarter and the product is R10 per unit. The manufacturing and sales levels for each quarter were as follows:

	Quarter 1	Quarter 2	Quarter 3	Quarter 4
Production units	90 000	95 000	80 000	90 000
Sales units	90 000	80 000	95 000	95 000

There was no opening inventory, and the actual cost was the same as the budgeted cost.

Required

- (a) Prepare a Statement of Profit or Loss under the absorption costing method as well as a Statement of Profit or Loss under the variable costing method for the four quarters.
- (b) Reconcile the variable costing profit with the absorption costing profit.

8.4

Black Eagle (Pty) Ltd manufactures a single product. The following information is available:

	October	November	December
Production units	4 000	5 000	3 200
Sales units	4 000	4 000	4 000
Fixed manufacturing overheads	R8 000	R8 000	R8 000
Variable manufacturing overheads per unit	R16	R16	R16

There was no opening inventory at the beginning of October.

Required

- (a) Calculate the total manufacturing cost per unit.
- (b) Prepare a Statement of Profit or Loss under the absorption costing method as well as a Statement of Profit or Loss under the variable costing method for the three months October–December.
- (c) Reconcile the variable costing profit with the absorption costing profit.

9 Activity-based costing (ABC)



LEARNING OUTCOMES

How does activity-based costing compare to traditional costing?

How is activity-based costing used in costing a product?

When is it appropriate to use activity-based costing?

- Discuss the short falls of traditional unit-based cost drivers
- Identify the relevance of activity-based costing
- Design an activity-based costing system
- Calculate product cost using an activity-based approach
- Explain the criteria for using an activity-based system

CHAPTER OUTLINE

Chapter 7 discussed the traditional method of allocating indirect manufacturing overheads to cost objects. This method requires costs to be allocated first to cost centres, and then to cost objects, using an allocation rate calculated by a traditional cost driver. These traditional cost drivers are typically the number of production hours or units produced.

This chapter explains why traditional allocation methods have fallen out of favour due to the more modern developments in cost accounting. In certain situations, an unsophisticated cost driver can lead to sub-optimal decision-making, and the situation where this occurs is highlighted as the shortcomings of the traditional allocation method.

In response to the shortfall of the traditional allocation method, activity-based costing (ABC) was developed. This is a sophisticated method used to allocate indirect manufacturing overheads to cost objects. The four steps involved are discussed, as well as the general conditions under which it would be favourable to implement an ABC system.

INTRODUCTION

Most manufacturers have applied absorption costing systems for years, using volume-based cost drivers (traditional allocation method) to allocate indirect manufacturing fixed costs to the manufactured units. Before the industrial revolution, most manufacturing enterprises were labour-intensive, with direct labour costs being easily traceable to products and fixed costs being low. The result is that costs consisted of a small percentage of overheads and the method of allocating the overheads did not significantly influence the actual cost of a product.

After the industrial revolution, the costing of products changed, because directly traceable labour costs dropped, while indirect manufacturing fixed costs increased. An example is the cost of purchasing a machine and performing maintenance on it. These types of costs are difficult to trace to products, and need to be allocated using an overhead rate instead. Because fixed costs play a significant role in costing a product, it has become more important to allocate these costs using a proper methodology.

The need for more accurate product costs has forced many organisations to re-evaluate their costing procedures. Traditional cost allocation systems that worked quite well in the past may have outlived their usefulness.

The correct allocation, as well as the accurate calculation, of cost are both important for correct pricing and decision-making.

An incorrect product costing may result in a product being over- or under-priced. For example, if a competitor's price seems very low, the company should question the accuracy of their costing system. Furthermore, incorrect costing may result in a product running at a loss. Ultimately, an incorrect decision about the divestment of the product may be made.

The allocation of direct costs (variable costs) does not create problems, including when only one product is manufactured, and these overheads are simply allocated to one product.

Traditional allocation of overheads takes place in two stages (as discussed in chapter 7), namely, primary cost allocation to production and supporting departments and secondary allocation, where the costs of supporting departments are allocated back to production departments. This traditional costing system tends to allocate overheads on an arbitrary basis (a single allocation base), ignoring all other cost causal relationships.

The shortcomings of the traditional costing system resulted in the development of the activity-based costing system, or ABC as it is referred to.

The ABC system is based on the principle that products are created from activities. Such activities are cost drivers, and these costs created are allocated on the basis of the activities.

ABC system design

The traditional allocation methods have a major flaw. This impairs their ability to assign fixed costs accurately to products, resulting in cost prices reflecting inaccurate unit costs. The following factors are mainly responsible for these shortcomings:

Incorrect application of unit-based cost drivers

Fixed overheads do not directly relate to production volume, but vary with other factors unrelated to production volume. These factors are known as non-unit-based cost drivers.

The difference between unit-based cost drivers (allocation bases) and non-unit-based cost drivers must be understood to grasp the problem under discussion. **Unit-based cost drivers** *are factors that increase in direct proportion to the number of units produced and are therefore responsible for the variable costs in the production environment.* Examples of unit-based cost drivers are, among others, direct labour hours, machine hours, and direct material.

Non-unit-based cost drivers *are factors other than the number of units produced that cause fixed costs.* Examples of non-unit-based cost drivers are, among others, the number of set-ups, material handling hours, and inspection hours.

Thus, unit-based cost drivers cannot accurately assign fixed costs (indirect costs) to products.

If non-unit-based overhead costs are only a small percentage of the total overhead costs, the distortion of product costs will be minor. Under these circumstances, a traditional absorption costing system might be acceptable.

Degree of product diversity

The reason for distortion is the break in the link between the cause for the support activity costs (for example, set-up hours) and the allocation basis of the costs (for example, machine hours) awarded to the individual products. Two related factors contribute to these distortions:

- ☐ allocation based on unit-related measures; and
- ☐ differences in relative consumption ratios.

Product diversity is the situation that presents itself when products consume overheads in different proportions. For example, assume that two products, A and B, have the same machine hours per unit. According to the traditional costing system, set-up costs would have been allocated to products A and B at a fixed rate per machine hour. If, however, product A is manufactured in larger batches and fewer machine set-ups are required, a fixed rate per machine hour will distort the cost of the product (too much for product A and too little for product B). The allocation to product A is charged at the same rate as for product B because machine hours are used as the cost driver. Conventional allocation methods use unit-related cost drivers to allocate support activity costs, even when the demand for these activities is driven by batch-related and product-sustaining cost drivers such as set-ups and engineering changes.

Cost distortions were expanding with the secondary allocation, when the first allocation had already lost a great deal of its integrity. Assume product A needs one set-up hour, but product B needs two set-up hours, per batch. Both products require the same number of machine hours per unit. The actual consumption ratio of product A to product B for set-up activity is 1:2, based on the actual cost driver's set-up hours ratio. The apparent consumption ratio used to allocate set-up costs is 1:1, based on machine hours. This difference in the proposed driver cost and the unit-level cost drivers used by traditional systems results in over-costing product A and under-costing product B.

ABC costing could reduce such distortions because the actual cost driver for each support activity allocates costs directly to the products used.

Example 9.1 will enhance the discussion of setting up an ABC system:

Example 9.1

An analysis of the overhead costs allocated to the Inbound Logistics Department of African Products (Pty) Ltd's records shows the following:

	R
Salary:	6 000
Materials manager	
Miscellaneous expenses	12 000
Purchasing section:	12 000
Salaries (3 purchasing officers × R4 000)	
Materials receiving section:	
Salaries (5 receiving clerks × R3 000)	15 000
Total overhead costs	45 000

Additional information (Inbound Logistics Department):

- ☐ The Inbound Logistics Department makes 200 purchase orders a year with a total monetary value of R800 000.
- ☐ 37,5% of the materials manager's time is allocated to the purchasing centre, and 62,5% (12,5% verifying purchasing orders and 50% to the purchasing officers) to the materials receiving section.
- ☐ The receiving clerks spend 20% of their time verifying the specific requirements for each order and 80% of their time on tasks related to the receiving of materials.
- ☐ Miscellaneous costs are allocated as follows: 15% to the purchasing section and 85% to the materials receiving section.

Additional activity costs similar to those calculated for the Inbound Logistics Department are available:

Machining Department:

Set-up	R250 per job
Conversion	R100 per machine hour

Finishing Department:

Assembling	R50 per labour hour
Painting	R60 per labour hour

Additional information (Job 42)

A new job order has come in:

- 1 Job 42 requires two purchase orders from the Inbound Logistics Department, in the amounts of R5 000 and R3 500 respectively. The company treats these two purchase orders as cost objectives.
- 2 Job 42 requires 40 hours for conversion, 30 hours for assembling and 25 hours for painting.

Required

- (i) Calculate the overhead cost per purchase order using the traditional allocation method.
- (ii) Calculate the overhead cost per purchase order using an ABC system.
- (iii) Using the answers calculated in (i) and (ii) above, calculate and compare the costing of Job 42 under the two different overhead cost allocation methods.

(i) Traditional allocation

Under a traditional costing system, overhead costs are allocated to departments, namely, in this example certain salaries and miscellaneous expenses were allocated to the Inbound Logistics Department.

To find the allocation rate for a product or, in this case, a purchase order, we divide the total overhead cost of the department by an appropriate cost driver. As this is a logistics department, the number of purchase orders is deemed to be suitable.

$R45\,000 / 200 \text{ orders} = R225 \text{ per order}$

Thus, the overhead cost per purchase order using the traditional allocation method is R225.

(ii) Activity-based Costing

To set up an ABC system, four main steps must be followed:

Step 1: Identify activities

An enterprise must identify all its activities before installing an ABC system. An **activity** is a task, action or unit of work being done within an enterprise.

The identification process requires an excellent knowledge of all the production processes within the enterprise. The identification of activities with their associated cost drivers must be performed in a structured manner to ensure that all relevant information is gathered. Small tasks must be grouped into meaningful activities. The overheads allocated to each activity consist of an activity cost pool. Activities can be classified into four major categories, as follows:

Unit-level activities

Unit-level activities are activities that relate to individual units produced. In other words, unit-level activities must be performed each time a batch is produced. Production volume therefore directly influences the volume of unit-level activities. Examples of costs associated with these types of activities include direct material, direct labour, and variable manufacturing overheads.

Batch-level activities

Batch-level activities are performed each time a batch of goods is produced and, therefore, relate directly to production batches, not to individual products. Each time a batch of products is to be manufactured, activities such as machine set-ups, purchasing orders and inspections must be performed. These types of activities are therefore classified as batch-level activities. The cost of batch-level activities is variable, in relationship to the number of batches manufactured. However, a fixed cost is allocated to the number of units in each batch. Examples of these costs are the costs for processing a sales order, costs for the equipment set-up, costs for moving a batch between workstations, and costs for inspection of each batch.

Product-sustaining activities

Product-sustaining activities are performed to support the different products manufactured. For example, if costs are incurred to enhance a specific product, then the costs will be written off against the product and not against the number of units produced. Examples of product-sustaining activities include compiling new bills of materials for new and modified products, compiling and distributing engineering changes and developing new process- and product-testing procedures.

Facility-sustaining activities

Facility-sustaining activities are performed to sustain a factory's general manufacturing processes. These activities benefit the manufacturing processes, and the related costs are written off against the total production. They are viewed as fixed costs affecting all products manufactured in the plant. Examples include landscaping, plant management, and security.

In Example 9.1, three activities were identified, namely, purchasing orders, verifying orders and materials receiving. They can be classified as follows:

Activity	Activity classification
Purchasing orders	Unit-level
Verifying orders	Unit-level
Materials receiving	Unit-level

Step 2: Identify cost drivers for each activity

Cost drivers are factors that cause the different activity costs, specifically overhead costs. They are simply the drivers of a certain cost within an activity. Cost drivers must be identified for every activity.

Cost drivers must satisfy the criteria of being measurable, and must also be able to be allocated to products. A direct relationship between the cost driver and the activity that must be performed must therefore exist.

Examples of cost drivers are as follows:

Activities	Cost drivers	Activity classification
Direct labour hours	Direct labour hours	Unit-level
Set-ups	Number of batches	Batch-level
Maintenance	Maintenance hours	Product-sustaining
Accounting services	Headcount	Facility-sustaining

The cost driver is the cause of the incurring of costs every time an activity is performed. The number of production batches is the cause for setting-up machines. Therefore, machine set-up costs are allocated based on the number of production batches. In other words, the number of production batches serves as the cost driver for allocating machinery set-up costs.

The following cost drivers were identified in Example 9.1 for the three specific activities:

Activity	Cost driver	Cost driver quantities
Purchasing orders	Number of orders	200 orders
Verifying orders	Number of orders	200 orders
Materials receiving	Monetary value of materials	R800 000

Step 3: Cost pool creation and allocation

The cost of each activity is accumulated in a cost pool. A **cost pool** involves related costs, such as departmental manufacturing overheads that are allocated to one or most cost objective(s), such as products, services, and activities. Some enterprises

may find that a limited number of cost pools are required to control their costs, while others will need a more detailed system. The nature of the enterprise and the type of product being manufactured will determine the number of cost pools and the cost driver for each cost centre. Only one cost driver per cost pool is normally permitted.

The following factors should be considered in determining the number of cost pools:

- ☐ the activity cost must be material in size to justify separate treatment; and
- ☐ the cost driver should be identified as the most suitable for the cost pool. If this is not possible, then a further division of the cost pool may be considered. In the case of different activities using identical cost drivers, the aggregation of cost centre pools will be considered.

Cost pooling into the activity centres for Example 9.1 is shown as follows:

	Purchasing orders R	Verifying orders R	Materials receiving R
Salaries:			
Purchasing officers:	12 000		
Receiving clerks:			
(R15 000 × 20% verifying orders)		3 000	
(R15 000 × 80% materials receiving)			12 000
Purchasing manager:	2 250		
(R6 000 × 37.5% purchasing orders)	2 250		
(R6 000 × 12.5% verifying orders)		750	
(R6 000 × 50.0% materials receiving)			3 000
Miscellaneous expenses:			
(R12 000 × 15% purchasing section)	1 800		
(R12 000 × 85% materials receiving section)			10 200
Total	<u>16 050</u>	<u>3 750</u>	<u>25 200</u>

Step 4: Trace activity costs to cost objectives

Activities cause costs, and cost objectives consume activities. Costs are allocated to the various cost pools first, and thereafter to the various cost objectives.

The rates used to allocate costs from cost centres to products are calculated as follows:

$$\text{Cost centre rate} = \frac{\text{Activity cost (cost centre cost)}}{\text{Cost driver volume}}$$

The cost centre rates for Example 9.1 are calculated as follows:

	Purchase orders	Verifying orders	Materials receiving
Total activity cost	R16 050	R3 750	R25 200
Cost driver quantities	÷ 200 orders	÷ 200 orders	÷ R800 000
Unit cost per activity	R80.25 per order	R18.75 per order	R0.0315 per Rand

Therefore, by multiplying the cost centre rate by the cost driver volume for a particular product (for example, the number of labour hours, or the number of production batches) we can calculate the allocated amount for that product.

(iii) Under a traditional costing method

Total cost	R
Direct materials:	
Order 1	5 000
Order 2	3 500
Material processing and acquisition:	
Order 1	225
Order 2	225
Manufacturing activities:	
Set-up	250
Conversion (40 hours × R100 per machine hour)	4 000
Assembling (30 hours × R50 per labour hour)	1 500
Painting (25 hours × R60 per labour hour)	1 500
Total (cost objective) cost	<u>16 200</u>

Under an ABC system

	Purchase order 1 R	Purchase order 2 R
Activity costs:		
Purchase orders	80.25	80.25
Verifying orders	18.75	18.75
Materials receiving:		
(R5 000 × R0.0315)	157.50	
(R3 500 × R0.0315)		110.25
Total	<u>256.50</u>	<u>209.25</u>
Total cost		R
Direct materials:		
Order 1		5 000
Order 2		3 500
Material processing and acquisition:		
Order 1		256.50
Order 2		209.25
Manufacturing activities:		
Set-up		250
Conversion (40 hours × R100 per machine hour)		4 000
Assembling (30 hours × R50 per labour hour)		1 500
Painting (25 hours × R60 per labour hour)		1 500
Total (cost objective) cost		<u>16 215.75</u>

The comparison

Costing Job 42 using both these methods results in a difference of R15.75 (R16 200 – R16 215.75). In this case, the purchase orders did not consume overheads in significantly different proportions. However, if there was a greater difference in the monetary value of the two orders (namely, the R5 000 and R3 500) the difference may have been greater.

AN ILLUSTRATIVE EXAMPLE OF ABC

Example 9.2 illustrates the use of a traditional absorption costing system and an ABC system to calculate the overhead cost per product.

Example 9.2

Alpha Ltd produces two products: A and B. The enterprise produces both products with the same equipment. Product B is a high-volume product while product A is produced in low volumes. Details of cost of activities, inputs and output are as follows:

Overhead cost analysis

	R
Material handling	150 000
Material procurement	50 000
Set-up	150 000
Quality control	250 000
Production	600 000
Total	<u>1 200 000</u>

Cost driver analysis

Overhead	Cost driver	Product A	Product B	Total
Material handling	Material movements	100	50	150
Material procurement	Number of orders	200	100	300
Set-ups	Number of set-ups	60	40	100
Quality control	Number of inspections	150	100	250
Production	Direct labour hours	40 000	10 000	50 000
Annual output	Product A: 80 000 units Product B: 20 000 units			

Required

Calculate the overhead cost per product using:

- a traditional absorption costing system
- an ABC system.

Solution 9.2

(a) Traditional absorption costing system

Cost centre allocated costs	R1 200 000	
Total direct labour hours	50 000 hours	
Overhead rate per direct hour	(R1 200 000 ÷ 50 000 hours)	R24 per hour
Manufacturing time	: A (40 000 hours ÷ 80 000 units)	0.5 hours
	: B (10 000 hours ÷ 20 000 units)	0.5 hours
Overheads per unit	: A (0.5 hours at R24 per hour)	R12
	: B (0.5 hours at R24 per hour)	R12

(b) ABC system

Calculation of activity rates

Activities	Activity costs R	Cost driver volumes	Activity rates
Material handling	150 000	150 movements	R1 000 per material movement
Material procurement	50 000	300 orders	R166.67 per order

continued

Activities	Activity costs R	Cost driver volumes	Activity rates
Set-ups	150 000	100 set-ups	R1 500 per set-up
Quality control	250 000	250 inspections	R1 000 per inspection
Production	600 000	50 000 hours	R12 per direct labour hour
	<u>1 200 000</u>		
Calculation of activity rates			
		Product A R	Product B R
Material holding: (100 × R1 000)		100 000 (50 × R1 000)	50 000
Material procurement: (200 × R166.67)		33 333 (100 × R166.67)	16 667
Set-ups: (60 × R1 500)		90 000 (40 × R1 500)	60 000
Quality control: (150 × R1 000)		150 000 (100 × R1 000)	100 000
Production: (40 000 × R12)		480 000 (10 000 × R12)	120 000
Total		<u>853 333</u>	<u>346 667</u>
Number of products:		80 000	20 000
Overhead cost per unit:		R10.67	R17.33

It can be concluded, based on the above information, that the ABC system, by using an applicable cost driver for every activity's cost, generates more accurate cost prices.

Criteria for use of an ABC system

When an ABC system is considered as a possibility for implementation, the enterprise must comply with some criteria to make the system worthwhile. The following indicators can signal the need for a new costing approach:

- ☐ The non-unit-based costs (fixed manufacturing costs) should be a significant percentage of the total overheads. If not, a traditional absorption costing system may be used to allocate overheads to products, since the results will not differ significantly from those of an ABC system.
- ☐ The consumption rate of unit-based and non-unit-based activities must differ significantly. If products consume all overhead activities in roughly the same ratios, it does not matter if unit-based cost drivers are used to allocate all overhead costs to individual products. Again, the results of both the traditional absorption costing system and ABC system will differ insignificantly.
- ☐ When line managers doubt the integrity of product costs reported by the management accountant.
- ☐ When the marketing department refuses to use the reported product costs as a basis for pricing the products.
- ☐ Divisional profit margins are difficult to explain.
- ☐ Product lines are diverse.
- ☐ Certain products with suspicious profit margins.
- ☐ The marketing department suggests that a seemingly profitable product must be dropped.
- ☐ The number of low-priced products is increasing while the profits are declining due to under-costing of the said products.

SUMMARY

Traditional absorption costing systems accurately measure the volume-related cost resources consumed in proportion to the number of production units. These systems assume, however, that products also consume non-unit-related costs in proportion to production volumes, thus reporting distorted product costs. If an enterprise has a high level of product diversity, unit costs may also be distorted.

An ABC system first traces costs to activities and then to products. Four steps must be followed to set up an ABC system: identification of activities, identification of cost drivers, creation of cost centres, and allocation of activity costs to products.

An ABC system may be considered when non-unit-based overhead costs are significant and a high level of product diversity exists.

PERSPECTIVES ON COSTING

Knowledge

You should know:

- ☐ the shortfalls of traditional unit-based cost drivers;
- ☐ why activity-based costing is used to correct these shortfalls;
- ☐ the theoretical construct of an activity-based system; and
- ☐ the criteria that are needed for using an activity-based system.

Skills

You should be able to:

- ☐ describe the shortcomings of the traditional method of allocating costs;
- ☐ describe the advantages of ABC;
- ☐ design and construct an activity-based costing system;
- ☐ identify the activity centres of an enterprise;
- ☐ identify the respective cost drivers of an activity centre;
- ☐ allocate costs to activity centres; and
- ☐ trace the activity costs to specific cost objects.

KEY TERMS AND CONCEPTS

Batch-level activities	249	Facility-sustaining activities	250
Cost drivers	250	Product-sustaining activities	249
Cost pool	250	Unit-based cost drivers	247

REVIEW PROBLEMS

Problem 9.1

GTH provides management consultant advice to three major clients, S, R and T.

GTH charges its clients a 25% mark-up on total cost. Currently, the costs are attributed to each client based on the hours spent on system improvements made and consultancy advice provided. GTH is considering changing to an activity-based costing system.

The annual costs and drivers have been totalled and are presented as follows:

Activity cost	R
System improvements and consultancy advice provided	750 000
Requesting missing information	15 000
Holding client meetings	65 000
Travelling costs to clients	20 000
Issuing fee payment reminders	5 000
Total overheads	855 000

The following information relates to three of GHT's clients and to GHT as a whole:

Client	S	R	T	Total
Hours spent in system improvements and consultancy advice provided	1 000	250	340	1 590
Number of requests for missing information	4	10	6	20
Number of client meetings held	4	6	5	15
Number of kilometres travelled to client meetings	150	600	30	780
Number of payment reminders	2	8	10	20

Required

Prepare calculations to show the effect on the fees charged to each of GHT's clients, when changing to the new activity-based costing system.

Solution 9.1

Activities	Activity costs	Cost driver volumes	Activity rates
	R		R
System improvements and consultancy advice provided	750 000	1 590 hours	471.70 per hour
Requesting missing information	15 000	20 requests	750 per request
Holding client meetings	65 000	15 meetings	4 333.33 per meeting
Travelling costs to clients	20 000	780 km	25.64 per km
Issuing fee payment reminders	5 000	20 reminders	250 per reminder
Total	855 000		

Client	S	R	T
	R	R	R
System improvements and consultancy advice provided	471 700	117 925	160 378
Requesting missing information	3 000	7 500	4 500
Holding client meetings	17 333.32	26 000	21 666.65
Travelling costs to clients	3 846	15 384	769.20
Issuing fee payment reminders	500	2 000	2 500
Total costs on ABC	442 379.32	168 809	189 813.85
Total cost on original basis*	537 740	134 435	182 831.60
Client fees – ABC	552 974.15	211 011.25	237 267.31
Client fees – original basis	672 175	168 043.75	228 539.50
Increase/(Decrease)	(119 200.85)	42 967.5	8 727.81

*Total cost on original basis: $855\,000 \div 1\,590 = R537.74$ per hour

Problem 9.2

Beauty (Pty) Ltd has recently started making two types of special face cream using the juice from Aloe plants. The products are sold in small bottles and are called 'AloeZap' and 'AloeCure'. Their manufacture is a complicated process, for which the company currently uses a conventional product costing system, but management is considering implementing an activity-based costing system. Details of the products are as follows:

	Hours per unit		Material	Volume
	Labour hours	Machine Hours	Per unit	Units
AloeZap	1	3	R25	7 000
AloeCure	1	1	R12	1 250

Direct labour costs R6 per hour. Production overheads are absorbed on a machine hour basis and the rate for the period is R28 per machine hour.

Further analysis shows that the total production overheads can be allocated to the following activity centres 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	<u>100%</u>

The following activity volumes are associated with the product lines for the period as a whole.

Total activities for the period:

	Number of set-ups	Number of movements of materials	Number of inspections
AloeZap	480	87	670
AloeCure	115	21	180

Required

- (a) Calculate the cost per unit for the product AloeZap and AloeCure using activity-based costing principles.
- (b) Discuss briefly what the differences are between accounting for overhead costs using a traditional approach and using an activity-based costing approach.

Solution 9.2

		AloeZap R	AloeCure R
Direct materials	R25/R12 per unit	25	12
Direct labour	$(1 \times 6)/(1 \times 6)$	6	6
Overheads	$(3 \times 28)/(1 \times 28)$	84	28
Cost per unit		115	46
Total overhead cost	$(84 \times 7\,000)/(28 \times 1\,250)$	588 000	35 000
Allocation of overhead costs to activity centres			
		Total cost	
Set-up	$(588\,000 + 35\,000) \times 35\%$	218 050	
Machinery	$(588\,000 + 35\,000) \times 20\%$	124 600	
Material handling	$(588\,000 + 35\,000) \times 15\%$	93 450	
Inspection	$(588\,000 + 35\,000) \times 30\%$	186 900	
		623 000	
Total cost per driver			
Direct materials	$(25 \times 7\,000)/(12 \times 1\,250)$	175 000	15 000
Direct labour	$((6 \times 7\,000)/(6 \times 1\,250))$	42 000	7 500
Set-up	$218\,050 \times 480/595$ and $115/595$	175 905.88	42 144.12
Machinery	$124\,600 \times 21\,000/22\,250$ and $1\,250/22\,250$	117 600.00	7 000.00
Material handling	$93\,450 \times 87/108$ and $21/108$	75 279.17	18 170.83
Inspection	$186\,900 \times 670/850$ and $180/850$	147 321.18	39 578.82
Total cost		733 106.23	129 393.87
Total machinery hours	$(3 \times 7\,000) + (1 \times 1\,250) = 22\,250$ hours		
Unit cost	$(733\,106.23 / 7\,000)/(129\,393.87 / 1\,250)$	R104.73 per unit	R103.52 per unit

- (b) When looking at the product costs under the traditional method, it is interesting to note that the production overhead accounts for a substantial proportion of the total costs. This means that the overhead cost will have a significant effect on the total unit cost. In this example, the traditional method assumes that the production cost varies with machine hours.

The ABC method assumes that the overhead costs vary with different activity cost centres and not with divisions, labour, units, or machine hours only. The result is that a cost re-allocation based on activity cost centres may re-allocate the overhead costs very differently from traditional costing methods, and presumably be more accurate as well.

ABC appears to be superior to the traditional method as it uses more than one cost allocation basis, but it is only relevant if the overhead costs do in fact vary with the selected cost drivers. If the overheads are fixed or there is only one product, then ABC is inappropriate.

EXERCISES

9.1 Allocation rates: Absorption costing versus ABC

Rajah Ltd manufactures a variety of products. The budgeted costs and estimated operating information are as follows:

Cost information	
	R
Machine set-ups	125 000
Inspection	93 750
Material handling	187 500
Material procurement	218 750
Production	312 500
Total overheads	<u>937 500</u>
Operating information	
Machine hours	25 000
Material usage (kg)	125 000
Machine set-ups	500
Purchase orders	6 250
Inspections	750

Required

- (a) Calculate a single overhead rate for the entire plant using machine hours as allocation basis.
- (b) Calculate the cost centre rates which the ABC system will use during the next financial year.

9.2 Comparison between an ABC and absorption costing system

Robertson Ltd manufactures two products, namely A and B. They operate an absorption costing system, gathering all overheads in a single cost centre and allocating them to products using direct labour as allocation basis. The enterprise has just

implemented an ABC system. The budgeted information for the following financial year is as follows:

	Product A R	Product B R	Total R
Direct material per unit	90	10	
Direct labour costs	100 000	900 000	1 000 000
Overheads:			
Machine set-ups			100 000
Design costs			300 000
Other overheads			1 100 000
Total overheads			1 500 000
Units manufactured	1 000	9 000	10 000
Machine set-ups	50	50	100
Design hours	2 000	8 000	10 000
Other overheads are allocated to individual products based on direct labour costs.			

Required

- Calculate the unit costs using the absorption costing system.
- Calculate the unit costs using the ABC system.
- Comment on the results in (a) and (b).

9.3 Comparison between an ABC and an absorption costing system

Telex Ltd manufactures three products, namely A, B and C. The enterprise operates an absorption costing system, accumulating all overheads in a single cost centre, and allocates overheads to products using direct labour as allocation basis. The enterprise is considering the implementation of an ABC system. The budgeted information for the following financial year is as follows:

	Product A R	Product B R	Product C R	Total R
Direct material per unit	3,20	32	160	
Direct labour	480 000	56 000	8 000	544 000
Overheads:				
Machine set-ups				640 000
Other overheads				372 600
Total overheads				1 012 600
Units manufactured	48 000	1 600	80	49 680
Direct labour hours	72 000	7 200	800	80 000
Machine set-ups	240	160	80	480
Other overheads are allocated to individual products based on direct labour hours.				

Required

- Calculate the total manufacturing costs as well as the unit costs using the absorption costing system.
- Calculate the unit costs using the ABC system.
- Comment on the results in (a) and (b).

9.4 ABC, distortion of unit costs

Fantasia Ltd manufactures two products, namely A and B. At present, the enterprise is operating a traditional absorption costing system, based on production volumes, to allocate overheads to products. The budgeted costing information for 2015 is as follows:

Budgeted information	Cost R	Cost driver
Machine set-ups	55 000	Number of set-ups
Material procurement	64 000	Number of orders
Quality control	52 500	Number of inspections
Material insertion	800	Number of parts

	Product A	Product B	Total
Number of set-ups	500	50	550
Number of orders	6 000	400	6 400
Number of inspections	9 000	1 500	10 500
Number of parts	128	32	160
Production volumes	10 000	10 000	20 000

Required

- Calculate the unit costs of each product using the existing absorption costing system.
- Calculate the unit costs of each product using the ABC system.
- Comment on the results in (a) and (b).

10 Job costing systems



LEARNING OUTCOMES

How does job costing compare to that of process costing?

What are the accounting entries for a job costing system?

How is the cost of a product calculated under a job costing system?

How is revenue recognised on contracts that span over multiple accounting periods?

- Explain the difference between job costing and process costing
- Describe the function of a job costing card
- Process the accounting entries in respect of the cost of material, labour and manufacturing overheads in a job costing system
- Calculate the profit or loss of a job
- Calculate the manufacturing unit cost in a job costing system
- Calculate the stage of completion using an appropriate method
- Calculate the contract profit and recognise revenue and costs in different accounting periods

CHAPTER OUTLINE

Within the business environment, certain expenses are incurred to manufacture goods and provide services, from which a profit is made. Expenses can further be refined into the concept of cost, which is allocated to cost objects. The process of allocating costs to cost objects is usually performed within an established system using an accounting software package. The most basic scenario where job costing would be applicable is a business that manufactures large and unique products, such as boats, oil tankers, etc. Companies that predominantly engage in the type of business that resembles a single project use a system called job costing. Such projects may be unique, and the time taken to complete them may also vary.

This chapter introduces the concept of job costing and contrasts it with another well-known system called process costing. Their differences are illustrated, and the method used to determine a product cost is explained.

The focus is then shifted to job costing, which uses a ledger system to allocate costs to various jobs. Finally, the techniques used to deal with spoiled units are examined.

A specialised form of job costing, called 'Contract Costing', that allows for revenue and cost recognition of contracts that extend over multiple accounting periods, is also explained.

INTRODUCTION

This chapter is the first in several successive chapters that describe the process of product cost determination. The most important aim of product cost determination is the establishment of unit manufacturing costs. The unit cost is indispensable to a manufacturing enterprise's financial reporting, especially the valuation of inventory and the determination of the cost of goods sold.

In this and the following chapters, product cost determination is discussed from an absorption approach. This approach is described because it provides for the absorption of all manufacturing costs (whether fixed or variable) by the units produced. This system is also described as the total cost approach.

Basically, there are two types of product costing systems:

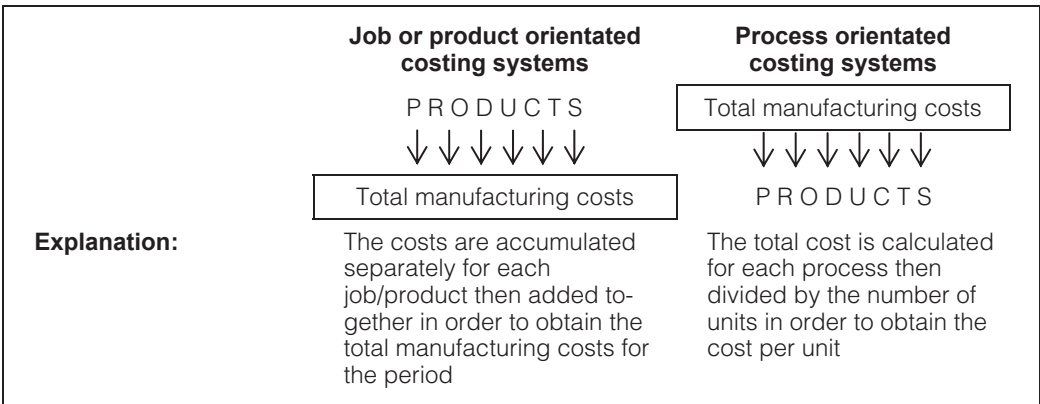
- ☐ job costing systems; and
- ☐ process costing systems.

Job costing systems are used in cases where heterogeneous products, that is, products which differ from each other, are manufactured using the same manufacturing facilities. Construction enterprises that engage in building office blocks and bridges are examples of enterprises that will use job costing systems.

Process costing systems are used where large ranges of homogeneous (identical) products are manufactured using the same production facilities. Shampoo, soap, bread, and garden tool manufacturers are some examples. In process costing systems, the total costs incurred in the production process during a particular period are determined first and then the cost per product is calculated by dividing the total costs of the process by the quantity of units manufactured during the period.

Each of these costing systems furnishes a product cost according to a physical standard, for example, units, kilograms, and litres.

The following diagram shows the differences in emphasis between the two main groups of costing systems:



continued

	Job or product orientated costing systems	Process orientated costing systems
Cost accumulation point:	The product	The process
Types of products manufactured:	Heterogeneous products	Homogeneous products
Type of industry in which the costing system can be found:	Building industry Civil engineering	Food industry Canning factory
Specific costing systems resorting under each group:	Job costing systems and Contract accounts	Process costing system and Joint and by-products

Diagram 10.1

Job costing is discussed in this chapter and process costing in chapter 11.

The discussion which follows is based on certain aspects that have already been covered in previous units:

- ☐ Cost elements:
 - Direct material (chapter 3).
 - Direct labour (chapter 3).
 - Manufacturing overheads (chapter 7).
- ☐ Flow of costs (chapter 6).
- ☐ Predetermined overheads tariffs (chapter 7).

In the study of job costing systems, each one of these aspects is examined again, to analyse how they are involved in the determination of unit costs.

THE JOB DESCRIPTION

Before a job is begun, a job description is prepared by the production planning department. The job description initiates the execution of a job, either on special order or for replenishing items, in which case repeat orders are received.

Copies of the job description, together with engineering specifications, where applicable, are sent to all the sections involved in the manufacturing process to ensure that the required material, labour, tools and machinery are available timeously so that the job may be completed on time.

COST DETERMINATION OF A JOB

As the name 'job costing system' indicates, the costs of each different product or job are accumulated and determined. The cost of direct material and direct labour that can be ascribed to a specific job (piecework), which may consist of a single unit or batch of units, is a portion of the cost of that particular job. Normal overheads are allocated to the job according to a predetermined overhead rate.

INVENTORY LEDGERS

The inventory records in a job costing system include control accounts as well as subsidiary ledgers. The control accounts include the following:

- ☐ Raw material control account.
- ☐ Production account (incomplete work or work in progress).
- ☐ Finished goods control account (completed goods).

For each of these accounts there is a supporting ledger containing detailed accounts which support the balances in the control accounts, namely:

- ☐ A **material ledger**, in which the quantities and unit costs of each type of material are recorded on a separate ledger card.

MATERIAL CARD						
ITEM NUMBER: KP3-3047			RE-ORDER QUANTITY: 2 000			
DESCRIPTION: Copper pipe			MAX/MIN QUANTITY: 6 000/1 000			
LOCATION: Roof 2/102						
Date	Document reference	Unit cost R	Received	Issued	Balance Units	Price R
2015						
Feb 2	Inv D7700	0.50	6 000		6 000	3 000
	Zed Ltd					
7	Req 302	0.50		1 000	5 000	2 500

Diagram 10.2

- ☐ A **cost ledger** in which a **job cost card** is kept for each job on which the enterprise works. The job card serves as a supporting record for work in process. As Diagram 10.3 indicates, each of these cards shows the cost of direct material, direct labour, and the applied overheads relevant to the job.

When a job is completed, the total costs are divided by the number of units in the job to obtain the unit cost.

JOB COST CARD									
CLIENT: Cloe Ltd PRODUCT F108.6 JOB QUANTITY: 1 000				JOB NO: 2005 DATE STATED: 07/02/2015 DATE COMPLETED 20/02/2015					
Direct material				Direct labour			Overheads		
Date	Req no	Quantity	Amt	Time card no	Hrs	Amt	Allocation basis	Rate	Amt
20.8			R			R			R
Feb 7	302	1 000	500	AB 107	10	100	Direct labour Costs	100%	450
				AB 108	20	200			
				AB 115	15	150			
			<u>500</u>			<u>450</u>			<u>450</u>
R									
Cost summary:									
Direct material			500	Units 1 000					
Direct labour			450	Costs per unit R1.40					
Overheads			450						
Total costs			<u>1 400</u>						
Inputs from:									
Material requisitions				Time cards			Overheads allocation schedule		

Diagram 10.5 shows the relationship between the various control accounts and supporting ledgers (in T-format):

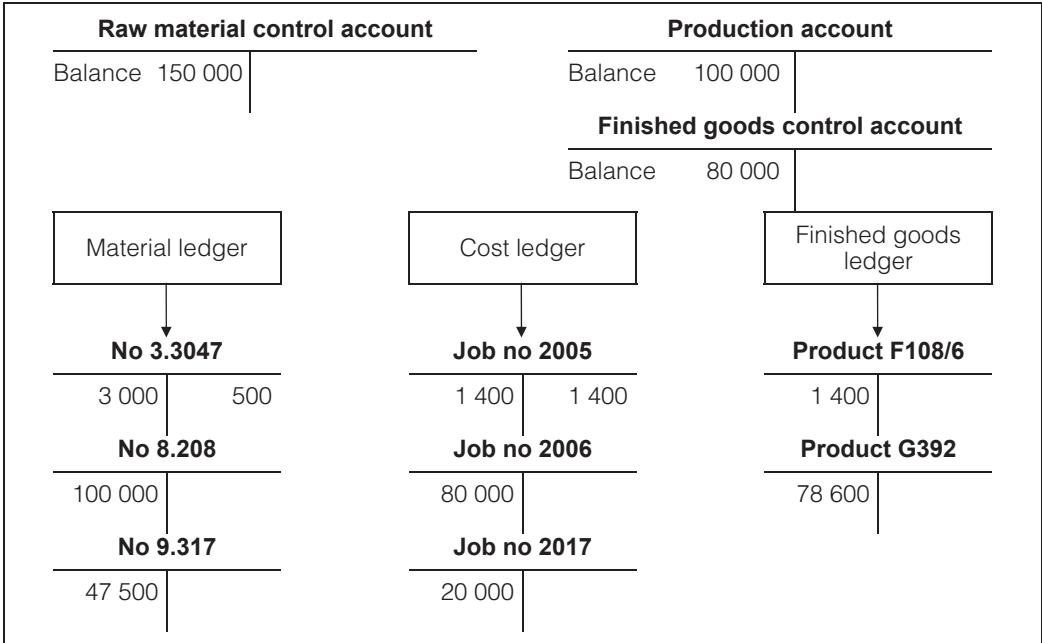


Diagram 10.5

The relationship between the control accounts and supporting ledgers and the purpose of these accounts in a manufacturing enterprise thus corresponds with the relationship and purpose of these accounts in a retailing enterprise. In both cases the supporting ledger is kept up to date on a continuous basis while the control accounts are brought up to date periodically.

COMPREHENSIVE EXAMPLE OF A JOB COSTING SYSTEM

The following example illustrates a job costing system. Azaad Manufacturers is a local company that manufacture two products, A and Z, for their own inventory purposes. Two raw materials (B and C) are part of the products, while material D is used in the factory but is not incorporated in the products as such. (The necessary book entries are illustrated diagrammatically and in journal entry form.)

The recording of material costs

Upon receipt, the material purchased is shown on the relevant material inventory card. At the end of the financial period the total of the material purchases is posted from the purchases journal to the material control account. Once this has been done the balance in the control account must agree with the total of the balances on the various cards in the material ledger account. Whenever material is requested by means of material requisitions, the issues are recorded on the inventory cards and in the control account. Requisitions for direct material are recorded on the relevant job cards and debited to the production account, while indirect material is debited to the overheads account.

Example 10.1

Suppose that Azaad Manufacturers made the following purchases and issues during their first month of business:

	Purchases	Issued
	R	R
Raw material B	5 000	2 000 (for job 1)
Raw material C	3 000	1 000 (for job 2)
Raw material D	1 000	400 (indirect material)

In this example, we concentrate on the monetary value of the items. It must be remembered that units, where applicable, must also always be recorded.

(1) Journal entry for purchases of material

	R	Dr R	Cr R
Material inventory account		9 000	
Creditors (trade payables)			9 000
Purchases of the following: *			
Raw material B	5 000		
Raw material C	3 000		
Raw material D	1 000		

* Details from supporting records

(2) Journal entry for the issue of material

	R	Dr R	Cr R
Production account		3 000	
Manufacturing overheads		400	
Material inventory account			3 400
Issue of the following: *			
Raw material B (Job 1)	2 000		
Raw material C (Job 2)	1 000		
Raw material D (Indirect material)	400		

* Details from supporting records

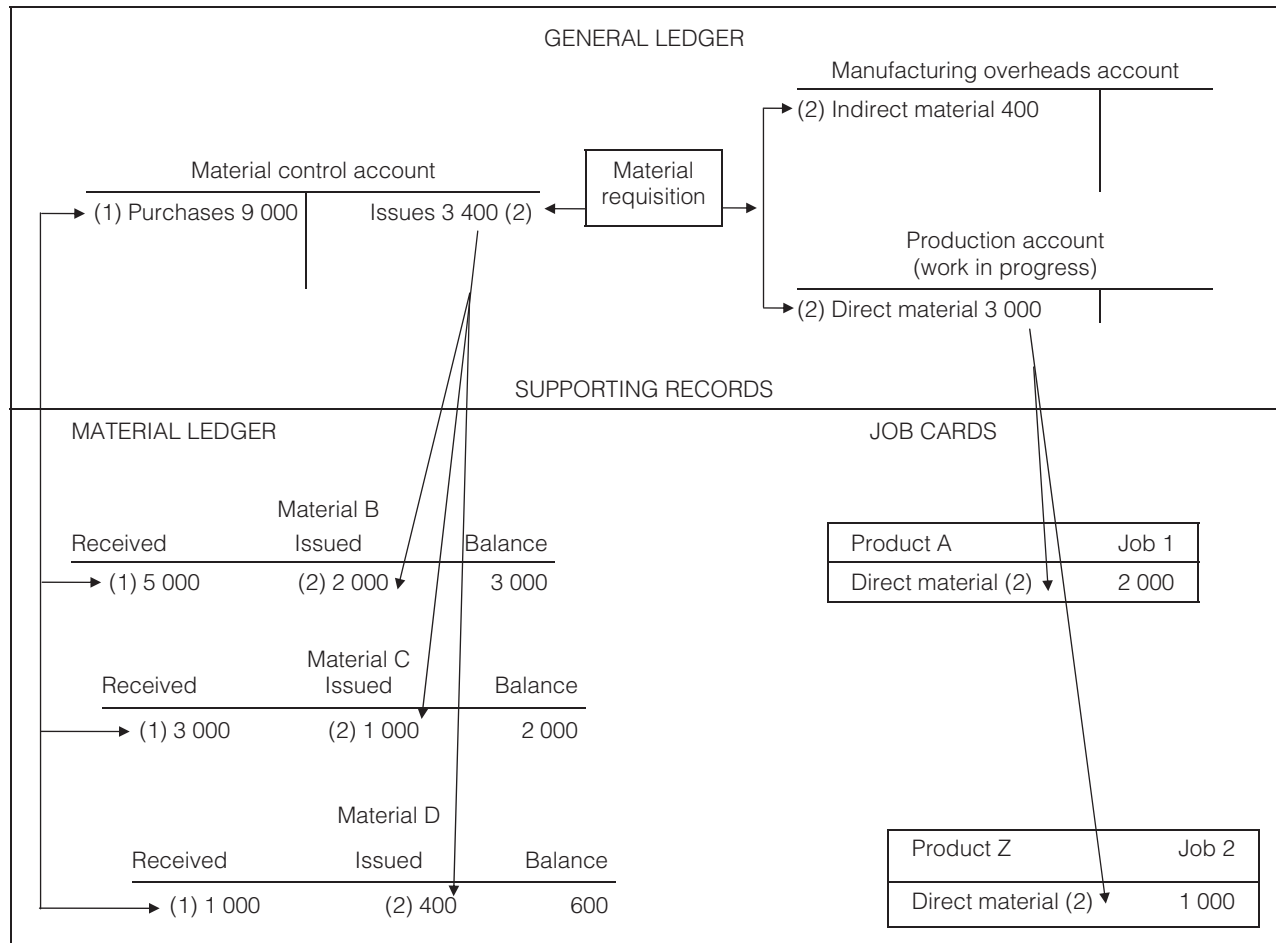


Diagram 10.6 Schematic representation of the entries for the purchase and issue of materials

The recording of labour costs

In order for the labour costs associated with specific jobs to be identified, time cards are used to determine the time spent by employees on various jobs. The hourly wage rate can be used to determine the labour costs of the various jobs. The details are transferred periodically from the time cards to the job cards.

Suppose that Azaad Manufacturers incurred the following labour costs:

Example 10.2		Hours	Cost R
Direct labour:	Job 1	400	1 600
	Job 2	200	800
Indirect labour for the period			1 000

A time card provides an hour-by-hour summary of the activities of an employee. When an employee works on a particular job (direct labour) he indicates the job number and the time spent on it on his daily time card. He also indicates the time spent on, for example, the maintenance of machinery (indirect labour).

The daily time cards of all the employees on the production floor are aggregated on the labour summary sheet and analysed in order that the appropriate apportionment may be made.

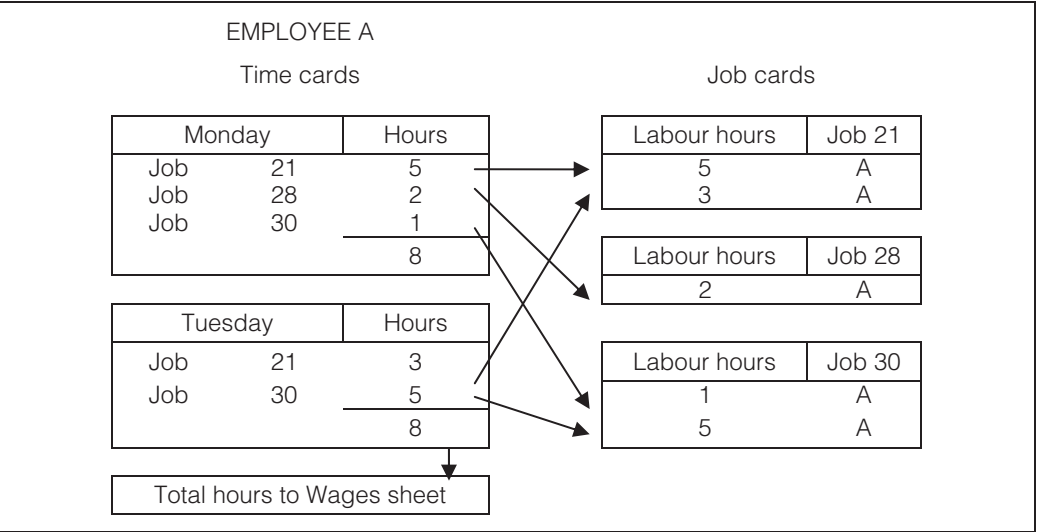


Diagram 10.7 Schematic representation of the apportionment procedures using time cards

TIME CARD		
EMPLOYEE:	PERSONNEL NO:	HOURLY RATE:
CLOCK CARD NO:		
DEPARTMENT:		
JOB/PIECEWORK:		
TIME STARTED:		
TIME ENDED:		
TIME SPENT:		
SIGNED:		
EMPLOYEE:		
SUPERVISOR:		

Diagram 10.8 Representation of a typical time card

Date	Time card number	Job number	Department	Hours	Rate	Cost
						

Diagram 10.9 Labour summary sheet

(3) Journal entry for labour costs

	Dr R	Cr R
Labour cost control account	3 400	
Wages payable		3 400
Recording of wages payable		

(4) Journal entry for the allocation of labour costs

	R	Dr R	Cr R
Production account		2 400	
Manufacturing overheads account		1 000	
Labour cost control account			3 400
Allocation of labour costs as follows:			
Job 1	1 600		
Job 2	800		
Overheads	1 000		

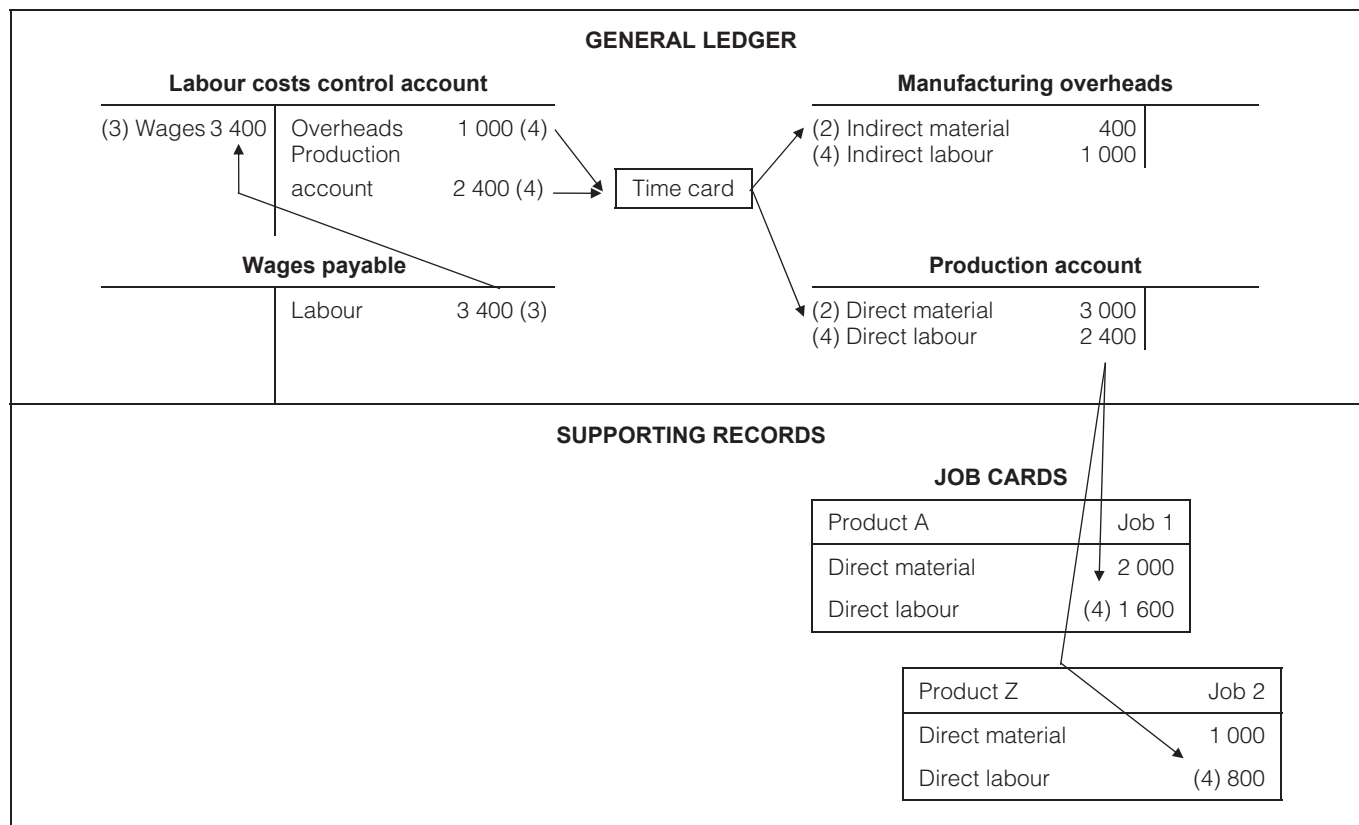


Diagram 10.10 Schematic representation of the recording and allocation of labour costs

The recording of manufacturing overheads

When the recording of material and labour was dealt with it was shown that indirect material and indirect labour are recorded in the production overheads account. Periodically other overhead items are transferred to this account from the accounts in which they were recorded when the costs were incurred. As has already been explained, this account is also described as the **actual manufacturing overheads account**.

Example 10.3

Suppose that Azaad Manufacturers, in addition to indirect material and indirect labour costs, incurred the following overheads during the relevant financial period: power and water consumption R300, maintenance of equipment R200 and depreciation of equipment R200. These entries are recorded as follows:

(5) Journal entry when the costs are incurred

	Dr R	Cr R
Power and water consumption	300	
Maintenance of equipment	200	
Depreciation: Equipment	200	
Creditors		500
Accumulated depreciation: Equipment		200

(6) Journal entry for the transfer to overheads control account

	Dr R	Cr R
Overheads control account	700	
Power and water consumption		300
Maintenance of equipment		200
Depreciation: Equipment		200
Transfer of production overheads from individual cost accounts to control account		

The direct material and direct labour costs are allocated by means of material requisition forms and time cards directly to the products (and the relevant job cards). However, it is not possible to allocate the indirect manufacturing costs directly to the cost of a particular product and predetermined overheads rates are used (as has already been explained in chapter 7) for the allocation of indirect manufacturing overheads.

As the actual manufacturing costs arise, they are debited to the overheads control account (as explained in journal 6 above).

Overheads that are allocated to the products during the period in question are debited to the production account (and to the applicable job cards) by means of the overheads rate, and the applied overheads account is credited.

Suppose that Azaad Manufacturers uses an overheads rate of R3 per direct labour hour then, with regard to the example, the following allocation would take place:

(7) Journal entry for the allocation of overheads

	Cr R	Dr R
Production account	1 800	
Applied overheads account		1 800
Allocation of overheads @ R3 per direct labour hour:		
Job 1: (400 hours × R3) = R1 200		
Job 2: (200 hours × R3) = R600		

Once the overheads have been entered on the job card, it contains all the cost elements incurred in respect of each job to date.

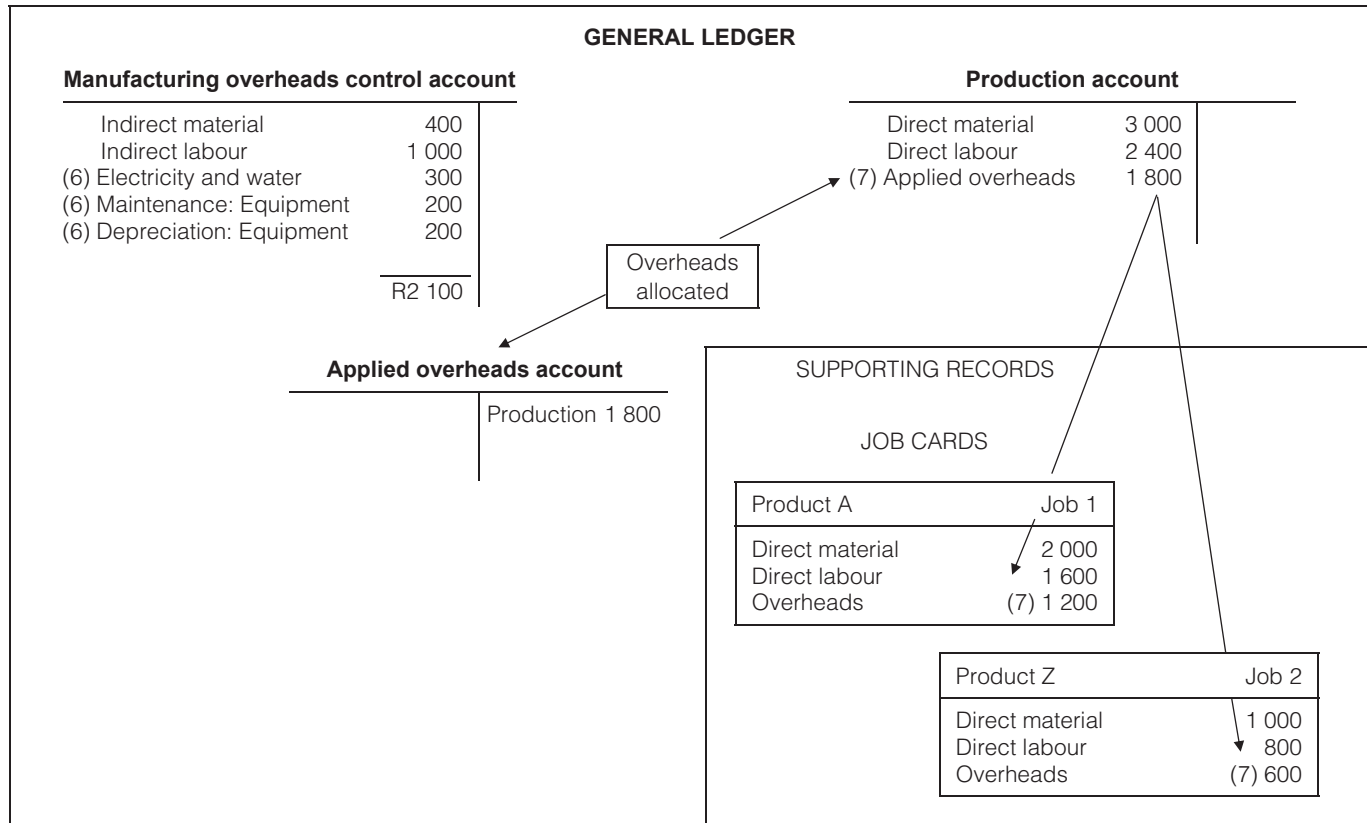


Diagram 10.11 Schematic representation of the transfer of indirect costs to the overheads control account

It is noticeable that the overheads applied (R1 800) are R300 less than the actual overheads incurred. As has already been explained in chapter 7, the under-applied overheads are debited to the cost of goods sold.

	Dr R	Cr R
Overheads applied account	1 800	
Overheads control account		1 800
Overheads applied		
Cost of goods sold account	300	
Overheads control account		300
Transfer of overheads under-applied		

Overheads control account				Overheads applied			
Balance	2 100	Applied	1 800	Overheads control	1 800	Balance	1 800
		Cost of sales	300				
Cost of sales							
Overheads control	300						

Diagram 10.12

In fact, the balance on the overheads account has a bearing on incomplete goods still in inventory, as well as on the cost of goods sold. If the balance is a material amount, it can be allocated to each of the categories on a reasonable basis (for example, the direct labour hours of each category).

The recording of completed/finished goods

When a job is complete, the unit costs of the items in that job are obtained by dividing the total costs by the number of units produced. The job card can be removed from the production ledger and filed. At the same time, the necessary entries are made in the finished goods ledger on the applicable inventory cards to show the quantity, unit costs and total costs. At the end of the period, an accounting entry debiting the finished goods accounts and crediting the production account is made.

When goods are sold, the appropriate entry is made on the inventory cards, and at the end of the period an entry is made to credit the finished goods account and debit the cost of goods sold account with the cost price of the goods sold.

Example 10.4

Suppose that Job 1 is completed by Azaad Manufacturers during the first month, that 1 000 units are produced and that 600 of these units are sold for R3 200 during the month. Job 2 is still in process. The book entries are as follows:

	Dr R	Cr R
(8) Finished goods	4 800	
Production account		4 800
Job 1 (1 000 units) of Product A completed at a cost of R4.80 per unit		
(9) Cost of goods sold	2 880	
Finished goods		2 880
Cost of 600 units of Product A sold (cost: R4.80 per unit)		
(10) Debtors	3 200	
Sales		3 200
Sale of 600 units of Product A		

Once transactions (8) to (10) have been recorded, the entries in the relevant accounts and subsidiary records will be as in Diagram 10.13. Special attention must be given to the following:

- (a) There is an obvious relationship between the physical flow of the goods and the associated book entries.
- (b) The various supporting records contain a detailed analysis of the total amounts and balances which appear in the associated control accounts in the general ledger.
- (c) The selling of finished goods results in the entries being made for the cost price as well as the selling price of the goods.

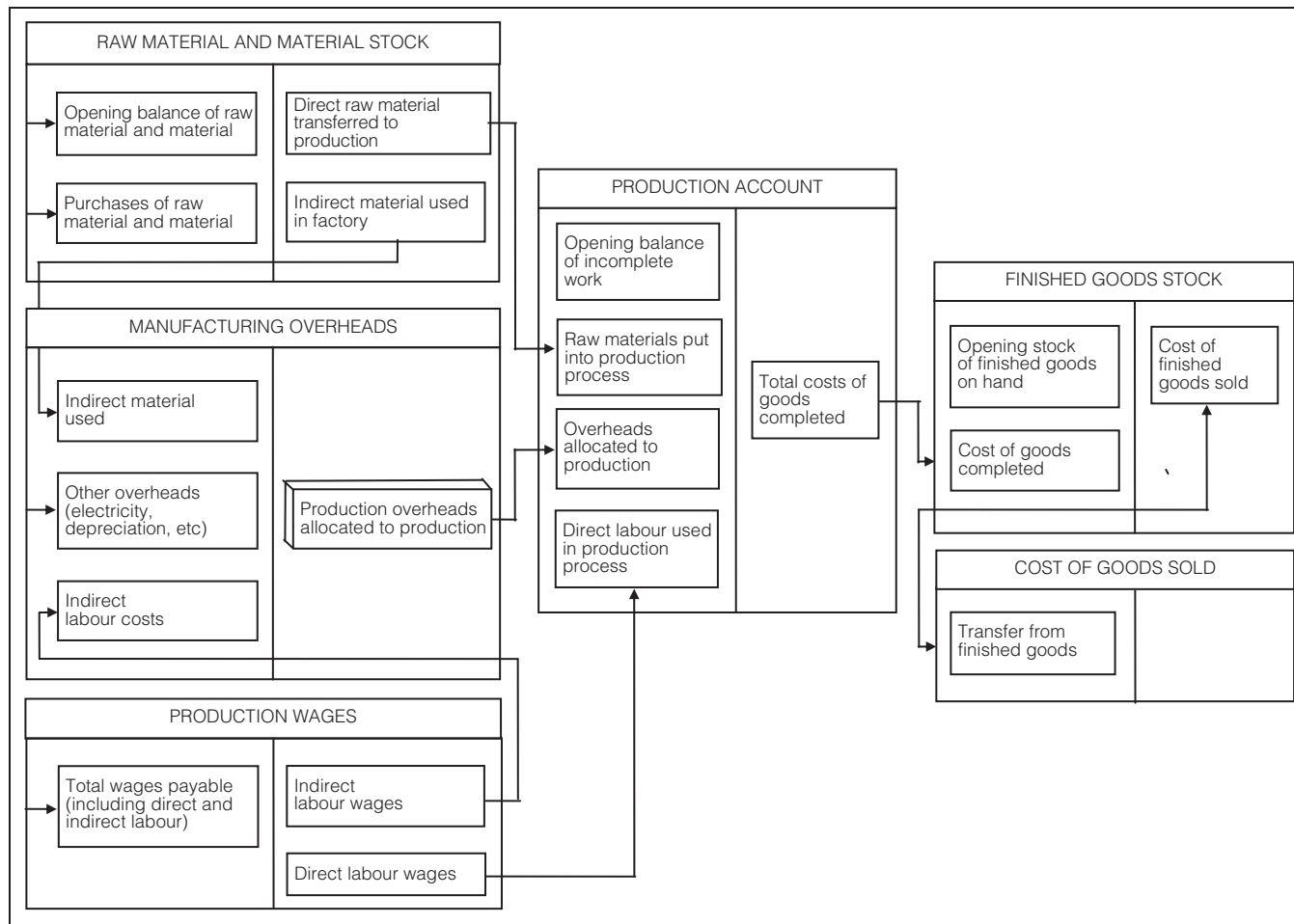


Diagram 10.13 Summary of the book entries (in T-account block format) in a job costing system

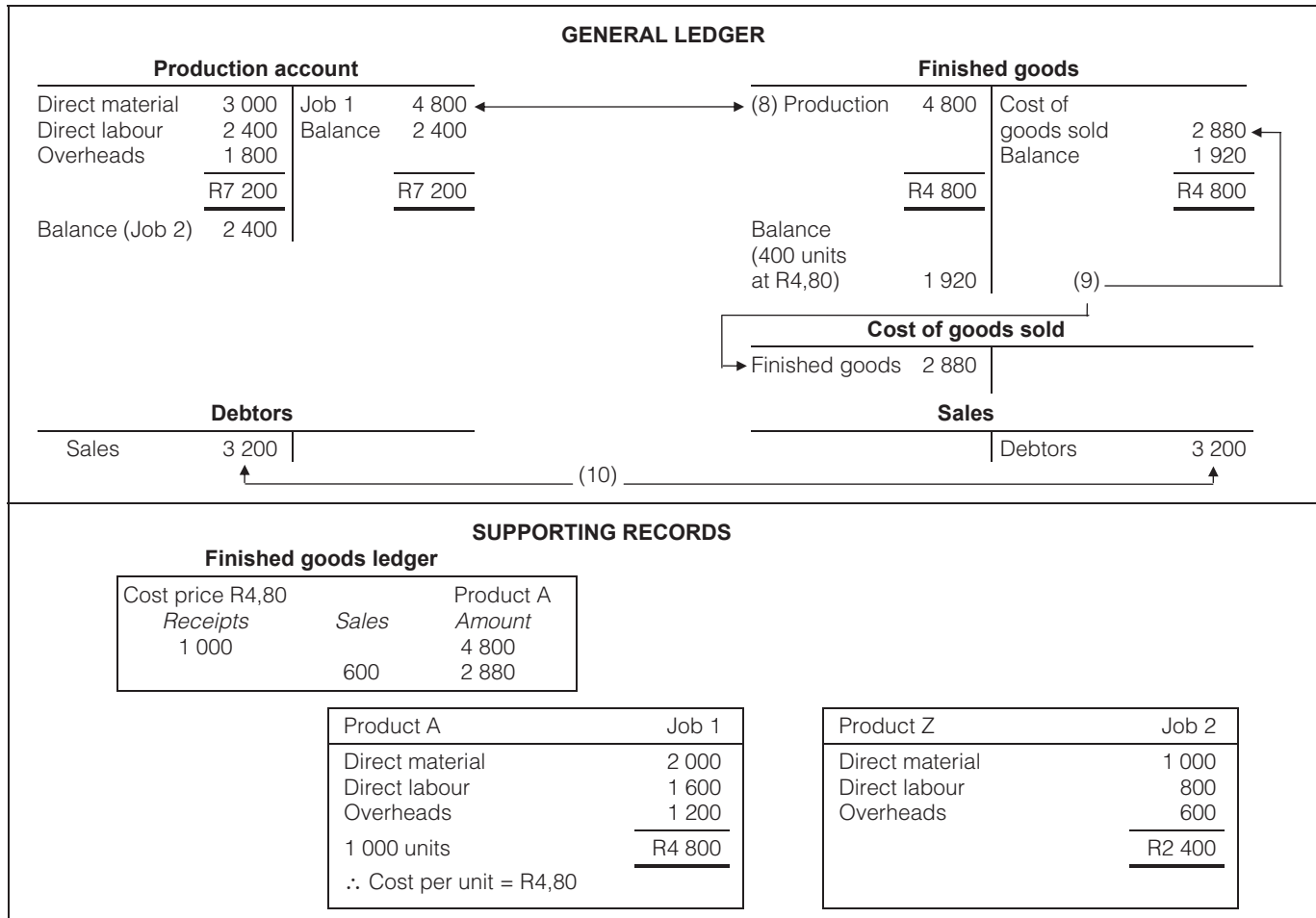


Diagram 10.14 Schematic representation of the book entries for finished goods and sales

SPOILT UNITS

In the preceding discussion, it was assumed that all units which enter the manufacturing process are eventually converted into saleable finished products.

Spoilt products

This assumption is not valid in practice, because in most manufacturing processes **spoilt products**, *that are products which do not meet the quality specifications*, occur.

Management must consider the degree of defectiveness of such products to decide whether the products should be shown as wasted units or whether it is possible to re-process them to approved products.

Wastage

Suppose that an enterprise receives an order for the manufacture of 50 000 units of Product X and that after completion of the manufacturing process it is found that 600 of the units do not comply with the client's specifications. The 600 must be evaluated to decide:

- ☐ whether the spoilt units must be classified wholly or partially as wasted units and sold as junk; and
- ☐ whether the spoilt units, or some of them, can possibly be re-processed so that they comply with the quality specifications and can be sold as normal products.

Shrinkage and evaporation

Besides wastage, units can be lost during a manufacturing process as a result of shrinkage and evaporation. This arises when the quantity of material necessary to complete a given job or process is more than the quantity that is theoretically necessary. In contrast to wastage, with shrinkage and evaporation there are no spoilt products.

Changes in the temperature during a chemical process can cause higher than normal or expected evaporation, with the result that a lower number of units than projected is produced.

Since accounting for wastage and for shrinkage and evaporation is done in the same manner from here on reference is made to wastage only.

Wastage can be classified into two categories, namely, normal wastage, and abnormal wastage.

Normal wastage

Normal wastage *is wastage that is inherent in the product or the manufacturing process. It is thus wastage that is anticipated (in other words it usually occurs) and occurs repeatedly.* Therefore, provision is made for it in the planning of the production. Suppose, for example, that 1 000 units must be manufactured and the normal wastage in the relevant process is 100 units, then 1 100 units will be put into production.

Since normal wastage is expected, it is accounted for by treating the cost of the normal wastage as part of the cost of the good products.

The cost of the normal wastage is thus deemed to be a product cost, and is allocated to the acceptable units manufactured.

Abnormal wastage

Abnormal wastage is wastage which is not anticipated and could be avoided; in other words, it is wastage which is deemed to be controllable. Suppose, for example, that the normal wastage rate in a process is 5%. If the actual wastage rate is 8%, the abnormal wastage is the difference between the actual wastage rate and the normal wastage, being 3%.

Since abnormal wastage is not anticipated, the cost thereof is written off as a loss in the Statement of Profit or Loss in the period in which it occurred.

Scrap

In most manufacturing processes there is waste material which arises from the manufacturing process. This is known as **scrap**. It usually has little value and is therefore not shown in the inventory account as an asset.

If scrap is sold, the proceeds are credited to the actual overheads account as follows:

	Dr R	Cr R
Cash (or debtors)	XXX	
Actual overheads		XXX
Recording of the sale of scrap		

Since the amount of the proceeds of the scrap reduces the actual overheads, this will be considered in the determination of the overheads recovery rate.

ACCOUNTING FOR SPOILT WORK IN JOB COSTING SYSTEMS

As a general manufacturing cost

In job costing systems, various jobs are carried out on orders from clients and according to their specifications. A certain amount of normal wastage is to be expected, since (particularly with piecework) the same machinery and labour is used on all the jobs in a particular enterprise although the jobs are not similar.

The costs of this normal wastage are associated with all the tasks carried out during a given period and are consequently attributed to them rather than to a specific task.

The most general way in which the allocation of the costs of normal wastage to the total production for a period is carried out is by providing for normal wastage in the predetermined overheads rate. This is done by estimating the cost of the normal wastage at the beginning of the period for the entire period and including the estimate as part of the total estimated overheads used to calculate the overheads rate.

Example 10.5

Accounting for normal and abnormal wastage in a job costing system.

Suppose Inyathi Construction estimate that normal wastage for all jobs amounts to 5% of the units which enter production, and that the enterprise makes provision for the cost thereof in the determination of the overheads rate.

The following information refers to completed Job no AX 573:

	R
Cost of direct material used	2 000
Direct labour costs	2 500
Overheads applied	2 500
Total costs	<u>7 000</u>

The required material to complete 1 000 units for the job was put into production.

The total wastage was 90 units.

The expected wastage for the particular task is $5\% \times 1\,000 \text{ units} = 50 \text{ units}$. In this case, the abnormal wastage is thus $90 - 50 = 40 \text{ units}$

The unit cost for Job no AX 573 = $\frac{R7\,000}{1\,000} = R7.00 \text{ per unit}$.

The unit cost includes a provision for normal wastage which is built into the overheads rate used for the allocation of overheads to the job.

In this case, the costs of the approved units and the normal and abnormal wastage are calculated as follows:

	Units	R
Approved units completed	= 910 × R7 per unit =	6 370
Normal wastage	= 50 × R7 per unit =	350
Abnormal wastage	= 40 × R7 per unit =	280
	<u>1 000</u>	<u>7 000</u>

The journal entry for the recording of the completion of Job no AX 573 is as follows:

	R	R
Finished goods	6 370	
Actual manufacturing overheads	350	
Loss due to abnormal wastage	280	
Production (Job AX 573)		7 000

Bear in mind that the cost of normal wastage is debited to the actual manufacturing overheads account, since the estimated normal wastage has already been credited to it and has been allocated to the production account by means of the overheads rate.

Job-related normal wastage

In contrast to the above procedure, where normal wastage is associated with the total production, an alternative procedure, in which a special job wastage rate is employed, may also be used.

Example 10.6

Job-associated wastage

Suppose that as in the previous example, Inyathi Construction estimate that the expected normal wastage for all jobs is 5% and that provision is made for this in the overheads rate. However, the enterprise accepted an order which has particular manufacturing problems associated with it.

Wastage of 15% is expected for the job (no. AX 920). (As a result of the high wastage rate the enterprise will require a higher price for the special job.)

The following information applies to the job:

	R
Cost of material used	29 600
Direct labour	50 000
Overheads applied	50 000
	<u>129 600</u>

The material required to manufacture 600 units was put into production.

After completion of the task the completed units were inspected, and it was found that 475 units complied with the client's specifications.

In this example, there are three possible types of wastage:

General process-related wastage	5%
Job-related wastage	<u>10%</u>
Total expected wastage	<u>15%</u>
Abnormal wastage – everything above	15%
The general process-related wastage is thus	$5\% \times 600 = 30 \text{ units}$
The job-related wastage is thus	$10\% \times 600 = 60 \text{ units}$
Expected wastage is thus	<u>90 units</u>

The actual wastage was $600 - 475 = 125$ units

Therefore the abnormal wastage is $125 - 90 = 35$ units

The cost per unit is: $\frac{R129\,600}{600} = R216.00$ per unit

The allocation of the total costs of R129 600 is as follows:

	R
Approved units ($475 \times R216.00$)	= 102 600
Job-related normal wastage ($60 \times R216.00$)	= <u>12 960</u>
Costs allocated to 475 approved units	= 115 560
Process-related normal wastage ($30 \times R216.00$)	= 6 480
Abnormal wastage ($35 \times R216.00$)	= <u>7 560</u>
	<u>129 600</u>

The job-related normal wastage is thus allocated to the cost of the approved units. It increases the average unit cost of these units from R216 to R243.28, calculated as follows:

$$\frac{R115\,560}{475 \text{ units}}$$

It reflects the additional costs of completing this particular job.

The journal entry for the recording of the completed job is:

	Dr R	Cr R
Finished goods ($475 \times R243.28$)*	115 560*	
Actual manufacturing overheads ($30 \times R216$)	6 480	
Abnormal wastage loss ($35 \times R216$)	7 560	
Production (Job no. AX 920)		129 600

* $475 \times R243.28 = R115\,558$: The difference is due to rounding to two decimals.

Re-processing costs

By incurring additional cost in respect of material, labour, and overheads, it is sometimes possible to re-process some of the spoilt units so that they comply with the manufacturing specifications. These additional costs can be treated in two ways:

- ☐ If they are process-related, they may be debited to actual manufacturing overheads and allocated to the total production costs for the year by means of the overheads rate.

Suppose, for example, that the following re-processing costs are incurred in respect of Job no. 1059:

	R
Direct material	700
Direct labour	500
Overheads applied	500
	<u>1 700</u>

The additional costs will be recorded as follows:

	Dr R	Cr R
Actual manufacturing overheads	1 700	
Material control account		700
Wages control account		500
Overheads applied account		500

If the re-processing costs are job-related (in other words, caused by the special requirements of the job), the costs of R1 700 will be debited to the production account for the specific job.

CONTRACT COSTING

A special type of job cost is called 'Contract Costing'. Job costing is applied in scenarios where companies are engaged in manufacturing non-unique products over a longer period of time. Typically, these goods are manufactured on the companies' premises.

Contract costing applies in the scenario where non-unique products of high value are manufactured or built, the key difference being that the duration of the manufacturing or building phase stretches across several accounting periods. Such a project

would be backed by a contract that was signed between the buyer and the manufacturer, and that is where the name comes from. Contract costing typically occurs in the construction and civil engineering industry where large projects are undertaken that take several years to complete on a specific site.

IFRS 15 (applicable from 1 January 2018), determines that revenue on the sale of goods can be recognised when the transfer of promised goods or services to customers occurs, at an amount that reflects the consideration which the various entities expect to receive. When it comes to construction contracts, this rule will create a distortion in the accounting records, showing the full profit of a contract in the year of completion, but nothing in the years spent in the construction phase. The substance of the contract is that even though the contract is not complete, a certain portion of the revenue has been earned because a certain portion of the work has been undertaken and completed. A fair view of the operations is achieved by allocating the revenue and costs to the accounting periods in which the construction work is performed. To correctly account for these long-term contracts, IAS 11 *Construction Contracts* was issued on 1 January 1995, and subsequently replaced by IFRS 15. IFRS 15 governs revenue recognition for long-term contracts and allows for revenue to be recognised when control is passed to the customer, either over time or at a specific point in time. A common method in use to determine this is the stage of completion method.

The stage of completion of the contract is usually interpreted as a percentage (sometimes also called the percentage of completion), and the percentage is applied to the revenue and costs to determine the profit that is allowed to be recognised in a particular period. There are three prescribed methods to determine the stage of completion:

- (1) Proportion of cost to total cost incurred.
- (2) Survey of work completed.
- (3) Physical proportion of contract work completed.

An entity is free to use a more suitable method if it is justified in doing so.

The proportion of cost method analyses the costs incurred to date on the contract and divides that amount by the total estimated costs to complete the contract. The survey method is used where a specialist such as a quantity surveyor or engineer needs to evaluate the stage of the project. The specialist will issue a certificate that confirms the percentage of work that has been completed. Finally, the physical proportion method judges the stage of completion by the physical proportion of work completed. Whichever method is chosen must be consistently applied by the company so that comparability between periods is retained.

Revenue is usually specified in the contract. Any excess of contract revenue over cost will equal profit. This profit will be limited to the stage of completion as calculated every year. Any excess or shortfall will be recognised on the Statement of Financial Position until it is realised. It is important to notice that profit can only be recognised to the extent that forecasts can be reliably made. Therefore revenue, costs, and the stage of completion must be reliably estimated. If it cannot be reliably estimated, then no profit may be recognised on the contract.

If it is estimated that the contract has entered a loss-making position, then the loss must be recognised immediately. The total expenses less total revenue is used to determine the loss to be recognised, and this is done irrespective of the stage of completion or even if work has commenced on the contract.

Sometimes revenue is subject to a retention or progress payment. Often in contracts it is agreed that the client will withhold a certain percentage of the revenue for an agreed upon PERIOD OF TIME to ensure that the contractor attends to any residual faults that

may be detected after the completion date. Once this date has been reached, the retention money is paid over. It is also often agreed upon that at certain stages of completion, a progress payment is made by the client, usually determined by an expert.

In the accounting records of the company, an account is opened to record all the costs incurred related to a contract. These costs are subject to the following rules:

- (1) All costs should relate directly to the contract.
- (2) Fixed costs that are attributable to the contract can be allocated using a suitable method.
- (3) Costs specifically chargeable as stipulated in the contract may be added to the cost of the contract.

Costs usually fall under the categories of labour, material and overheads.

Example 10.7

Mnandi Engineering operates within the built environment and constructs buildings in inner city locations. Their financial year is from 1 January to 31 December. They recently signed a contract with a client to build an apartment block with a shopping complex on the first three floors. This is a very big project, and it is expected to take three years to complete. The contract stipulates that a revenue figure of R22 000 000 will be paid upon completion with a 10% retention for one year being allowed.

It is estimated that costs incurred to complete the project will be R16 500 000 and that when the contract reaches 20% completion the client will make a progress payment of R2 000 000. When the contract reaches 60% completion a further R8 000 000 progress payment will be made.

All progress payments and retentions will be made in accordance with the results of a survey done by a professional quantity surveyor and for accounting purposes the stage of completion will be determined by the proportion of contract cost incurred method.

At the end of Year one, the situation was as follows:

Material costs incurred	R2 500 000
Labour	R3 600 000
Firm plant and equipment transferred to site	R2 000 000
Equipment hired	R600 000
Supervisor salaries	R420 000
Head office costs	R320 000

A site inspection at year-end showed that raw material of R720 000 was still on site. Depreciation is calculated at 20%, using the reducing balance method.

A professional quantity surveyor certified work completed to 35% and the client duly made a progress payment of R2 000 000 during the year. The surveyor also indicated that an estimated R10 000 000 will need to be incurred to complete the contract.

Solution 10.7

The first step is to calculate the actual cost incurred (according to accounting principles) as follows:

	Cost	Adjustment	Cost incurred
Materials	R2 500 000	(R720 000)	R1 780 000
Labour	R3 600 000	–	R3 600 000
Firm Plant and Equipment	R2 000 000	×20%	R400 000
Equipment hire	R600 000	–	R600 000
Supervisor salaries	R420 000	–	R420 000
Head office costs	R320 000	–	R320 000
Total			R7 120 000

Because materials on hand are issued to the site but not yet used, this cost is not added to the project. Depreciation is used as cost incurred, and not the full value of firm plant and equipment used.

Total contract profit is calculated as follows after year 1:

Contract revenue	R22 000 000
Actual costs	(R7 120 000)
Estimated completion cost	(R10 000 000)
Profit	R4 880 000

The quantity surveyor confirmed that the project is 35% completed, however it is the accounting policy of the company to use the proportion of cost incurred method to determine the stage of completion. The stage of completion is as follows:

Actual costs / Total costs × 100

$$R7\,120\,000 / R17\,120\,000 (7\,120\,000 + 10\,000\,000) \times 100 = 41.59\%$$

Statement of Profit and Loss (year 1)		
Revenue	22 000 000 × 41.59%	R9 149 800
Less: Cost of Sales	17 120 000 × 41.59%	(R7 120 208)
Contract profit		R2 029 592

Because the client made a progress payment, and also because the cost of sales is slightly different to the costs actually incurred, some amounts will remain on the Statement of Financial Position until the following year, as follows:

Statement of Financial Position		
Trade receivables	(R9 149 800 – R2 000 000)	R7 149 800

SUMMARY

Job costing systems are used in cases where heterogeneous products, that is, products which differ from each other, are manufactured using the same manufacturing facilities. The cost for each different product or job is accumulated and determined.

The inventory records in a job costing system include control accounts as well as subsidiary ledgers. Material transactions are found on material inventory cards. Labour costs associated with specific jobs are recorded on time cards. Predetermined overhead rates are used for the allocation of indirect manufacturing overheads to the production account and to the applicable job cards. Normally, provision for normal wastage is made in the predetermined overhead rate.

Contract costing is a specific type of job cost that allows for revenue to be recognised over multiple accounting periods using the stage of completion method. This is different to recognising profit on the sale of a good or service which happens in a single accounting period.

PERSPECTIVES ON COSTING

Knowledge

You should know:

- ☐ that the most important aim of cost determination is the unit cost of a product or unit cost per service rendered;
- ☐ that there are basically two types of costing systems, namely, job and process costing systems;
- ☐ that process costing systems are used where a large range of homogenous products are manufactured, or services are rendered;
- ☐ that job costing systems are used where heterogeneous products are manufactured or services are rendered;
- ☐ the job description initiates the executing of a job;
- ☐ the inventory records in a job costing system include control accounts as well as subsidiary ledgers;
- ☐ the overheads that are allocated to the products during the period are debited to the production account by means of the overhead rate and the applied overheads account is credited;
- ☐ when goods are completed, the finished goods account is debited, and the production account is credited;
- ☐ the costs of normal wastage are associated with all the good tasks carried out;
- ☐ the costs of abnormal wastage are not anticipated; therefore, it is written off as a loss in the Statement of Profit or Loss for the period in which it occurs;
- ☐ long-term contracts are accounted for according to the stage of completion method;
- ☐ the stage of completion can be determined using three methods, namely, the proportion of cost, survey of work completed, and the physical proportion method; and
- ☐ profit recognised on long-term contracts is limited to the stage of completion percentage, and if losses are present the loss is recognised in full immediately, regardless of percentage of completion.

Skills

You should be able to:

- ☐ prepare job cards and relevant ledger accounts;
- ☐ determine product costs and net profits of jobs;
- ☐ prepare journal entries and ledger accounts, using a job costing system;
- ☐ calculate the stage of completion of a long-term contract;
- ☐ accurately allocate costs to a long-term contract; and
- ☐ calculate annual profit on a long-term contract.

KEY TERMS AND CONCEPTS

Abnormal wastage	282	Material ledger	266
Cost ledger	266	Normal wastage	281
Finished goods ledger	267	Process costing system	264
Job cost card	266	Scrap	282
Job costing system	264	Spoilt products	281

REVIEW PROBLEMS

Problem 10.1

Mandisa Construction (Pty) Ltd lost a contract due to the company's high bid. Therefore, the enterprise decided to review its job costing system. After the development and implementation of the new costing system, the budget for the coming year was compiled. The budget is presented as follows:

	Partners	Employees
Number of consultants	7	15
Payable consulting hours per person	1 680 hours per year	1 680 hours per year
Average compensation	R360 000	R180 000
	Local support	Out-of-town support
Other costs	R500 000	R150 000
Cost driver	Total labour hours	Total days out of town

The total budgeted out-of-town days equates to 600 days.

Required

- (a) Calculate the budgeted direct cost rates for (i) partners and (ii) employees.
- (b) Calculate the budgeted direct cost rates for (i) general support and (ii) out-of-town support.

- (c) Calculate the budgeted job costs for Indaba Ltd and Makarapa Ltd using the following information:

	Indaba Ltd	Makarapa Ltd
Partners	38 hours	73 hours
Employees	21 hours	164 hours
Days out of town	4 days	7 days

Solution 10.2

- (a) Calculation of direct cost rates

$$\text{Labour rate} = \frac{\text{Average consulting compensation}}{\text{Payable consulting hours}}$$

$$\begin{aligned} \text{(i) Partner} &= \frac{\text{R}360\,000}{1\,680 \text{ hours}} \\ &= \text{R}214.29 \text{ per hour} \end{aligned}$$

$$\begin{aligned} \text{(ii) Employee} &= \frac{\text{R}180\,000}{1\,680 \text{ hours}} \\ &= \text{R}107.14 \text{ per hour} \end{aligned}$$

- (b) Calculation of direct cost rates

$$\begin{aligned} \text{(i) Local support rate} &= \frac{\text{Local support costs}}{\text{Total payable consulting hours}} \\ &= \frac{\text{R}500\,000}{(7 + 15) \times 1\,680 \text{ hours}} \\ &= \text{R}13.53 \text{ per hour} \end{aligned}$$

$$\begin{aligned} \text{(ii) Out-of-town support rate} &= \frac{\text{Out-of-town support costs}}{\text{Total days out of town}} \\ &= \frac{\text{R}150\,000}{600 \text{ days}} \\ &= \text{R}250 \text{ per day} \end{aligned}$$

- (c) Calculation of budgeted job costs

	Indaba Ltd R	Makarapa Ltd R
Partner labour (38 hrs × R214.29)	8 143.02	(73 hrs × R214.29) 15 643.17
Employee labour (21 hrs × R107.14)	2 249.94	(164 hrs × R107.14) 17 570.96
Local support		((73 + 164) hrs
((38 + 21) hrs × R13.53)	798.27	× R13.53) 3 206.61
Out-of-town support (4 days × R250)	1 000	(7 days × R250) 1 750
Budgeted job costs	<u>12 191.23</u>	<u>38 170.74</u>

Problem 10.2

The following information from the records of PPD Construction (Pty) Ltd for the period is available:

	Job 1 R	Job 2 R	Total R
Budgeted information:			
Direct material	30 000	20 000	50 000
Direct labour	60 000	20 000	80 000
Maintenance			35 000
Indirect materials			15 000
Administration costs			14 500
Actual information:			
Direct material	32 000	19 000	51 000
Direct labour	50 000	18 000	68 000
Maintenance	21 000	7 000	28 000
Indirect materials	16 000	5 000	21 000
Direct labour hours:			
Estimated	750 hrs	250 hrs	1 000 hrs
Actual	625 hrs	225 hrs	850 hrs
Sales	R140 000	R60 000	R200 000
Number of units manufactured	14 000	12 000	26 000
The allocation of manufacturing overheads is based on direct labour hours.			
Required			
(a) Calculate the net income.			
(b) Determine the unit cost for each product.			

Solution 10.2

(a)	Job 1 R	Job 2 R	Total R
Sales	140 000	60 000	200 000
Less: Cost of sales	(113 250)	(48 250)	(161 500)
Direct materials	32 000	19 000	51 000
Direct labour	50 000	18 000	68 000
Applied overheads	31 250 ¹	11 250 ²	42 500
	26 750	11 750	38 500
Less: Under-applied overheads	(5 750)	(750)	(6 500)
	21 000	11 000	32 000
Less: Administration costs			(14 500)
Net income			17 500
(b)			
Cost of sales	R113 250	R48 250	
Number of units	14 000	12 000	
Unit costs per product	R8.09	R4.02	

continued

1	$\frac{\text{R50 000}}{1\ 000\ \text{hours}}$	$\times 625\ \text{hours} = \text{R31 250}$
2	$\frac{\text{R50 000}}{1\ 000\ \text{hours}}$	$\times 225\ \text{hours} = \text{R11 250}$

EXERCISES

10.1

Isandla Ltd, with a normal capacity of 2 000 labour hours per month, and budgeted monthly manufacturing overheads of R70 000, uses a job costing system.

During May 2015, an order to manufacture 100 units of a certain product was received (Job 101). The scheduling section compiled the following cost estimate for the execution of the job:

Material per unit	R12.50
Labour per unit	3 hours @ R7 per hour

During May 2015, all the material for Job 101 was issued, but only 80 units were manufactured and completed.

Required

- Calculate the value of the uncompleted Job 101 on 31 May 2015.
- Calculate the over- or under-applied manufacturing overheads with regard to Job 101 for May 2015 if the actual overheads for the month amounted to R75 000. (No material or labour variances have been noted for the month.)

10.2

The following information for the year ended 28 February 2015 applies to Prospective China Ltd which manufactures and markets product X:

Manufacturing:	
Material: Opening inventory	40 000 kg
Value	R100 000
Purchased during the year	180 000 kg @ R2.70 per kg
Material: Closing inventory	20 000 kg

Direct labour:	
Hours worked during the year	80 000
Rate per hour	R10.00

Manufacturing overhead: Applied on direct labour hours at a rate of R6.00 per hour

Work in process:	
Opening inventory	R100 000
Closing inventory	R80 000

Finished goods (units):	
Manufactured	20 000
Sold	18 400
Opening inventory	4 000
Selling price per unit	R250

The following information is also available:

- 1 Actual manufacturing overheads: R464 000
- 2 Prospect Ltd uses FIFO in costing all its inventories.
- 3 Manufacturing overheads over- or under-applied must be charged to cost of sales.
- 4 Actual cost of opening inventory of finished goods: R95 per unit
- 5 Administrative and marketing costs: R1 120 000

Required

- (a) A statement of cost of goods manufactured and sold for the year ended 28 February 2015.
- (b) The Statement of Profit or Loss for the year ended 28 February 2015.

10.3

Tugela Manufacturing Company manufactures heavy-duty machinery according to client specifications. On 1 April 2015, the incomplete work consisted of one job, no. 305, with accumulated costs to an amount of R13 000.

The following information in respect of April 2015 is available:

- ☐ Materials to an amount of R7 500 were in inventory at the beginning of the month. Additional materials to an amount of R38 200 were purchased. Only one control account is used for both direct and indirect material.
- ☐ Materials were issued as follows:

	R
Job 305	15 800
Job 306	13 400
Job 307	9 100
Indirect material	2 100

- ☐ Labour costs:

Job 305	16 000
Job 306	12 000
Job 307	9 000
Indirect labour and supervising	5 500
- ☐ Other manufacturing overheads for April 2015:

Depreciation on machinery and equipment	6 000
Water and electricity	3 000
Sundry overheads	1 900

(Overheads are allocated to the jobs according to direct labour costs).

- ☐ Jobs 305 and 307 were completed during the month and invoiced to clients at R65 600 and R27 200 respectively.

Required

- (a) Prepare a Statement of Profit or Loss for April 2015 for each job individually, and show the inventory levels at the end of the month.
- (b) Assume that a system of applied overheads was used and that there was an amount of R2 000 in under-applied overheads at the end of the month. Prepare a journal entry that will show the handling of the under-applied overheads in the books of the company at the end of the period.

10.4

Komatipoort Ltd uses a job costing system. The following information is available in respect of May 2015, the first month of business:

	R
1 Purchases of raw materials	42 600
2 Materials were issued as follows:	
Direct materials	
Job no 1	16 950
Job no 2	17 360
Indirect materials	4 360
3 The payroll was summarised as follows:	
Direct labour:	
Job no 1 (249 hours)	12 450
Job no 2 (273 hours)	13 650
Indirect labour	2 800
4 Overheads are applied on a labour hour basis. The budgeted manufacturing overheads are R27 000 per month, and the budgeted normal capacity is 600 labour hours per month.	
5 Job no 1 (300 units) was completed during the month, and 200 units were sold on 31 May for R130 per unit.	
6 The following additional expenditure was debited to the overheads control account:	
	R
Electricity and water	3 130
Depreciation: Equipment	8 200
Rent of factory	8 000

Required

- Calculate the total cost of Job no 1 and the cost of the work in progress of Job no 2 at 31 May 2015.
- Calculate the profit or loss on the sale of the 200 units for Job no 1.
- Calculate the total manufacturing overheads over- or under-applied.

11

Process costing



LEARNING OUTCOMES

What are the basic characteristics of process costing systems?

- Describe the basic characteristics and nature of a process costing system
- Explain the concept of unit cost
- Explain the difference between product and cost flow

How is a process cost report constructed?

- Explain the steps to be followed in compiling a process costing report
- Construct a process costing report for a single product using a single process/multiple processes

How are incomplete units accounted for using process costing?

- Calculate equivalent completed units
- Explain different ways of using manufacturing resources in a production process
- Complete the cost report for a process receiving transfers from a previous process
- Prepare a process costing report using either the weighted average method or FIFO to value opening inventory

How are the effects of increased units and costs accounted for in process costing?

- Explain how unit costs will increase when adding additional material and labour to a process
- Calculate the current period's equivalent unit costs using the weighted average or FIFO method

How are spoilt units accounted for in process costing?

- Explain the various stages where wastage can occur in a production process
- Explain the absorption of the cost of normal wastage
- Calculate abnormal wastage

CHAPTER OUTLINE

This chapter introduces the concept of process costing and process costing systems. When large volumes of similar products are produced in the manufacturing process, a process costing system is used to cost the products. The chapter starts by providing a walk-through of what a process costing system looks like and describes the fundamental nature of the system. Typical characteristics include the manufacturing of identical products, large production volumes, and sequential production processes. Products are typically manufactured continuously or in similar batches according to a pre-established standard.

A process costing report is used to report on the system, and its construction is discussed to establish a basic understanding of when and why process costing is used. More advanced topics that are covered include single and multiple products and processes. Furthermore, the transfer of costs from one process to the following process is described. There are three costing approaches that can be followed: first-in, first-out (FIFO), last-in, first-out (LIFO) and weighted average (AVCO). LIFO is not allowed for accounting purposes and is typically not used in decision-making. Therefore, FIFO and weighted average are the industry standard, and best describe how costs are allocated to products.

The chapter concludes by discussing incomplete units, where the manufacturing process crosses the financial year-end. The concept of equivalent units is used to address this problem. Finally, wastage and the role it plays in a process costing system is explained and demonstrated with a practical example.

INTRODUCTION

Job costing is an accounting system used to capture and report on costs when each job that is undertaken differs from the previous one and products manufactured are not similar. The products are usually manufactured according to the particular specifications of the client, which means that manufacturing does not begin until the client has placed an order. In job costing the jobs are usually not identical, although naturally repeat orders do occur. The costs are collected per job and are finalised after completion of the job. A **process costing system** is different in every respect. It is an accounting system used to capture and report on costs when the products that are manufactured are similar (homogenous) and produced in large volumes. In the first place, products are manufactured on a continuous basis according to standard specifications. The products are typically identical and manufactured in large quantities. Because the units are identical, each unit manufactured requires the same quantity of material, labour and manufacturing overheads. In addition, costs are not collected per job, but for a fixed period. This period can coincide with anything from batches to seasons, and on a higher level, with the financial year of a company.

Process costing is suited to enterprises which manufacture homogeneous products on a continuous basis. Therefore, it is used in the petrol, chemical, food, and electronic industries, where standardised products are produced. In a process costing system production departments or processes are thus cost collection points (centres). The proper classification of the production activities of a factory into departments or processes is one of the first and most important steps in the operating of a process costing system. The factory can be divided according to the nature of the enterprise into

processes with relatively large spheres of activity, or into smaller cost centres (or places) limited to a single activity.

DEPARTMENTALISATION AND UNIT COSTS

In a job costing system, a **job card** is the collection point for all the manufacturing costs incurred for each job. The final cost of the job is determined only after it is finished. The manufacturing process may stretch over more than one accounting period, in which case the costs at the end of the first period are merely classified as incomplete work and the accumulated costs are transferred to the next period.

In process costing, the manufacturing costs are collected by department or process for determined periods. The information required is collected on a process cost report. The number of units manufactured is also determined by department or process. Since each process manufactures a standard product, the average cost per unit of a specific department for an accounting period can easily be calculated as follows:

Total manufacturing costs (for the period)
Number of units manufactured (in the period)

Costs incurred in production are typically not directly variable with the number of units produced. In fact, it is rather difficult to determine what portion of the costs incurred belong to each unit produced. Therefore, the above formula is used on total costs incurred during a specific period and divided by the number of units produced during that same period to arrive at an approximation of the unit costs. A manager would therefore be responsible for process costs in two important aspects:

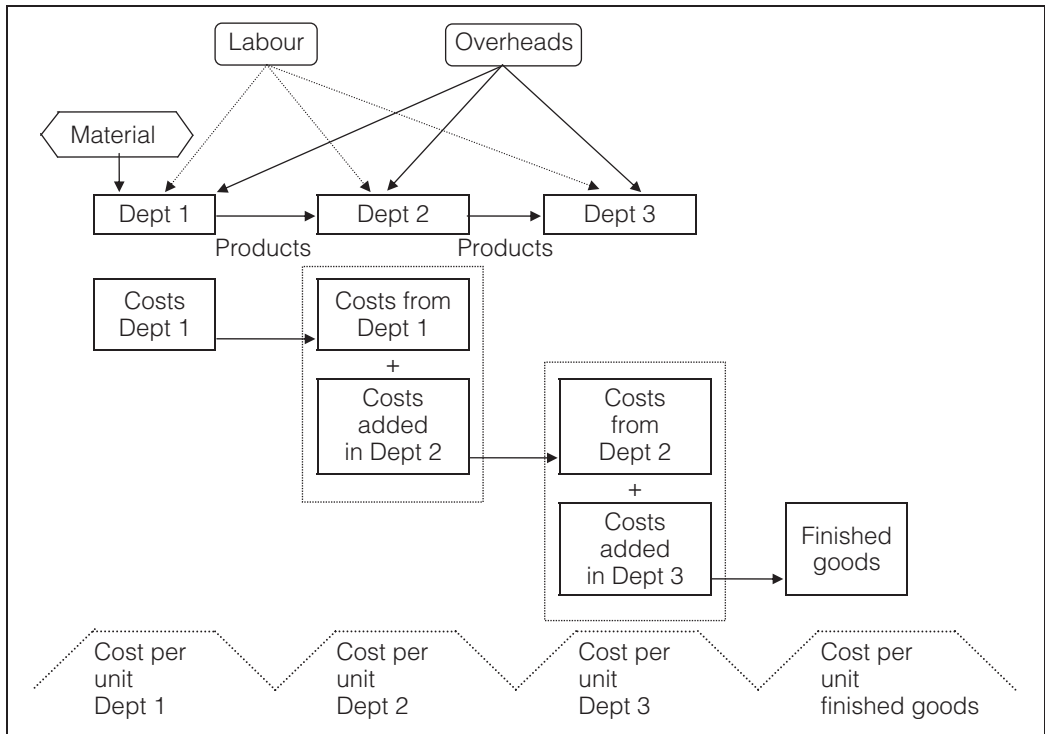
- ☐ the responsibility for costs (the numerator in the above formula); and
- ☐ the responsibility for quantities (the denominator in the above formula).

PRODUCT AND COST FLOWS

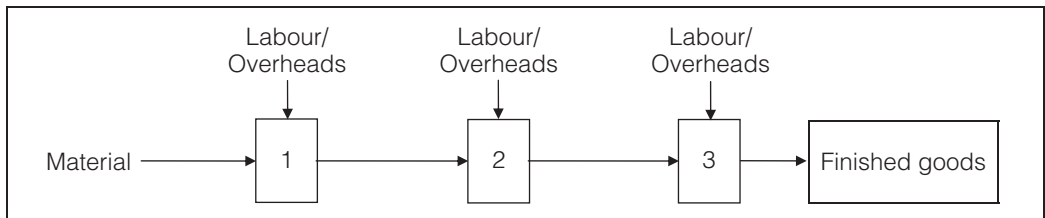
After processing, the initial input into the first process in a multiple process system is transferred to the next process, where it is one of the inputs for that process. In the second process, further material may be added, and further conversion costs incurred.

Unit costs are calculated periodically for each department, and the process will increase by department as the output of a previous department forms one of the inputs into the next department.

The ability to understand and visualise the transfer of partly completed products from one department to the next (the product flow) and the associated cost flow is a key factor in the solution of process costing problems. The basic product and cost flow in a multiple process costing system is illustrated in the following diagram:

**Diagram 11.1**

The product and cost flows in process costing systems can take different forms. Study the following diagram:

**Diagram 11.2**

In the above diagram, the complete production system stretches over three departments. The completed product from Department 1 becomes the input for the next department, and so on. Raw materials are added at the start of the process in Department 1 only. In all three of the processes, conversion costs are incurred.

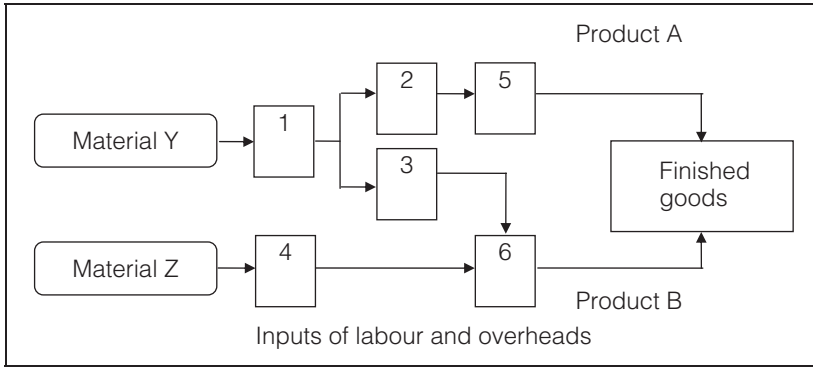


Diagram 11.3

In the above diagram, materials Y and Z enter at the start of the process in Departments 1 and 4. The output of Department 1 becomes the input for Departments 2 and 3. The output of Department 2 is transferred to Department 5, from which the final output, Product A, emerges. The outputs of Departments 3 and 4 form the input for Department 6, in which Product B is completed. Thus Departments 1, 2 and 5 form a production line in which Product A is produced and Departments 1, 3, 6 and 4 form a production line in which Product B is produced. Material is inserted only at the commencement in Departments 1 and 4 respectively. Labour and overheads are added in all departments.

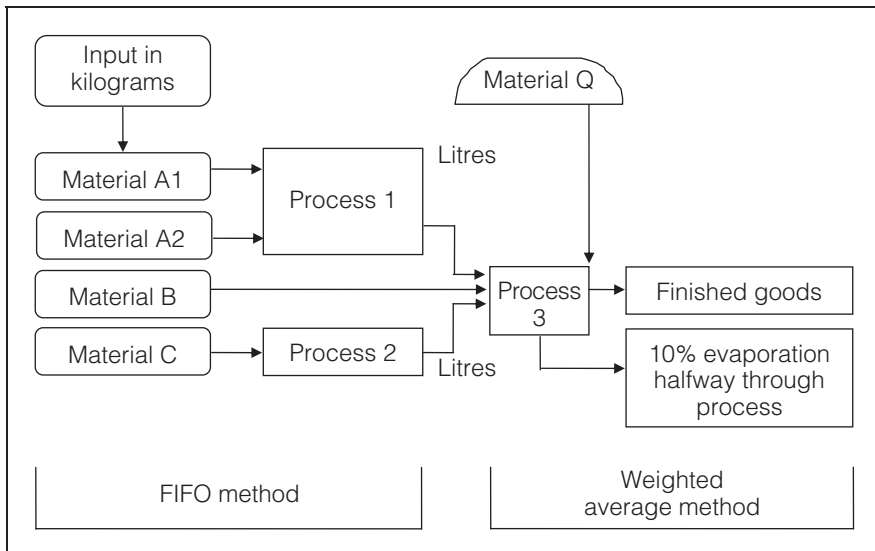


Diagram 11.4

The production programme shown above includes various other factors which influence departmental unit costs. (All these factors are dealt with in the sections which follow.)

- Material input in kilograms is converted into the products of processes 1 and 2, with the output being in litres. In turn these products form the inputs for process 3.

Another material, B, is added at the beginning of process 3 and material Q is added at the end of the process. In process 3, evaporation of 10% takes place at the halfway stage of the process.

- The output of process 3 forms the final finished product. Inventory valuation is according to the first-in, first-out method in process 1 and process 2, but according to the weighted average method in process 3. It is acceptable for a company to employ different costing methods at different points in the production process. This is dependent on experience, judgement, and knowledge of which method most closely approximates the reality of the production process.

Production diagrams are useful for analysing and organising data for process costing.

PROCESS COST REPORTS

Specific process costing methods are determined by the type of manufacturing processes that are utilised in different industries. The following scenarios are representative of various manufacturing industries:

- single product requiring a single production process;
- single product requiring multiple production processes; and
- multiple products requiring both single and/or multiple production processes.

These scenarios will be discussed in the following sections. The instrument used to record the costs and production flow of a process, the production cost report, is dealt with first.

*Total and unit costs for each department or process are summarised and determined in a **production cost report**.* Production cost reports can be prepared using different formats, but for the sake of consistency, only one format is used in this book. Below are the steps that should be followed every time a process costing report is prepared:

Step 1 **Quantity or production statement**

The quantity statement shows how many units were received in the department or process and how these were utilised – in other words, if they were transferred to a following process, or to finished products, or whether they are still being processed in the department (incomplete work).

The quantity statement deals with the physical flow of the units as well as the stage of completion reached by the units in the process.

The units shown in the quantity statement are expressed in terms of the department's finished product (for example, litres and kilograms). If all the units in the department are not completed in the period covered by the report, the equivalent production must also be calculated. (This is discussed in the following section.) All the units manufactured in the department must be expressed using the same standard.

Suppose that ladies' dresses are made in a particular department and that two metres of material are required for each dress. If 2 000 metres of material enter the process, then the quantity statement will show 1 000 dresses (2 000 metres material @ 2 metres per dress), since dresses are the unit in which the department's production is measured.

Step 2 Establishment of production costs

The total production costs incurred by a department in an accounting period are determined in the cost statement of the report. The costs for any period can arise from various sources:

- ☐ They can, for example, arise from with the incomplete units that were in the process at the beginning of the period (in other words, the units and their associated costs transferred from the previous period).
- ☐ If the department or process is not the first cost centre (place) in the production process, the costs from the previous departments or processes will be received when the units are transferred from there to this department.
- ☐ Each process will incur labour and manufacturing overheads, and possibly further material costs.

Step 3 Calculation of unit costs

The unit costs are determined not only for the product as a whole, but also for each of the cost elements, namely, costs from previous departments, and costs added in this department (material, labour, and overheads).

Step 4 Allocation of costs

Once the total costs for which a department is responsible have been determined according to step 2, account must be given thereof: a portion of the costs will be attributable to units which were transferred to the next department or finished goods. The rest of the costs will be attributable to units which are still being processed in the department and, if applicable, to lost units.

Step 5 Proof that all costs are accounted for

Eventually it must be shown that the sections of the report dealing with costs (steps 2 and 4) agree.

SINGLE PRODUCT: SINGLE PROCESS (NO OPENING OR CLOSING INVENTORY)

Enterprises that manufacture a single product in a single process will prepare a single process costing statement for each accounting period for which a report must be made.

The costs of the material that enters the process are obtained from the material requisitions and the labour costs are obtained from the relevant wage analysis statements. Overheads are allocated to the department by application of the appropriate overhead allocation rate.

In the following example, it is assumed that 50 000 units enter the process in the period concerned and are completed in the same period. Material, labour, and overhead costs are given on the statement.

Example 11.1

Production cost report – single product in a single process (no opening or closing inventory)

Department X

Process cost report: May 2015

Quantity statement**Input**

0	Units in opening inventory
50 000	Units entering the process
	Units completed and transferred
	Units in closing inventory

Production

50 000
0

50 000

50 000

Step 1

Accounting
for number
of units

Cost statement

	Total costs R	Unit- costs* R
Material	40 000	0.80
Labour	25 000	0.50
Overheads	15 000	0.30
	80 000	1.60

Steps 2 and 3

Cost allocation

Units completed and transferred:
50 000 units @ R1.60 per unit

80 000

Step 4

Step 5
Reconciliation
of costs

Calculations for Step 3

All the units that entered the process (50 000) are complete. Therefore, there are no incomplete units.

Material costs per unit	=	$\frac{\text{R40 000}}{50\,000 \text{ units}}$	=	R0.80 per unit*
Labour costs per unit	=	$\frac{\text{R25 000}}{50\,000 \text{ units}}$	=	R0.50 per unit*
Overheads per unit	=	$\frac{\text{R15 000}}{50\,000 \text{ units}}$	=	R0.30 per unit*

* Comment: Note how not only the total unit cost (R1.60), but also the unit cost of each element is calculated. These are important figures for cost control.

The summary of the costs on the cost statement is the basis for the following journal entries at the end of the period:

	Dr R	Cr R
Dr Production account	80 000	
Cr Material control		40 000
Cr Labour control		25 000
Cr Overheads control		15 000
<i>Recording of production costs for the month</i>		
Dr Finished goods	80 000	
Cr Production account		80 000
<i>Transfer of completed units: 50 000 units @ R1,60 each</i>		

The production account, sometimes also called the work-in-progress account, is an account in the general ledger in which the costs of material, labour and overheads which enter the process are collected and from which the transfer of completed units is made. If there is more than one department or process, a production account will be opened for each. The account represents an asset and will appear in the Statement of Financial Position.

SINGLE PRODUCT: MULTIPLE PROCESSES

In most enterprises where a process costing system is employed, there is more than one department through which a product must move consecutively in order to be converted into the finished product which is manufactured by the enterprise.

The costs incurred in each of the departments through which the product moves are collected and accounted for in the same manner as for a single process. The total costs of each department (which will include in the second and further departments the costs transferred from a previous department) are divided by the production of that department to determine the unit cost for that department.

To illustrate this, an enterprise which manufactures steel bumpers for motor vehicles is used as an example:

Example 11.2

Single product, multiple processes. No incomplete work at the beginning or end of the accounting period. The only raw material is sheet metal.

In Department 1 the sheet metal is cut according to specifications. The cut metal pieces are then transferred to Department 2, where special equipment is used to bend and form them into mudguard shapes. The shaped mudguards are then transferred to Department 3, where they are completed and polished, and then they are transferred to the finished goods storage area. Thus there is a continuous physical flow of the products being processed through various departments which are simultaneously involved in the various facets of the manufacturing action.

The production diagram for this enterprise thus corresponds with that given in Diagram 11.4: material enters the manufacturing process in Department 1 only, while conversion costs (that is, labour and overheads) are incurred in each of the departments. These costs must be collected per department and allocated to the units processed in each department.

continued

In the example, it is assumed that all the units which enter the process in each department during a fixed period are completed in the same period:

Wadeville Manufacturers started manufacturing steel bumpers for motor vehicles on 1 June 2015. The following data relates to their activities for June:

- 1 Plate metal from which 10 000 units can be manufactured is cut in Department 1.
- 2 The units were completed during the month.
- 3 Costs incurred:

	Department		
	1	2	3
	R	R	R
Material	30 000	—	—
Labour	4 000	8 000	2 000
Overheads	2 000	4 000	1 000

PROCESS COST STATEMENT

	Department		
	1	2	3
Quantity statement:	Units	Units	Units
Units not complete at beginning of month	0	0	0
Units entering the process	10 000	0	0
Received from previous department	0	10 000	10 000
	<u>10 000</u>	<u>10 000</u>	<u>10 000</u>
Units completed and transferred	10 000	10 000	10 000
Units not complete at end of month	0	0	0
	<u>10 000</u>	<u>10 000</u>	<u>10 000</u>

Transferred to finished products

→ 10 000

continued

Cost statement						
	Dept 1		Dept 2		Dept 3	
	Total costs	Unit costs	Total costs	Unit costs	Total costs	Unit costs
	R	R	R	R	R	R
Costs transferred from previous department	0	0	36 000	3.60	48 000	4.80
Material	30 000	3.00 ¹	0		0	
Labour	4 000	0.40 ²	8 000	0.80 ⁵	2 000 ⁷	0.20
Overheads	2 000	0.20 ³	4 000	0.40 ⁶	1 000 ⁸	0.10
	<u>36 000</u>	<u>3.60⁴</u>	<u>48 000</u>	<u>4.80</u>	<u>51 000</u>	<u>5.10</u>

Cost allocation statement:						
	R	R	R	R	R	R
Completed units transferred to the next department	36 000	3.60	48 000	4.80	51 000	5.10
Incomplete units	0	—	0	—	0	—
	<u>36 000</u>	<u>3.60</u>	<u>48 000</u>	<u>4.80</u>	<u>51 000</u>	<u>5.10</u>

Costs transferred to finished products	
R51 000	

Calculations

¹ $R30\,000 \div 10\,000 = R3.00$

² $R4\,000 \div 10\,000 = R0.40$

³ $R2\,000 \div 10\,000 = R0.20$

⁴ $10\,000 \text{ units} \times R3.60 \text{ per unit} = R36\,000$

⁵ $R8\,000 \div 10\,000 = R0.80$

⁶ $R4\,000 \div 10\,000 = R0.40$

⁷ $R2\,000 \div 10\,000 = R0.20$

⁸ $R1\,000 \div 10\,000 = R0.10$

Because there are no incomplete units at the end of the period in any of the departments, the total costs are transferred from one department to the next in proportion to the units that have physically moved to the next department, until they are eventually transferred to completed goods. Note also how the unit costs gradually increase:

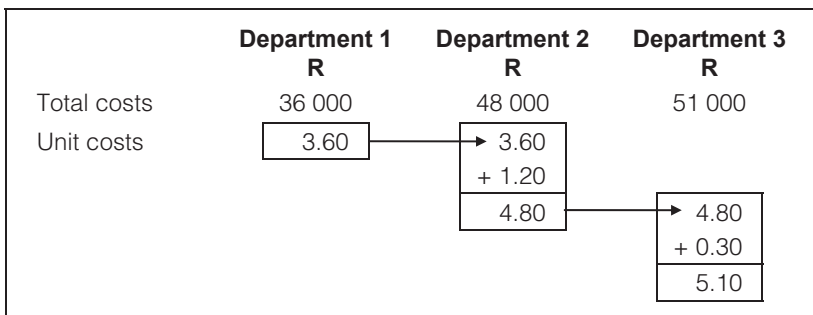


Diagram 11.5

The following journal entries can now be prepared from the process cost report:

	Dr R	Cr R
Dr Production account (Dept 1)	30 000	
Cr Material control		30 000
<i>Recording of material costs</i>		
Dr Production account (Dept 1)	4 000	
Dr Production account (Dept 2)	8 000	
Dr Production account (Dept 3)	2 000	
Cr Wages control		14 000
<i>Recording of labour costs</i>		
Dr Production account (Dept 1)	2 000	
Dr Production account (Dept 2)	4 000	
Dr Production account (Dept 3)	1 000	
Cr Overheads control		7 000
<i>Recording of overheads allocated</i>		
Dr Production account (Dept 2)	36 000	
Cr Production account (Dept 1)		36 000
<i>Transfer of units from Dept 1 to Dept 2</i>		
Dr Production account (Dept 3)	48 000	
Cr Production account (Dept 2)		48 000
<i>Transfer of units from Dept 2 to Dept 3</i>		
Dr Finished products	51 000	
Cr Production account (Dept 3)		51 000
<i>Transfer of 10 000 completed units @ R5.10 per unit to finished goods</i>		

THE CALCULATION OF INCOMPLETE UNITS IN THE CLOSING INVENTORY OF A PROCESS

As was seen in the previous section, the calculation of the cost per unit in a department where all the units that have entered production and are completed in the same period is not a problem. However, in a process costing system which is continuous in nature, it is unlikely that there will be no partially processed products present at the end of an accounting period.

The presence of partially processed products creates a new problem: at what value should they be recorded in the annual financial statements. As a starting point, the total manufacturing costs for a period must be allocated to both completed and incomplete units. The situation can be illustrated as follows:

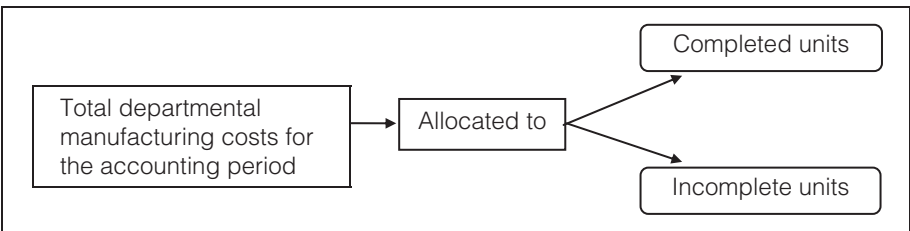


Diagram 11.6

It would be nonsensical merely to add the number of completed units to the number of incomplete units and use the total to calculate the average unit cost, because a meaningless mixture of units is then used and the calculated cost per unit is incorrect. In such cases *it is necessary to express the completed and incomplete units in terms of the equivalent completed units of the product.*

EQUIVALENT COMPLETE UNITS

The concept of 'equivalent completed units' (ECU) requires that units that are partially completed at the end of the financial period be numerically converted into the equivalent number of completed units that they represent. This completed number of units is then used in the process costing calculation. The following example explains the concept of ECU:

Example 11.3

	R
Department: X 03	
Period: June 2015	
Units entering the process	20 000
Units completed and transferred	14 000
Units still in process at the end of the period	<u>6 000</u>

There are 6 000 partially processed or incomplete units at the end of the period.

Although only 14 000 units were completed and transferred during the period, this does not represent the complete production activity of the department for the period, because work was also done on the 6 000 incomplete units. The amount of work done on the incomplete units must thus be determined and added to the production of the completed units to determine the department's total production for the period.

This is done by determining the equivalent completed production of the incomplete units by inspecting the units and establishing what percentage of the total resources necessary to complete the units has been expended on the incomplete units. (Total resources include all the production resources, namely, material, labour, and overheads.)

Assume that an inspection of the incomplete units shows that they are 70% complete. The ECU is then calculated as follows:

$$\begin{aligned}\text{ECU} &= 6\,000 \times 70\% \\ &= 4\,200\end{aligned}$$

The department's output in terms of ECU is determined as follows:

Completed units	14 000	
Equivalent completed units in closing inventory	<u>4 200</u>	(6 000 × 70%)
ECU	<u>18 200</u>	

The latter figure is now used to calculate the unit cost.

WAYS OF USING MANUFACTURING RESOURCES

It is necessary to investigate the use of resources in the production process and how this influences the calculation of equivalent production.

In fact, this comes down to the calculation of the cost per equivalent production of each cost element.

Resources are used in two ways in the production process, namely:

- ☐ continuously during the process (in this case it is also assumed that the use occurs evenly); or
- ☐ in lots at specified stages in the process.

Although this is not always valid, it is generally accepted that labour and overheads are used continuously and evenly during the production process. On the other hand, material usually enters the process in lots at specified stages (most often at the beginning).

The costs of labour and overheads are thus accounted for on an even basis and the costs of material at the stages when it enters the process.

The way in which the manufacturing resources are used has an important effect on the calculation of unit costs:

- ☐ For resources which are used continuously and evenly, the equivalent production is deemed to be directly proportionate to the extent of completeness of the product (for example, 70%).
- ☐ For resources which are added to the production process in lots at certain stages, the equivalent completed units are the units which have already passed the stage at which the resource is used (material added at the start calculated as 100%).

Example 11.4

Suppose that 20 000 units are added to the process and that all the material is added at the beginning of the process, while labour and overheads are used continuously and evenly.

No units are completed during the accounting period. All the units are physically 70% complete at the end of the period.

Calculation of equivalent production:

	Equivalent completed units	
	Direct material	Conversion costs
Closing inventory of incomplete work:		
20 000 units remained incomplete		
20 000 × 100%	20 000	
20 000 × 70%		14 000

All the units have already moved past the point at which the material is added (at the beginning of the process), therefore they are 100% complete in respect of material.

Because it is assumed that both labour costs and overheads are incurred on a continuous basis, the two cost resources are combined as conversion costs. This makes no difference to the appropriate calculations, provided that both labour costs and the overheads are completed to the same degree (70% in this example).

INCOMPLETE UNITS IN CLOSING INVENTORY

This aspect was touched on in the previous chapter. It will now be developed further by considering the production information of a department which receives products from a previous department as its input and then processes them further.

Example 11.5

Assume the following information:

Process 2: Production information August 2015

☐ Units:

	Units
Opening inventory of incomplete units	0
Units received from Process 1	30 000
Units completed	25 000
Closing inventory of incomplete units:	5 000
100% complete in respect of material	
60% complete in respect of conversion costs	

☐ Costs:

	R
Transferred from Process 1	60 000
Direct material	30 000
Direct labour	14 000
Overheads applied (50% of direct labour)	7 000

- ☐ Material is added at the beginning of Process 2 when the input is received from Process 1.
Conversion costs are incurred continuously and evenly in the process.

The flow of the units in Process 2 can schematically be presented as follows:

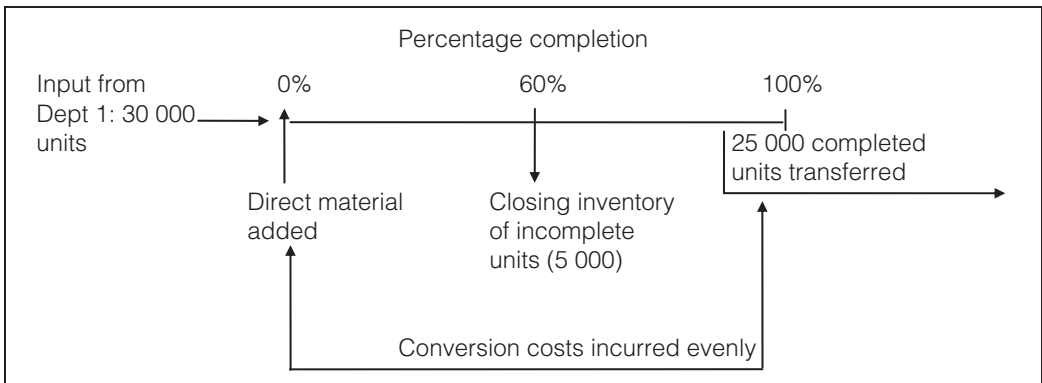


Diagram 11.7

In Process 2 there are three groups of costs that must be taken into consideration:

- ☐ costs from the previous process;
- ☐ direct material added in this process; and
- ☐ conversion costs incurred in this process.

It is not necessary to analyse the costs received from the previous process into its elements (material, labour, and overheads). In Process 2 it is merely (in total) treated as a cost element of the process.

The calculation of the equivalent completed units of Process 2 is as follows:

	Total	Group 1 Previous process ECU*	Group 2 Material ECU	Group 3 Conversion costs ECU
Incomplete units (opening)	0	0		0
Units completed	25 000	(100%) 25 000	(100%) 25 000	(100%) 25 000
Incomplete units (closing)	5 000	(100%) 5 000	(100%) 5 000	(60%) 3 000
		<u>30 000</u>	<u>30 000</u>	<u>28 000</u>

* ECU = Equivalent completed units (also called equivalent production).

Therefore, the cost per unit for the various cost groups is:

Group 1:	$\frac{R60\,000}{30\,000 \text{ units}}$	= R2.00 per unit
Group 2:	$\frac{R30\,000}{30\,000 \text{ units}}$	= R1.00 per unit
Group 3:	$\frac{(R14\,000 + R7\,000)}{28\,000 \text{ units}}$	= R0.75 per unit

The following is the complete process cost report of Process 2:

Process 2									
Process cost report: August 2015									
Quantity statement			Equivalent production						
Input		Pro- duction	Previous process		Material		Conversion costs		
			Units	%	Units	%	Units	%	
0	Incomplete units (opening)	—	—		—		—		
30 000	Units received from Process 1								
	Units completed and transferred	25 000	25 000	(100)	25 000	(100)	25 000	(100)	
	Incomplete units (closing)	5 000	5 000	(100)	5 000	(100)	3 000	(60)	
<u>30 000</u>		<u>30 000</u>	<u>30 000</u>		<u>30 000</u>		<u>28 000</u>		

continued

Cost statement

	Total costs R	Equivalent units	Unit costs R
Costs transferred from previous process	60 000	30 000	2.00
Material	30 000	30 000	1.00
Conversion costs	21 000	28 000	0.75
	<u>111 000</u>		<u>3.75</u>

Cost allocation statement

	R
Completed units transferred to the next process (25 000 units @ R3.75 per unit)	93 750
Incomplete units at end of the month:*	17 250
Transferred from previous process	5 000 × R2.00
Material	5 000 × R1.00
Conversion costs	3 000 × R0.75
	<u>111 000</u>

* Important: Note that as far as the incomplete units are concerned in the cost allocation section, all three of the cost groups are brought into account at their equivalent unit costs, otherwise the cost statement and cost allocation sections will not reconcile.

INCOMPLETE UNITS IN OPENING INVENTORY

The next factor in a process costing system is the opening inventory of incomplete goods in the different processes. In the examples dealt with thus far it has been assumed that there was no opening inventory of partially completed goods present in the departments. In practice it seldom happens that there is no opening inventory of incomplete goods present in a department or process because of the continuous nature of the process costing system. The closing incomplete work in Process 2 in the previous example automatically becomes the opening inventory present in the process at the beginning of the next period.

As mentioned before, there are two main methods that are used to account for the cost of the opening inventory in the calculation of unit costs.

□ Weighted average method

In the use of the **weighted average method**, *the cost of the opening inventory is added to the cost of the current period so that all the units which are complete have the same unit (cost).*

The units in the opening inventory are treated in the same way as the units which are started and completed in the current period.

This method will be referred to throughout as the weighted average method.

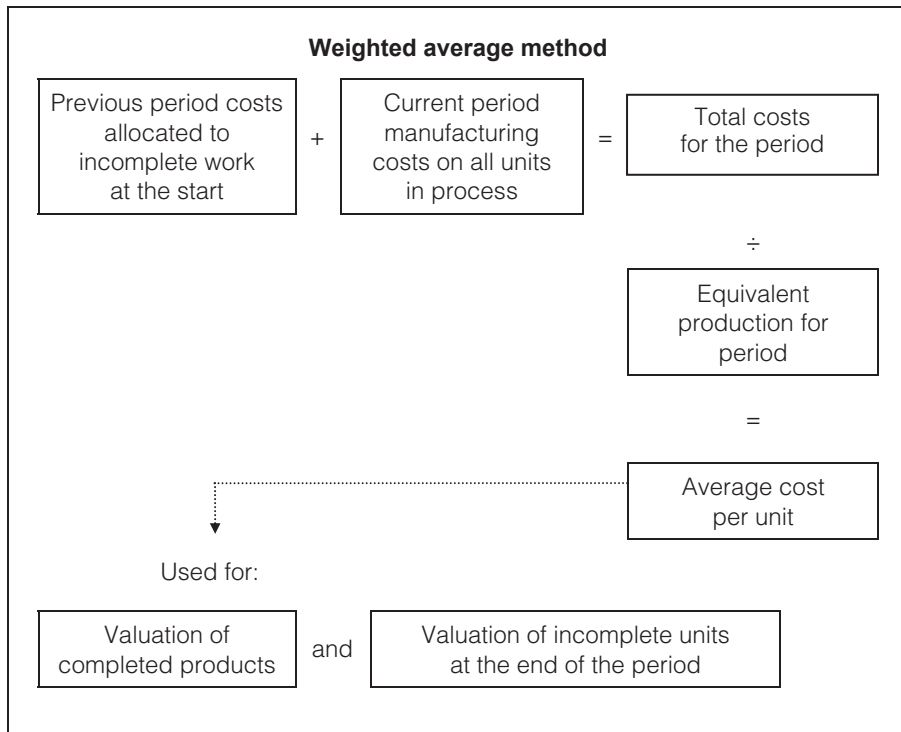


Diagram 11.8

(**Note:** In the above diagram lost units which are discussed later are not considered.)

☐ **First-in, first-out method (FIFO)**

In the **FIFO method**, the costs of the units in the opening inventory which are subsequently completed are kept separate from the costs of the units which are begun and completed in the current period.

The costs of the goods which are completed and transferred are made up of:

- ☐ the cost of the units completed which were in the opening inventory; and
- ☐ the cost of the units which were started and completed in the current period.

The closing inventory of incomplete work is valued at the unit cost of the current production. The unit cost of the current production is determined by dividing the production costs incurred in the current period (only) by the equivalent units manufactured during the current period.

☐ **Difference in equivalent units**

The equivalent units calculated by means of the FIFO method differ from those calculated by means of the weighted average method due to the different ways in which the opening inventory is treated in the two methods.

The formulae for the determination of the equivalent completed units (ECU) according to the two methods are as follows (Note: Although the treatment of lost units is dealt with in the next section, it is included in the formulae for the sake of completeness):

	1	2	3	4
ECU (Weighted average method)	= Units completed and transferred	+ Units completed and on hand @ 100%	+ Incomplete units in closing inventory @ % of completion	+ Units lost @ % of completion at the time the loss is ascertained

	1	2	3	4	5
ECU (FIFO method)	= Units completed and transferred @ 100%	+ Units completed and on hand @ 100%	+ Incomplete units in closing inventory @ % of completion	+ Units lost @ % of completion at the time the loss is established	- Opening inventory @ % of completion

Example 11.6

Quantity statement

	Units
Opening inventory (40% complete for all costs elements)	2 400
Put in process	3 600
	<u>6 000</u>
Units completed and transferred	5 400
Closing inventory (20% complete for all cost elements)	600
	<u>6 000</u>

Equivalent completed units according to the weighted average method:

(1*)		(2)		(3)		(4)		
5 400	+	0	+	120	+	0	=	<u>5 520</u>

Equivalent completed units according to the FIFO method:

(1)		(2)		(3)		(4)		(5)	
5 400	+	0	+	120	+	0	-	960	=
				(600 × 20%)				(2 400 × 40%)	<u>4 560</u>

* These figures refer to the steps in the previous formula.

Example 11.7

Weighted average method (opening and closing inventory)

Assume that the following details refer to Process X for March 2015:

Production details:

Units of incomplete work (opening)	Units
(100% complete iro material, 40% complete iro conversion costs)	12 000
Units received from previous process	21 000
	33 000
Units completed and transferred	24 000
Units of incomplete work (closing)	9 000
(100% complete iro material, 70% complete iro conversion costs)	

Details in connection with costs:

☐ Incomplete work (opening)	R
	80 175
Costs of previous process	63 150
Direct material	11 340
Conversion costs	5 685
☐ Costs incurred during March	172 650
Transferred from previous process	113 400
Direct material	21 000
Conversion costs	38 250
	252 825

Solution 11.7

Process X

Process cost report: March 2015 (Weighted average method)

Quantity statement			Equivalent production					
Input		Pro- duc- tion	Previous process		Material		Conversion costs	
			Units	%	Units	%	Units	%
12 000	Incomplete units (beginning of month)	—	—		—		—	
21 000	Received from previous pro- cess							
	Completed and transferred	24 000	24 000	(100)	24 000	(100)	24 000	(100)
	Incomplete units (at end of the month)	9 000	9 000	(100)	9 000	(100)	6 300	(70)
<u>33 000</u>		<u>33 000</u>	<u>33 000</u>		<u>33 000</u>		<u>30 300</u>	

continued

Cost statement

	Opening inventory	Current period	Total	Average cost per unit*
	R	R	R	R
Previous process costs	63 150	113 400	176 550	5.35
Material	11 340	21 000	32 340	0.98
Conversion costs	5 685	38 250	43 935	1.45
	<u>80 175</u>	<u>172 650</u>	<u>252 825</u>	<u>7.78</u>

* The average cost per unit is calculated by dividing the total costs by the total equivalent units for the period.

Cost allocation statement

	R
Completed units transferred:	
24 000 × R7.78	186 720
Incomplete work at end of month:	66 105
Previous process costs: 9 000 × R5.35	48 150
Material: 9 000 × R0.98	8 820
Conversion costs: 6 300 × R1.45	9 135
	<u>252 825</u>

Note (in the quantity statement) how the opening inventory and the units added during the month are combined (refer to the formula) to calculate the equivalent production and the average cost per unit.

Note (in the cost statement) that since the total costs comprise three cost groups (previous process costs, material, and conversion costs), it is necessary to calculate the average unit cost of each of the three components in order to be able to calculate the value of the incomplete units at the end of the period.

Example 11.8

First-in, first-out method (opening and closing inventory)

Refer to Example 11.7. To illustrate the difference between the weighted average and the FIFO methods, exactly the same information is used.

From the previous discussion it is obvious that in contrast with the weighted average method, where the total costs are eventually attributed to two production groups (completed units and incomplete units at the end of the period), in the FIFO method there is also a third group to which costs must be attributed.

The three groups are:

- ☐ Group 1: the 12 000 units which were present in the opening inventory.
- ☐ Group 2: a further 12 000 units which were started and completed during the period (Groups 1 and 2 are thus the 24 000 units completed during the period).
- ☐ Group 3: the 9 000 units which were still incomplete at the end of the period.

It also seems obvious that the costs that are attributable to the first group consist of the costs from the previous period (R80 175) plus the costs incurred in the current period to complete the units. Moreover, it is obvious that the rest of the costs incurred in the period (this includes the cost input of units received during the month from the previous department) are allocated to the second and third cost groups (complete and incomplete units).

The FIFO method can be presented as follows:

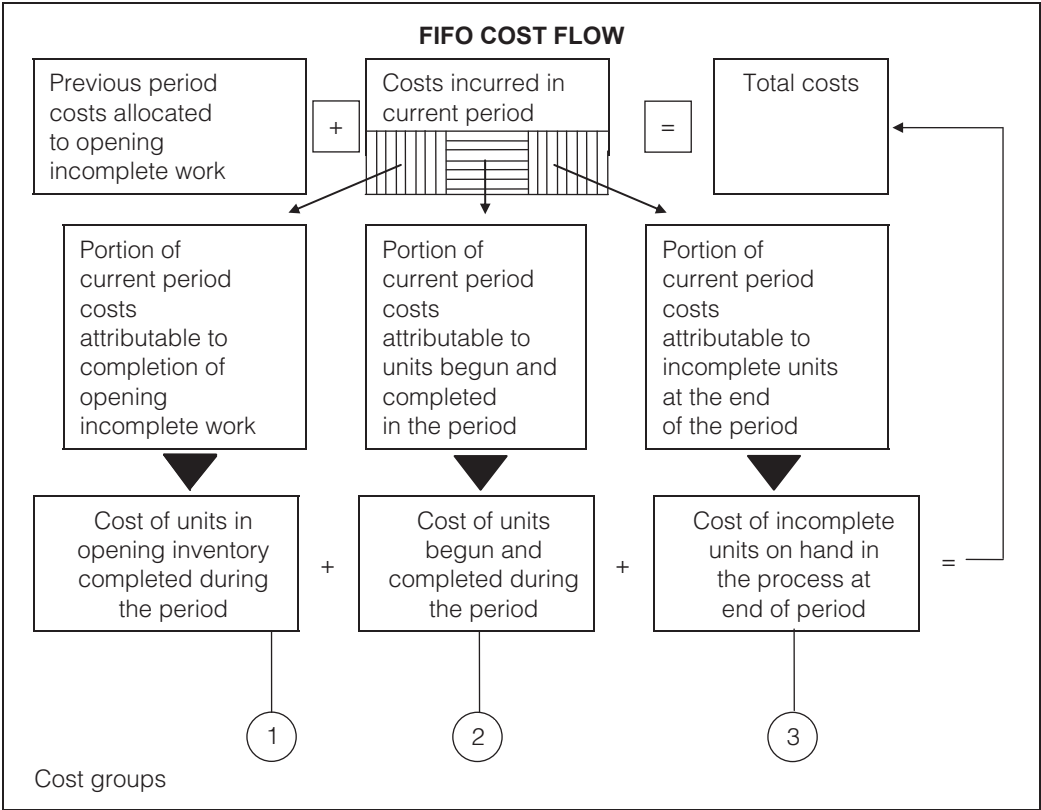


Diagram 11.9

Note: In the above diagram, lost units have been ignored for the sake of clarity.

Solution 11.8**Process X**

Process cost report: March 2015 (FIFO Method)

Quantity statement			Equivalent production						
Input		Pro- duc- tion	Previous process		Material		Conversion costs		
			Units	%	Units	%	Units	%	
12 000	Incomplete units (opening)					—			
21 000	Received from previous process								
	Completed and transferred from opening inventory	12 000		—		—		7 200	(60)
	Begun and completed during the month	12 000	12 000	(100)	12 000	(100)	12 000	(100)	
	Completed units transferred	24 000							
	Incomplete units (closing)	9 000	9 000	(100)	9 000	(100)	6 300	(70)	
33 000		33 000	21 000		21 000		25 500		

Cost statement		
	Costs	Current period costs per unit
	R	R
Opening inventory	80 175	—
Received from previous process	113 400	5.40*
Direct material	21 000	1.00*
Conversion costs	38 250	1.50*
	<u>252 825</u>	<u>7.90</u>

continued

Cost allocation statement

Units from opening inventory completed	90 975
Previous period costs (12 000) units	80 175
Costs incurred in current period to complete these units (7 200 units × current period conversion costs R1.50)	10 800
Units begun and completed in current period (12 000 × R7.90)	94 800
Total cost of units completed and transferred (24 000 units)	185 775
Incomplete units (end of the month)	67 050
Cost from previous process: 9 000 × R5.40	48 600
Material: 9 000 × R1.00	9 000
Conversion costs: 6 300 × R1.50	9 450
	252 825

Calculations:

FIFO unit cost per equivalent completed units:

			R
Previous process:	=	$\frac{R113\,400}{21\,000 \text{ units}}$	= 5.40
Direct material:	=	$\frac{R21\,000}{21\,000 \text{ units}}$	= 1.00
Conversion costs:	=	$\frac{R38\,250}{25\,500 \text{ units}}$	= 1.50
			<u>7.90</u>

In the quantity statement, the equivalent production is calculated for the three groups, namely, opening inventory of incomplete work, units begun and completed during the period and incomplete work at the end of the period. Since the opening inventory of incomplete units is already 100% complete in respect of material, it is only necessary to calculate the equivalent units in respect of conversion costs for this component.

Note that the equivalent unit costs are calculated only in respect of costs incurred in the current period.

Note (in the cost allocation statement of the process cost report) how the total costs of the 24 000 units (12 000 from the opening inventory and 12 000 from units that were begun and completed in the period) are determined. It is completely different from the method used in the weighted average cost method (compare the process cost report in Example 11.7 with the above example).

The cost of the incomplete work (closing) is determined in the same way as in the weighted average method but differs in total due to the difference in the costs per unit of the three components used in the calculation.

ALTERNATIVE LAYOUT FOR THE COMBINED PRODUCTION COST REPORT

It is also possible to use an alternative layout of the production cost report in the form of a combined quantity and production cost statement. The advantage of this layout is clarity and the fact that it is self-balancing. Example 11.9 (with reference to the previous example) illustrates the application of the combined quantity and production cost statement.

Example 11.9

Process X

Combined quantity and production cost statement for March 2015:

	Quantity	Value R	Unit price R
Incomplete work (opening)	12 000	80 175	
Received from previous process	21 000	113 400	5.40
Production during the month:			
Material		21 000	1.00
Conversion costs		38 250	1.50
Total input	<u>33 000</u>	<u>252 825</u>	<u>7.90</u>
Completed and transferred:			
From opening inventory	12 000	90 975	
Previous period costs		80 175	
Costs in current period to complete these units (7 200 × R1.50)		10 800	
Units begun and completed in current period (12 000 × R7.90)	<u>12 000</u>	<u>94 800</u>	<u>7.90</u>
Completed and transferred:	24 000	185 775	7.90
Incomplete work (closing):	9 000	67 050	
Costs from previous process (9 000 × R5.40)		48 600	
Material (9 000 × R1.00)		9 000	
Conversion costs (9 000 × 70% × R1.50)		9 450	
	<u>33 000</u>	<u>252 825</u>	<u>7.90</u>

INCREASE IN UNITS AS A RESULT OF THE ADDITION OF MATERIAL

The addition of material to a process usually means that the unit cost will increase. If material is added evenly during a process, the degree of completeness to determine the equivalent production in respect of material will be the same as for conversion costs.

In certain manufacturing processes the addition of material, however, means that the number of units in the process increases; for example, if 1 000 litres of chemical mixture is received from the previous department and a further 500 litres of liquid is added to the mixture in the process, the physical volume increases to 1 500 litres. Since the liquids are mixed and thus can no longer be distinguished, the total cost must be spread over the 1 500 litres.

Example 11.10

Increase in units as a result of the addition of material (weighted average method)

Assume the following information:

Lesedi Manufacturers: Process 2, October 2015:

Units:

	Units
Work in progress (opening)	1 000
(20% complete iro material and 10% iro conversion costs)	
Received from Process 1	13 000
Increase in units as a result of material added at the beginning of the process	2 000
	16 000
Less: Completed and transferred	(14 800)
Closing inventory of work in progress	
(33⅓% complete iro material and 75% iro conversion costs)	1 200

Costs:

	R
Opening inventory of incomplete work	4 246
Costs Process 1	4 000
Material	160
Conversion costs	86
Costs incurred during the month	91 490
Transferred from Process 1	65 000
Material	12 760
Conversion costs	13 730
	95 736

Solution 11.10**Lesedi Manufacturers**

Process cost report: October 2015 (Weighted average method)

Quantity statement			Equivalent production					
Input		Pro- duc- tion	Previous process		Material		Conversion costs	
			Units	%	Units	%	Units	%
1 000	Incomplete units (opening)							
13 000	Received from previous process							
2 000	Increase in units Completed and transferred	14 800	14 800	(100)	14 800	(100)	14 800	(100)
	Incomplete units (closing)	1 200	1 200	(100)	400	(33.33)	900	(75)
<u>16 000</u>		<u>16 000</u>	<u>16 000</u>		<u>15 200</u>		<u>15 700</u>	

Cost statement

	Opening inventory	Current period	Total	Average cost per unit
	R	R	R	R
Cost process 1	4 000	65 000	69 000	4.3125*
Material	160	12 760	12 920	0.8500*
Conversion costs	86	13 730	13 816	0.8800*
	<u>4 246</u>	<u>91 490</u>	<u>95 736</u>	<u>6.0420</u>

Cost allocation statement

	R
Completed units transferred: 14 800 × R6.0425	89 429
Work in progress (closing):	6 307
Previous process costs: (1 200 × R4.3125)	5 175
Material: (400 × R0.85)	340
Conversion costs: (900 × R0.88)	792
	<u>95 736</u>

□ **Calculations:**

Average cost per unit:

			R
Previous process costs:	=	$\frac{\text{R69 000}}{16\,000 \text{ units}}$	= 4.3125
Material:	=	$\frac{\text{R12 920}}{15\,200 \text{ units}}$	= 0.85
Conversion costs:	=	$\frac{\text{R13 816}}{15\,700 \text{ units}}$	= 0.88

After 13 000 units were received from Process 1 during the month material costing R12 760 was added in Process 2. As a result, the number of units increased by 2 000. In the weighted average cost method (on an equivalent production basis) the cost of these units is simply carried by all the units that were processed during the period (16 000). In the cost allocation statement, the cost is divided between the completed goods (14 800) and work in progress in the closing inventory (1 200).

It must be borne in mind that the unit cost of units received from Process 1 (R5.00, calculated by $\text{R65 000} \div 13\,000$) decreased to R4.3125 as a result of the increase in the number of units in Process 2.

Example 11.11

Increase in units as a result of the addition of material: FIFO method
(The information is the same as for the previous example.)

Solution 11.11

Lesedi Manufacturers

Process cost report

Quantity statement			Equivalent production					
Input		Pro- duc- tion	Previous process		Material		Conversion costs	
			Units	%	Units	%	Units	%
1 000	Incomplete units (opening)							
13 000	Received from previous process							
2 000	Increase in units							
	Completed and transferred from: Opening inventory	1 000	–		800	(80)	900	(90)
	Begun and completed during the month	13 800*	13 800	(100)	13 800	(100)	13 800	(100)
	Completed units transferred	14 800	13 800		14 600		14 700	
	Incomplete units (closing)	1 200	1 200	(100)	400	(33.33)	900	(75)
<u>16 000</u>		<u>16 000</u>	<u>15 000</u>		<u>15 000</u>		<u>15 600</u>	

* Balancing figure: = 14 800 units – 1 000 units

Cost statement

	Costs	Current period cost per unit
	R	R
Work in progress (opening)	4 246	
Received from Process 1	65 000	4.3333*
Direct material	12 760	0.8507*
Conversion costs	13 730	0.8801*
	<u>95 736</u>	<u>6.0641</u>

continued

Cost allocation statement

	R
Units completed from opening inventory (1 000)	5 719
Work in progress opening inventory	4 246
Costs incurred in current period to complete:	
Material (800 × R0.8507)	681
Conversion costs (900 × R0.8801)	792
Units begun and completed in the current period (13 800 × R6.0641)	83 685
Total cost of units completed and transferred	89 404
Work in progress closing inventory:	6 332
Costs from previous process (1 200 × R4.3333)	5 200
Material (400 × R0.8507)	340
Conversion costs (900 × R0.8801)	792
	<u>95 736</u>

Calculations:

FIFO equivalent unit cost:

		R
Previous process:	$= \frac{R65\,000}{15\,000 \text{ units}}$	$= 4.3333$
Direct material:	$= \frac{R12\,760}{15\,000 \text{ units}}$	$= 0.8507$
Conversion costs:	$= \frac{R13\,730}{15\,600 \text{ units}}$	$= 0.8801$

In the FIFO method, the cost of the work in progress of opening inventory is not brought into account in the calculation of the current period's equivalent unit costs. As in the weighted average method, the addition of material also results in the number of units increasing. Since it is assumed that it happens at the beginning of the department's process, the increase in the number of units in any period has a bearing on the new products only. If the increase in units takes place because the material is added continuously throughout the process, the increase in the number of units will have a bearing on both the new production and the opening inventory.

The value of the opening work in progress is not added to the current period's costs as in the weighted average method.

In the cost allocation section of the process cost report the following must be borne in mind:

- ☐ Since the opening inventory was only partially processed (material 20% and conversion costs 10%), further costs in respect of the two cost elements are assigned to the opening work in progress in order to complete it. (Refer to the quantity statement.)

- ☐ In the FIFO method the completed goods which are transferred consist of two groups of costs: the opening inventory of work in progress (1 000 units) now completely processed at a total cost of R5 719 and 13 800 units from current production at a cost of R83 686.
- ☐ The closing inventory of work in progress comprises of three cost elements, each of which is allocated to the work in progress according to the equivalent production and at the applicable unit cost.

ACCOUNTING FOR SPOILT UNITS

As enterprises in which process costing systems are used undertake mass production of standardised products, there will be no job-related wastage in these systems. Thus in process costing systems all wastage is either normal wastage associated with the process or abnormal wastage. (See chapter 10 for a discussion of normal wastage and abnormal wastage.)

In job costing systems the expected cost of normal wastage is included in the overheads recovery rate. In contrast with this, in process costing systems the cost of normal wastage is calculated at the end of the accounting period and, depending on the stage of completion reached in the manufacturing process when the wastage is detected, is allocated to work in progress and completed units.

Wastage is usually detected at fixed inspection points in the process. The cost of normal wastage is allocated only to the approved units that have already passed an inspection point or wastage point.

Losses or wastage can occur at any of the following stages in the production process:

- ☐ at the beginning of the process;
- ☐ at any stage during the process; and
- ☐ at the end of the process.

In the first two cases where the work in progress at the end of the period has reached the point of wastage, the cost of normal wastage is absorbed by:

- ☐ units manufactured and transferred to the next process or to finished goods;
- ☐ work in progress (closing); and
- ☐ abnormal losses.

However, if the wastage occurs during or at the end of the process and there is incomplete work in progress which has not yet reached the wastage point, no cost of normal wastage is allocated to such incomplete work. In this situation the cost of normal wastage will be absorbed only by:

- ☐ complete units; and
- ☐ abnormal losses.

Study the following diagram and the information given:

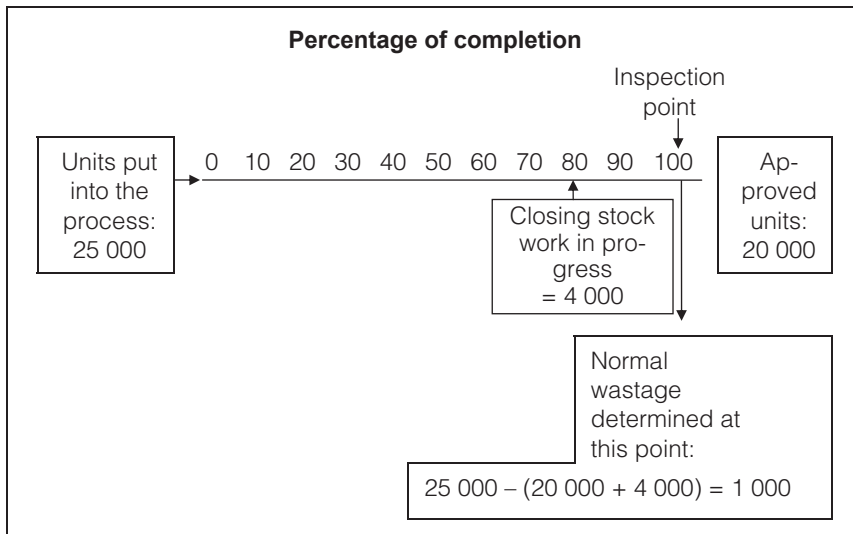


Diagram 11.10

In the above example there is no opening inventory. The diagram shows that 25 000 units were put into the process and that normal wastage amounts to 1 000 units. The wastage point in this example is at the completion of the units. In this case the cost of the normal wastage (since there is no abnormal wastage) will be allocated to the 20 000 completed units. The work in progress (4 000) has not yet reached the wastage point and therefore no cost of normal wastage is allocated to it.

The various possibilities are illustrated in the examples which follow.

ACCOUNTING FOR WASTAGE WHERE THE WEIGHTED AVERAGE METHOD IS APPLIED

This section is illustrated in the following six examples.

Example 11.12

- ☐ Normal wastage at the beginning of process
- ☐ No opening or closing inventory of work in progress

The following information relates to Process 1 of Lesedi Manufacturers for May 2015:

Work in progress – 1 May	0 kg
Input of material	100 000 kg
Completed and transferred to Process 2	95 000 kg
Material cost (added at the start of the process)	R190 000
Conversion costs (incurred evenly during the process)	R47 500

Normal wastage (inherent in the manufacturing process) is estimated at 5% of the input and occurs at the beginning of the process.

As there is no opening inventory in respect of work in progress, the method of valuation (FIFO or weighted average) is irrelevant.

Solution 11.12

Lesedi Manufacturers

Process cost report: May 2015

Quantity statement			Equivalent units			
Input		Pro- duction	Material		Conversion costs	
			Units	%	Units	%
–	Work in progress (opening)					
100 000	Put into process					
	Completed and transferred	95 000	95 000	(100)	95 000	(100)
	Normal wastage					
	(5% × 100 000 input)	5 000	–		–	
<u>100 000</u>		<u>100 000</u>	<u>95 000</u>		<u>95 000</u>	

Cost statement		Equivalent units	Costs per unit
	R		R
Cost from previous month	–	–	–
Cost for current month:			
Material	190 000	95 000	2.00
Conversion costs	47 500	95 000	0.50
	<u>237 500</u>		<u>2.50</u>

Cost allocation statement		R
Units completed and transferred to Process 2 (95 000 × R2.50)		237 500
Work in progress (closing)		0
		<u>237 500</u>

From the above example it is obvious that:

- ☐ normal wastage has no influence on the total production cost;
- ☐ normal wastage does have an influence on the unit cost, because the cost of normal wastage is absorbed by the approved units; and
- ☐ because normal wastage is inherent in the manufacturing process the number of wasted units is left out of the calculation of the equivalent units.

As has already been explained in chapter 10, for various reasons the actual wastage is seldom equal to the estimated normal wastage. This gives rise to abnormal wastage. The treatment of abnormal wastage becomes evident in the examples which follow.

Example 11.13

- ☐ Normal and abnormal wastage at the beginning of the process.
- ☐ No opening or closing inventory of work in progress.

The same information as given in the previous example is valid for this example with the exception that only 93 000 approved units are transferred to Process 2.

Solution 11.13**Lesedi Manufacturers**

Process cost report Process 1: May 2015

Quantity statement			Equivalent units			
Input		Pro- duction	Material		Conversion costs	
			Units	%	Units	%
–	Work in progress (opening)					
100 000	Introduced into process					
	Completed and transferred	93 000	93 000	(100)	93 000	(100)
	Normal wastage					
	(5% × 100 000 input)	5 000	–		–	
		<u>98 000</u>				
	Abnormal wastage	2 000	2 000 ¹		– ¹	
<u>100 000</u>		<u>100 000</u>	<u>95 000</u>		<u>93 000</u>	

Cost statement		Equivalent units	Costs per unit
	R		R
Cost from previous month:			
Work in progress (opening)	–	–	–
Cost for current month:			
Material	190 000	95 000	2.0000
Conversion costs	<u>47 500</u>	<u>93 000</u>	<u>0.5108</u>
	237 500		2.5108

Cost allocation statement		R
Units completed and transferred to Process 2 (93 000 × R2.5108)		233 504.40
Cost of abnormal wastage:		4 000.00 ²
Material (2 000 × R2.00)		4 000.00
Conversion costs		0
		<u>237 504.40*</u>

* The difference of R4.40 is due to the rounding of the unit costs to the fourth decimal place.

- Seeing that (in this example) abnormal wastage takes place at the beginning of the process, in other words, with the input of the material into the process but before any conversion costs are incurred, it is added for the calculation of equivalent unit costs of material, but not for conversion costs. The abnormal wastage is a balancing figure: (100 000 input – 98 000 output = 2 000 units).
- The cost of the abnormal wastage is transferred to an abnormal wastage account and eventually appears as a separate item in the costing and profit and loss account. It is also obvious that the completed units and the abnormal wastage absorb the cost of the normal wastage by means of the use of the equivalent units.

Example 11.14

- ☐ No incomplete work at the beginning of the process (the method of valuation is therefore irrelevant)
- ☐ Wastage at the beginning of the process
- ☐ Incomplete work at the end of the process

Nzima Ltd manufactures a single product in two processes. The following information is relevant to Process 1 for March 2015:

Work in progress (opening)	0
Material put into process: 50 000 units	R135 000
Direct labour	R82 000
Overheads applied	R20 200
Work in progress (closing):	6 000 units
Percentage of completion:	
Material	100%
Labour	50%
Overheads	40%
Units transferred to Process 2	38 000 units

Normal wastage is estimated at 10% of input.

Wastage takes place at the beginning of the process.

Solution 11.14

Nzima Ltd

Process cost report: Process 1: March 2015

Quantity statement			Equivalent units			
Input		Pro- duction	Material Units %	Labour Units %	Overheads Units %	
–	Work in progress (opening)					
50 000	Input during the month					
	Completed and transferred	38 000	38 000 (100)	38 000 (100)	38 000 (100)	
	Work in progress (closing)	6 000	6 000 (100)	3 000 (50)	2 400 (40)	
	Normal wastage (10% × 50 000)	5 000	–	–	–	
		49 000				
	Abnormal wastage	1 000 ¹	1 000 (100)	–*	–*	
50 000		50 000	45 000	41 000	40 400	

continued

Cost statement

	Total costs	Equivalent units	Costs per unit
	R		R
Material	135 000	45 000	3.00
Labour	82 000	41 000	2.00
Overheads	20 200	40 400	0.50
	<u>237 200</u>		<u>5.50</u>

Cost allocation statement

	R
Work in progress (opening)	0
Units completed and transferred to Process 2 (38 000 × R5.50)	209 000
Work in progress (closing):	25 200
Material (6 000 × R3.00)	18 000
Labour (3 000 × R2.00)	6 000
Overheads (2 400 × R0.50)	1 200
Abnormal wastage:	3 000
Material (1 000 × R3.00*)	3 000
Labour	0
Overheads	0
	<u>237 200</u>

1 Balancing figure: 50 000 units less 49 000 units = 1 000 units.

* Wastage takes place at the beginning of the process. Thus, as in the previous example, only material costs are involved in the abnormal wastage. Therefore, nothing in the allocation statement is added to the cost of the abnormal wastage in respect of labour and overheads.

Note again that in this example the cost of the normal wastage is absorbed by the three elements, namely, units completed and transferred, work in progress (closing), and abnormal wastage.

Example 11.15

- ☐ No opening inventory of work in progress (the method of valuation is irrelevant)
- ☐ Closing inventory on hand
- ☐ Wastage occurs *during* the process.

Habib Ltd manufactures a single product in two processes. The following information is applicable to Process 1 for June 2015:

Work in progress (opening)	0
Input of material for 100 000 units	R360 000
Conversion costs incurred	R173 600
Units completed and transferred to Process 2	80 000 units
Work in progress (closing)	8 000 units
Percentage of completion:	
Material	100%
Conversion costs	75%

All material is issued at the beginning of the process. Conversion costs are incurred evenly during the process. Normal wastage is estimated at 10% of input and takes place when production is 40% complete.

Solution 11.15**Habib Ltd**

Process cost report: Process 1: June 2015

Quantity statement		Equivalent units			
Input		Pro- duction	Material Units %	Conversion costs Units %	
–	Work in progress (opening)				
100 000	Input				
	Completed and transferred	80 000	80 000 (100)	80 000 (100)	
	Work in progress (closing)	8 000	8 000 (100)	6 000 (75)	
	Normal wastage (10% × 100 000)	10 000 ¹			
		98 000			
	Abnormal wastage	2 000 ²	2 000 ³ (100)	800 ⁴ (40)	
100 000		100 000	90 000	86 800	

1 Losses take place after the units are 40% converted. The closing work in progress is already 75% complete. Consequently the total input of 100 000 units is already past the wastage point.
 $100\,000 \text{ units} \times 10\% = 10\,000 \text{ units}.$

2 Balancing figure: $100\,000 - 98\,000 = 2\,000.$

3 Material is issued at the beginning of the process. Thus the equivalent units in respect of material for abnormal wastage are $2\,000 \times 100\%.$

4 Conversion costs are incurred evenly during the process. Wastage takes place when the units are 40% complete. The units which are lost as a result of abnormal losses were thus 40% complete in respect of conversion costs when the wastage took place, that is the equivalent of $2\,000 \times 40\% = 800$ units.

Cost statement

	R	Equivalent production	Cost per unit R
Material	360 000	90 000	4.00
Conversion costs	173 600	86 800	2.00
	<u>533 600</u>		<u>6.00</u>

Cost allocation statement

	R
Units completed and transferred ($80\,000 \times R6.00$)	480 000
Work in progress (closing):	44 000
Material ($8\,000 \times R4.00$)	32 000
Conversion costs ($6\,000 \times R2.00$)	12 000
Abnormal loss:	9 600
Material ($2\,000 \times R4.00$)	8 000
Conversion costs ($800 \times R2.00$)	1 600
	<u>533 600</u>

Example 11.16

- ☐ Normal and abnormal wastage
- ☐ Wastage takes place at the *end* of the process
- ☐ Both opening and closing inventory of incomplete work is present
- ☐ The weighted average method is used.

Masego Ltd: June 2017

Units	Units
Work in progress (opening)	24 000
(100% complete iro direct material; 50% complete iro conversion costs)	
Input of material	48 000
Total	<u>72 000</u>
Approved units completed	36 000
Spoilt units	6 000
(Normal wastage is 10% of approved <i>completed</i> units: wastage is determined at the end of the process)	
Work in progress (closing)	30 000
(100% complete iro material, 60% complete iro conversion costs)	
Total	<u>72 000</u>
	R
Costs	
Work in progress (opening):	108 000
Direct material	<u>80 000</u>
Conversion costs	<u>28 000</u>
Costs for June 2017:	280 000
Direct material	<u>160 000</u>
Conversion costs	<u>120 000</u>
Total costs	<u>388 000</u>

continued

The process cost report is as follows:

Masego Ltd					
Process cost report : June 2017					
Quantity statement			Equivalent units		
Input		Pro- duction	Material Units %	Conversion costs Units %	
24 000	Work in progress (opening)				
48 000	Put into the process				
	Approved units completed	36 000	36 000 (100)	36 000 (100)	
	Work in progress (closing)	30 000	30 000 (100)	18 000 (60)	
	Normal wastage (10% × 36 000)	3 600 ¹	3 600 (100)	3 600 (100)	
	Abnormal wastage (balancing figure)	32 400	2 400 ² (100)	2 400 ² (100)	
<u>72 000</u>		<u>72 000</u>	<u>72 000</u>	<u>60 000</u>	

1 Normal wastage is 10% of the approved completed units: 10% of 36 000 = 3 600.
2 Losses occur at the end of the process. The spoilt units were 100% completed.

Cost statement				
	Work in process (opening)	Costs current month	Total	Cost per unit*
	R	R	R	R
Direct material	80 000	160 000	240 000	3.3330*
Conversion costs	28 000	120 000	148 000	2.467*
	<u>108 000</u>	<u>280 000</u>	<u>388 000</u>	<u>5.800</u>

* Calculations: Cost per unit

Direct material:	=	$\frac{R240\,000}{72\,000\text{ units}}$	=	R3.333
Conversion costs:	=	$\frac{R148\,000}{60\,000\text{ units}}$	=	R2.467

continued

Cost allocation statement

	R
Abnormal wastage:	15 225
2 400 × R5.80	13 920
Part of normal wastage allocated	1 305 ¹
Finished goods:	228 375
36 000 × R5.80	208 800
Part of normal wastage allocated	19 575 ¹
Work in progress (closing):	144 406
Material (30 000 × R3.333)	100 000
Conversion costs (18 000 × R2.467)	44 406
Total	<u>388 006²</u>

- 1 As the closing work in progress had not yet reached the point of spoilage (losses occur at the end of the process), the cost of normal loss is calculated separately and then allocated to *abnormal loss* and the *finished goods*.

Calculate the total cost of the normal wastage: 3 600 units × R5,80 R20 880

The normal loss of R20 880 is allocated to:

	Units
Units completed and transferred	36 000
Abnormal wastage	2 400
	<u>38 400</u>

Allocation to abnormal loss:

		R
$\frac{2\,400 \text{ units}}{38\,400 \text{ units}} \times \frac{R20\,880}{1}$		1 305
Allocation to completed units:		
$\frac{36\,000 \text{ units}}{38\,400 \text{ units}} \times \frac{R20\,880}{1}$		19 575
		<u>20 880</u>

- 2 The difference of R6 is due to rounding the unit costs to the third decimal figure.

The calculation of equivalent completed units for spoilt units is, as previously explained, based on the stage of completeness that the products have reached when the wastage occurs. In this example it is at the end of the process. Therefore, the full applicable amount of material and conversion costs is allocated to the spoilt units.

Because the weighted average costing method is used, the cost (in the cost statement) of the opening inventory of work in progress is added to the costs incurred in the current period and is divided by the equivalent units of the relevant cost components to obtain an average cost (R5.80) per unit.

The journal entry to record the job upon completion is thus:

	R	R
Dr Losses in respect of abnormal wastage (2 400 × R5.80) + R1 305	15 225	
Dr Finished goods (36 000 × R5.80) + R19 575	228 375	
Cr Production account		243 600

ACCOUNTING FOR WASTAGE WHERE THE FIFO METHOD IS APPLIED

This section is illustrated in the following two examples.

Example 11.17

Kusasa Ltd manufactures a single product in a single manufacturing process. The company makes use of a process costing system and applies the FIFO method for the valuation of inventory. All materials are added at the beginning of the process and conversion costs are incurred uniformly throughout the process. Normal wastage is estimated at 20% of the units that reach the point of wastage. Losses occur when the process is 50% complete.

The following information is available for May 2017:

	Units	R
1 Work in progress – 1 May 2017	3 500	
40% complete		
Material		52 800
Conversion costs		38 540
2 Cost details for the month		
Material		512 560
Conversion costs		293 370
3 Production details for the month		
Units placed into production	21 500	
Units completed and transferred to finished goods	16 000	
Work in progress – 31 May 2017	3 600	
75% complete		

The process cost report is as follows:

Solution 11.17**Kusasa Ltd**

Process cost report for May 2017

Production statement			Equivalent production			
Input Units		Output Units	Material Units	%	Conversion costs Units	%
3 500	Work in progress – 1 May 2017					
21 500	Put into production					
	Completed from:					
	Opening inventory	2 800 ¹	— ²		1 680 ³	(60)
	Current production	13 200 ⁴	13 200 ⁵	(100)	13 200 ⁵	(100)
	Completed and transferred	16 000	13 200		14 880	
	Wastage					
	Normal	5 000 ⁶	— ⁷		— ⁷	
	Abnormal	400 ⁸	400 ⁹	(100)	200 ⁹	(50)
	Work in progress – 31 May 2017	3 600	3 600 ¹⁰	(100)	2 700 ¹⁰	(75)
25 000 ⁴		25 000	17 200		17 780	

Explanatory notes

- 1 Since the opening inventory passed the wastage point during the current period, only 80% of the opening inventory ended as finished products: $(3\,500 \times 80\% = 2\,800)$. Normal loss is 20% of the units that reach the wastage point. The normal loss of 700 units in respect of opening inventory is included in the total normal loss.
- 2 Material is added at the beginning of the process. No additional material is required to complete these units.
- 3 A further 60% conversion costs were incurred for the completion of units of the opening inventory which ended as finished products: $(2\,800 \times 60\% = 1\,680)$.
- 4 Balancing figure: $16\,000 - 2\,800 = 13\,200$.
- 5 Units which were begun and completed during the month were 100% complete in respect of both cost elements.
- 6 All 25 000 units which are being accounted for reached the wastage point during the current period: $(25\,000 \times 20\% = 5\,000)$.
- 7 Normal loss is not taken into account in the quantity statement because the work in progress at 31 May 2017 has already passed the wastage point. Since the work in progress (75% complete) at the end of the period passed the point of spoilage (when the process is 50% complete), the cost of the normal spoilage is absorbed by completed units, abnormal loss and work in progress. The number of normal wasted units is accordingly left out of the calculation of the equivalent units.
- 8 Balancing figure: $25\,000 - (16\,000 + 5\,000 + 3\,600) = 400$.
- 9 Raw material is added at the beginning and was therefore 100% wasted. Conversion costs are incurred evenly and are therefore incurred up to the wastage point (50%). Only 50% of conversion cost will therefore be lost $(400 \times 50\% = 200)$.
- 10 Closing work in progress contains 100% raw material but is only 75% complete in respect of conversion cost: $(3\,600 \times 75\% = 2\,700)$.

continued

Production cost statement

	Total R	Material R	Conversion costs R
Work in progress – 1 May 2017:	91 340		
Current costs	805 930	512 560	293 370
Cost to allocate	<u>897 270</u>		
Equivalent production (units)		17 200	17 780
Equivalent cost per unit	R46.30	R29.80	R16.50

Allocation statement

	R
Opening inventory – 1 May 2017:	119 060
Material	52 800
Conversion costs [R38 540 + (1 680 × R16.50)]	66 260
Current production (13 200 × R46.30)	611 160
Cost of units completed and transferred to finished goods	730 220
Abnormal wastage:	15 220
Material (400 × R29.80)	11 920
Conversion costs (200 × R16.50)	3 300
Closing inventory – 31 May 2015:	151 830
Material (3 600 × R29.80)	107 280
Conversion costs (2 700 × R16.50)	44 550
Total costs allocated	<u>897 270</u>

Example 11.18

- ☐ Normal and abnormal wastage
- ☐ Wastage takes place at the *end* of the process
- ☐ Both opening and closing inventory of incomplete work is present
- ☐ The first-in-first-out method for the valuation of inventory is used
- ☐ Normal wastage is 10% of the units that reach the point of wastage
- ☐ Abnormal wastage results from the input of the present month.

Bongwe Ltd: June 2015

Units	Units
Work in progress (opening)	
(100% complete iro direct material; 50% complete iro conversion costs)	24 000
Units put into the process	48 000
Total	<u>72 000</u>
Approved units completed	36 000
Spoilt units	6 000
Work in progress (closing)	
(100% complete iro material; 60% complete iro conversion costs)	30 000
Total	<u>72 000</u>

continued

Costs	R
Work in progress (opening):	108 000
Direct material	80 000
Conversion costs	28 000
Costs for June 2015:	280 000
Direct material	160 000
Conversion costs	120 000
Total costs	<u>388 000</u>

The process cost report is as follows:

Bongwe Ltd					
Process cost report for June 2015					
Quantity statement		Equivalent units			
Input		Pro- duc- tion	Material Units	%	Conversion costs Units %
24 000	Work in progress (opening)				
48 000	Put into process				
	Completed and transferred				
	From opening inventory	21 600 ¹	—		10 800 (50)
	From current production	14 400 ²	14 400	(100)	14 400 (100)
		<u>36 000</u>	<u>14 400</u>		<u>25 200</u>
	Normal wastage	4 200 ³			
	From opening inventory	2 400	— ⁵		1 200 ⁵ (50)
	From current production	1 800 ⁴	1 800 ⁵	(100)	1 800 ⁵ (100)
	Abnormal wastage	1 800 ⁶	1 800	(100)	1 800 (100)
	Work in progress (closing)	30 000	30 000	(100)	18 000 (60)
<u>72 000</u>		<u>72 000</u>	<u>48 000</u>		<u>48 000</u>

1 The opening inventory did not reach the point of wastage during the previous month; in other words, it is subject to wastage: 24 000 units less 10% = 21 600 units.

2 Balancing figure: 36 000 – 21 600 = 14 400 units

3 Opening inventory
Put into process

Units

24 000
48 000

72 000

Less: Closing inventory (30 000)

Units that reached the point of wastage 42 000

Normal wastage: 10% of 42 000 = 4 200 units

4 Balancing figure: 4 200 less normal wastage of 2 400 in respect of opening inventory = 1 800 units.

continued

5 Seeing that the FIFO method for inventory valuation is used, it is assumed that the wastage of 4 200 units during the month originates from two sources: opening work in progress (2 400) and units put into production during the month (1 800). Wastage occurs at the *end* of the process with the result that the cost of normal wastage must be calculated and *allocated* to:

- ☐ units completed and transferred, and
- ☐ abnormal wastage.

To calculate the cost of the normal spoilage, the equivalent units in respect of normal spoilage must be included in the quantity statement. The equivalent units for normal spoilage for material is not shown in the quantity statement for June 2015 as it was already included in the quantity statement for May 2015.

6 Balancing figure: Total loss (given) of 6 000 units less normal loss of 4 200 units = abnormal loss of 1 800 units.

Production cost statement

	Amount R	Equivalent units	Cost per unit R
Work in progress (opening)	108 000		
Material	160 000	48 000	3.333
Conversion costs	120 000	48 000	2.500
Cost to be allocated	<u>388 000</u>		<u>5.833</u>

The cost of normal wastage therefore consists of two components, namely:

- ☐ the cost of normal wastage which is included in the opening inventory; and
- ☐ the cost of normal loss which originates from the current production.

Calculation of the cost of normal wastage that must be allocated to the cost of completed units and abnormal wastage:

	R
Normal wastage included in the opening inventory:	10 800
Material: $2\,400 \times R3.333^1$	8 000
Conversion costs: $1\,200 \times R2.333^1$	2 800
Normal wastage that originates from current production:	13 500
Conversion costs in respect of opening inventory completed during the month: $1\,200 \times R2.50$	3 000
Units started and completed during the month: $1\,800 \times R5.833$	10 500
Normal wastage	<u>24 300</u>

continued

1 Calculation of the equivalent cost per unit of the work in progress at the beginning of the month.

Work in progress (opening):	Amount R	Equivalent units	Cost per unit R
Material	80 000	24 000	3.333 ¹
Conversion costs	28 000	24 000 × 50%	2.333 ¹
			Units
The normal wastage of R24 300 is allocated to:			
Units completed and transferred			36 000
Abnormal wastage			1 800
			<u>37 800</u>
			R
Units completed and transferred:			
$\frac{36\,000 \text{ units}}{37\,800 \text{ units}} \times \frac{R24\,300}{1} =$			23 143
Abnormal wastage:			
$\frac{1\,800 \text{ units}}{37\,800 \text{ units}} \times \frac{R24\,300}{1} =$			1 157
			<u>24 300</u>

Cost allocation statement

	R
Cost of completed units:	231 343
Work in progress (opening) (given)	108 000
Less: Normal wastage iro opening work in progress	<u>(10 800)</u>
	97 200
Add: on version costs to complete the opening work in progress (10 800 × 2.50)	<u>27 000</u>
	124 200
Units started and completed during the month (14 400 × R5.833)	<u>84 000</u>
	208 200
Add: Normal wastage allocated	<u>23 143</u>
Total cost of abnormal wastage:	11 657
1 800 units × R5.8333	<u>10 500</u>
Normal wastage allocated	<u>1 157</u>
Work in progress (closing):	145 000
Material (30 000 × R3.3333)	<u>100 000</u>
Conversion costs (18 000 × R2.50)	<u>45 000</u>
	<u>388 000</u>

SUMMARY

A process costing system is used where the manufacturing process produces products on a continuous basis according to standard specifications that are homogenous and in large volumes.

In process costing the manufacturing costs are collected by department or process for the accounting period. Unit costs are determined by dividing the total manufacturing costs for the period by the number of units manufactured for the same period.

After processing the initial input into the first process in a multiple process system, the work-in-progress (WIP) is transferred to the next process where it becomes the input for that process and the costs accumulated thus far carry forward to that process as opening costs.

The management of each enterprise determines specific process costing methods that will suit their manufacturing process. Total and unit costs for each department or process are then calculated, summarised, and presented in a production cost report. Total processed absorbed costs are divided by the units of output to determine unit costs for the particular process. This report is eventually recorded in the accounting records of the business.

Enterprises that manufacture a single product in a single process will prepare a single process cost statement for each accounting period. However, most enterprises with a manufacturing process in operation will most likely have multiple processes through which inputs are converted into a finished product.

Due to the continuous nature of a process costing system, there will normally be partially processed products at the end of an accounting period. In such cases, it is necessary to express the completed and incomplete units in terms of equivalent completed units of the product.

Resources are used in two ways in the production process, namely, continuously during the process and in lots at specified stages in the process. The way in which manufacturing resources are used has an important effect on the calculation of the unit costs.

Two methods in particular are used to account for the cost of the opening inventory in the calculation of unit costs, namely, the weighted average method and the FIFO method. The equivalent units calculated by means of the methods differ from each other due to the different ways in which opening inventory is treated.

Adding material and labour from a previous process increases the unit costs. If material is added evenly during the process, the degree of completeness to determine the equivalent production in respect of material will be the same as for conversion costs.

In the weighted average cost method (on an equivalent production basis), the cost of these units is carried by all the units which were processed during the period. In the cost allocation statement, the cost is divided between the completed goods and work in progress in the closing inventory. In the FIFO method, the cost of work in progress of opening inventory is not brought into account in the calculation of the current period's equivalent unit costs.

In a process costing system the products move through consecutive processes. Each process contributes to the conversion of the products to final products. Conversion costs are incurred in each process while material is added only in some of the processes. The cost accumulates as the products move through the different processes.

PERSPECTIVES ON COSTING

Knowledge

You should know:

- ☐ that a process costing system is used when identical (homogenous) products are manufactured in large quantities;
- ☐ that in process costing, the manufacturing costs are allocated to either a department or to the period;
- ☐ after processing the initial input into the process (in a multiple processing system), the initial input is transferred to the next process where it becomes one of the inputs for that process;
- ☐ process costing methods comprise single-product-single-process, single-product-multiple-processes and multiple-products-single or multiple-processes;
- ☐ the steps to follow when compiling a process cost report;
- ☐ a quantity or production statement deals with the physical flow of the units as well as the stage of completion;
- ☐ in a process costing system, the total manufacturing costs for the period must be allocated to both completed and incomplete units;
- ☐ two methods are used to account for the cost of the opening inventory, namely, the weighted average method and the first-in, first-out method (FIFO);
- ☐ another method is called last-in, first-out (LIFO) but this method is not prescribed by accounting standards and is generally not used;
- ☐ the addition of material and labour to a process means that the unit cost will increase;
- ☐ normally labour and conversion costs are incurred evenly throughout the period while material costs are incurred at a specific point;
- ☐ in the FIFO method, the cost of the work in progress of opening inventory is not brought into account in the calculation of the current period's equivalent unit costs as in the weighted average method;
- ☐ the cost of normal wastage is included in the overhead recovery rate;
- ☐ normal wastage is associated with the process, for example, the normal cut-offs during the manufacturing of clothes; and
- ☐ abnormal wastage is wastage over and above normal wastage. Examples may include utilisation of poor-quality material and incorrect set-up of machines.

Skills

You should be able to:

- ☐ draw up a process cost report for a single product using a single process;
- ☐ draw up a process cost report for a single product using multiple processes;
- ☐ prepare a process cost report;
- ☐ prepare a cost statement;
- ☐ prepare a quantity statement;
- ☐ prepare a cost allocation statement;
- ☐ calculate the equivalent and completed units by using both the FIFO and weighted average methods;
- ☐ prepare a cost statement when there is an increase in units and unit costs; and
- ☐ account for wastage where both the weighted average and FIFO methods are applied, by completing a process cost report (quantity statement, cost statement and cost allocation statement).

KEY TERMS AND CONCEPTS

Equivalent completed units	309	Process costing system	298
FIFO method	314	Production cost report	302
Job Card	299	Weighted average method	313
Job costing system	299		

REVIEW PROBLEMS

Problem 11.1

Ramurundo (Pty) Ltd uses two processes to manufacture shoes.

Assume that the following details refer to Process 2 for January 2015:

Production details:

Units of incomplete work (opening)

(100% complete iro material, 40% complete iro conversion costs)

Units received from previous process

Units

5 000

20 000

25 000

Units completed and transferred

15 000

Units of incomplete work (closing)

(100% complete iro material, 70% complete iro conversion costs)

10 000

Details in connection with costs:

R

□ Incomplete work (opening)

80 000

Costs of previous process

63 000

Direct material

11 000

Conversion costs

6 000

□ Costs incurred during March

172 000

Transferred from previous process

113 000

Direct material

21 000

Conversion costs

38 000

252 000

Required

Prepare a production statement for process 2 using:

- The weighted average method.
- The FIFO method.

Solution 11.1

Process 2

(a) Process cost report: January 2015 (Weighted average method)

Quantity statement			Equivalent production					
Input		Pro- duc- tion	Previous process		Material		Conversion costs	
			Units	%	Units	%	Units	%
5 000	Incomplete units (beginning of month)	—	—		—		—	
20 000	Received from previous process							
	Completed and transferred	15 000	15 000	(100)	15 000	(100)	15 000	(100)
	Incomplete units (at end of the month)	10 000	10 000	(100)	10 000	(100)	7 000	(70)
<u>25 000</u>		<u>25 000</u>	<u>25 000</u>		<u>25 000</u>		<u>22 000</u>	

Cost statement				
	Opening inventory	Current period	Total	Average cost per unit*
	R	R	R	R
Previous process costs	63 000	113 000	176 000	7.04
Material	11 000	21 000	32 000	1.28
Conversion costs	6 000	38 000	44 000	2.00
	<u>80 000</u>	<u>172 000</u>	<u>252 000</u>	<u>10.32</u>

* The average cost per unit is calculated by dividing the total costs by the total equivalent units for the period.

Cost allocation statement		R
Completed units transferred:		
15 000 × R10.32		154 800
Incomplete work at end of month:		97 200
Previous process costs: 10 000 × R7.04		70 400
Material: 10 000 × R1.28		12 800
Conversion costs: 7 000 × R2.00		14 000
		<u>252 000</u>

Solution 11.1

Process 2

(b) Process cost report: January 2015 (FIFO method)

Quantity statement			Equivalent production					
Input		Pro- duc- tion	Previous process		Material		Conversion costs	
			Units	%	Units	%	Units	%
5 000	Incomplete units (opening)				—			
20 000	Received from previous process							
	Completed and transferred from opening inventory	5 000	—		—		3 000	(60)
	Begun and completed during the month	10 000	10 000	(100)	10 000	(100)	10 000	(100)
	Completed units transferred	15 000	10 000		10 000		13 000	
	Incomplete units (closing)	10 000	10 000	(100)	10 000	(100)	7 000	(70)
<u>25 000</u>		<u>25 000</u>	<u>20 000</u>		<u>20 000</u>		<u>20 000</u>	

Cost statement		
	Costs	Current period costs per unit
	R	R
Opening inventory	80 000	–
Received from previous process	113 000	5.65*
Direct material	21 000	1.05*
Conversion costs	38 000	1.90*
	<u>252 000</u>	<u>8.60</u>

continued

Cost allocation statement

	R
Units from opening inventory completed	90 975
Previous period costs (5 000) units	80 000
Costs incurred in current period to complete these units (3 000 units × current period conversion costs R1.90)	5 700
Units begun and completed in current period (10 000 × R8.60)	86 000
Total cost of units completed and transferred	171 700
Incomplete units (end of the month)	67 050
Cost from previous process: 10 000 × R5.65	56 500
Material: 10 000 × R1.05	9 500
Conversion costs: 7 000 × R1.90	9 450
	<u>252 000</u>

Calculations:

FIFO unit cost per equivalent completed units:

		R
Previous process:	$= \frac{R113\,000}{20\,000 \text{ units}}$	= 5.65
Direct material:	$= \frac{R21\,000}{20\,000 \text{ units}}$	= 1.05
Conversion costs:	$= \frac{R38\,000}{20\,000 \text{ units}}$	= 1.90
		<u>8.60</u>

Problem 11.2

Moodley (Pty) Ltd manufactures a product in one process. Material is added at the beginning of the process and conversion costs are incurred uniformly during the month. Cost and production information for June 2015 is as follows:

	R	Units
Work in progress – 1 June – 40% completed	75 000	2 000
Material	45 000	
Conversion costs	30 000	
Material added in June	500 000	20 000
Conversion costs in June	300 000	
Completed and transferred to finished products		15 000
Work in progress – 30 June – 75% completed		3 000

Additional information

- 1 The first-in, first-out (FIFO) method is used for inventory valuation.
- 2 Normal wastage is 17.5% of input and occurs at the beginning of the process.

Required

- (a) Prepare the following statements for June 2015:
 - (i) Production statement.
 - (ii) Production cost statement.
 - (iii) Allocation statement.
- (b) Prepare the production statement if normal wastage occurs when the process is 50% complete.

Solution 11.2

- (a) Spoilage takes place in the beginning of the process
 - (i) Production statement for June 2015.

Input Units	Details	Output Units	Equivalent units			
			Material		Conversion costs	
			Units	%	Units	%
2 000	Work in progress – 1 June 2015					
20 000	Put into production					
	Completed from:					
	Opening stock	2 000	–		1 200	(60)
	Current production	13 000	13 000	(100)	13 000	(100)
	Completed and transferred	15 000	13 000		14 200	
	Spoilage:					
	Normal	3 500	–		–	
	Abnormal	500	500	(100)	–	
	Work in progress – 30 June 2015	3 000	3 000	(100)	2 250	(75)
<u>22 000</u>		<u>22 000</u>	<u>16 500</u>		<u>16 450</u>	

- (ii) Production cost statement

	Total	Material	Conversion costs
	R	R	R
Work in progress – 1 June 2015	75 000		
Current costs	800 000	500 000	300 000
	<u>875 000</u>	<u>500 000</u>	<u>300 000</u>
Equivalent units		16 500	16 450
Equivalent cost per unit		R30.30	R18.24

(iii) Allocation statement

	R
Work in progress – 1 June 2015	75 000
Current production	652 908
Material: 13 000 × R30.30	393 900
Conversion costs: 14 200 × R18.24	259 008
Completed and transferred	727 908
Abnormal spoilage	
Material: 500 × R30.30	15 150
Work in progress – 30 June 2015	131 940
Material: 3 000 × R30.30	90 900
Conversion costs: 2 250 × R18.24	41 040
	874 998

(b) Production statement – losses occur when the process is 50% complete

Input Units	Details	Output Units	Equivalent units			
			Material		Conversion costs	
			Units	%	Units	%
2 000	Work in progress – 1 June 2015					
20 000	Put into production					
	Completed from:					
	Opening stock	1 650	–		990	(60)
	Current production	13 350	13 350	(100)	13 350	(100)
	Completed and transferred	15 000	13 350	(100)	14 340	
	Spoilage:					
	Normal	3 850	–		–	
	Abnormal	150	150	(150)	75	(50)
	Work in progress – 30 June 2015	3 000	3 000	(100)	2 250	(75)
22 000		22 000	16 500		16 665	

Problem 11.3

Emboya (Pty) manufactures and sells large executive conference tables for R15 000 per table. Each table uses indirect materials and also the wood for every table comes from a single tree. Tree prices and other production costs have remained relatively stable, and wastage has been eliminated due to their excellent production process. The company presented you with the following information as at year-end:

Ending work in progress (900 tables)	R2 700 000
Finished goods (300 tables)	R2 100 000
Indirect labour	R187 500
Raw materials transferred into the production (1 050 trees)	R1 050 000
Beginning finished goods (600 tables)	R4 200 000

continued

Cost of glues and screws	R52 500
Beginning work in progress (750 tables)	R2 197 500
Ending raw materials (750 trees)	R750 000
Direct labour incurred during the period	R4 950 000
Selling, general and admin costs	R1 725 000
Depreciation of factory equipment	R112 500
Raw materials opening stock (450 trees)	R450 000
Raw materials purchased (1 350 trees)	R1 350 000
All other factory overheads	R450 000
Tables sold (1 200 tables)	R18 000 000

Required

- (a) Calculate the cost of goods sold.

Solution 11.3

- (a) It is important to note that the cost of goods manufactured is not the cost of goods sold and that a portion of the goods manufactured will remain unsold at the end of the year in closing inventory. The calculation will most likely also include opening inventory. Note that when you are confronted with this type of question that you have to distinguish between the different types of inventory: Raw materials, Work-in-progress (WIP) and Finished goods. Your calculation towards cost of sales will cover all three categories.

Raw materials

	Units	Cost (R)
Opening stock	450	450 000
Add: purchases	1 350	1 350 000
Less: Closing stock	(750)	(750 000)
Raw materials transferred to WIP	1 050	1 050 000

Work in progress (WIP)

Direct labour	4 950 000
Factory overheads:	802 500

Indirect materials
Indirect labour
Factory depreciation
Other overheads

R52 500
R187 500
R112 500
R450 000

Add: Beginning WIP	750	2 197 500
Less: Closing WIP	(900)	(2 700 000)

Cost of goods manufactured	900	6 300 000

Finished goods

Add: Opening finished goods	600	4 200 000
Goods available for sale	1 500	10 500 000
Less: Closing stock	(300)	(2 100 000)

Cost of goods sold	1 200	8 400 000

EXERCISES

11.1

Kudu (Pty) Ltd manufactures a single product in two consecutive processes and uses a process costing system to control the costs. Raw material is added at the beginning of each process, while conversion costs are incurred uniformly throughout the process.

The following information is available for May 2015:

	Process 1 Units	Process 2 Units
Opening inventory incomplete units (50% complete with regard to conversion costs)	5 000	Nil
Units placed into the process during the month	20 000	–
Units completed:		
Transferred to the next process	15 000	–
Transferred to finished goods		12 000
Closing inventory incomplete units (60% complete with regard to conversion costs)	10 000	3 000

Required

Calculate the equivalent completed units for the month (as for the FIFO method of inventory valuation).

11.2

Process Manufacturers manufacture a single product in three consecutive processes. Material is issued only to department 1, while conversion costs are incurred uniformly in each department.

	Dept 1	Dept 2	Dept 3
Production statistics for the week:			
Opening inventory incomplete goods	25 000	30 000	20 000
Stage of completion:			
Material	80%	–	–
Labour and overheads	40%	50%	60%
Units started in production	50 000	–	–
Units completed and transferred	55 000	70 000	82 000
Closing inventory incomplete goods	20 000	15 000	8 000
Stage of completion:			
Material	50%	–	–
Labour and overheads	60%	60%	75%

continued

	R	R	R
Production costs for the week:			
Opening inventory incomplete goods:			
Cost in preceding department	–	70 500	86 700
Cost in current department:			
Material	26 000	–	–
Labour	10 000	20 000	24 000
Overheads	4 000	10 000	12 000
Costs during the week:			
Material	78 750	–	–
Labour	31 350	76 800	114 000
Overheads	25 650	57 600	83 600

Required

Prepare a combined production report and cost statement. The FIFO method is used in the valuation of inventory.

11.3

Kunene (Pty) Ltd manufactures a single product in a single process. Material is added at the beginning of the process and conversion costs are incurred uniformly during the month.

Cost and production information for April 2015 is as follows:

	R	Units
Work in progress – 1 April – 40% completed	76 000	2 000
Material	44 000	
Conversion costs	32 000	
Material added in April	379 904	16 000
Conversion costs in April	220 065	
Completed and transferred to finished products		11 300
Work in progress – 30 April – 75% completed		3 000

Additional information

- 1 The first-in,first-out (FIFO) method is used for inventory valuation.
- 2 Normal wastage is 20% of input.
- 3 Wastage occurs at the beginning of the process.

Required

- (a) Prepare the following statements for April 2015:
 - (i) Production statement.
 - (ii) Production cost statement.
 - (iii) Allocation statement.
- (b) Prepare the production statement if normal wastage occurs when the process is 50% complete.

11.4

Eland (Pty) Ltd manufactures a single product in one process and uses a process costing system.

The following information is available for May 2015:

	R	Units
Work in progress – 1 May 2015	–	
Units placed into process during May		47 500
Units completed		35 000
Costs for the month: Material	356 250	
Conversion costs	276 000	
Work in progress – 31 May 2015		2 500
Percentage complete:		
Material 100%		
Conversion costs 140%		

Additional information

- 1 Raw material is added at the beginning of the process. Conversion costs are incurred evenly throughout the process.
- 2 Normal wastage is estimated at 10% of input that reach the point of wastage.
- 3 Losses occur at the end of the process.
- 4 Inventory is valued according to the weighted average method.

Required

Prepare the following statements for May 2015:

- (a) Production statement.
- (b) Production cost statement.
- (c) Allocation statement.

11.5

Impala (Pty) Ltd manufacture a single product in three consecutive processes. Material is added at the beginning of each process while conversion costs are incurred evenly. The losses arising in each process are normally equal to 5% of the units that reach the point of wastage, and arise when 50% of the conversion costs have been added.

The following information for May 2015 is applicable to process 2:

	Units
Opening inventory incomplete units	4 000
Received from process 1 during the month	30 000
Spoilt units	2 000
Transferred to process 3 during the month	27 000

continued

	R
Opening inventory incomplete units:	
Cost of previous process	20 400
Material	23 800
Conversion costs (60% complete)	13 440
Input during the month:	
Cost of previous process	152 475
Material	175 275
Conversion costs	243 810
The closing inventory of incomplete work was 70% complete with regard to conversion costs.	

Required

- Draft a process cost report for May 2015 using the FIFO method of inventory valuation.
- Show how the information contained in the process cost report must be shown in a combined quantity and cost statement.
- Draft a process cost report for May 2015 using the weighted average method of inventory valuation.

11.6

Memeza (Pty) Ltd manufactures a single product in three consecutive processes. Material is issued only to department 1, while conversion costs are incurred uniformly in each department.

	Dept 1	Dept 2	Dept 3
Production statistics for the week:			
Opening inventory incomplete goods	25 000	30 000	20 000
Stage of completion:			
Material	80%	—	—
Labour and overheads	40%	50%	60%
Units started in production	50 000	—	—
Units completed and transferred	55 000	70 000	82 000
Closing inventory incomplete goods	20 000	15 000	8 000
Stage of completion:			
Material	50%	—	—
Labour and overheads	60%	60%	75%
	R	R	R
Production costs for the week:			
Opening inventory incomplete goods:			
Cost in preceding department	—	70 500	86 700
Cost in current department:			
Material	26 000	—	—
Labour	10 000	20 000	24 000
Overheads	4 000	10 000	12 000
Costs during the week:			
Material	78 750	—	—
Labour	31 350	76 800	114 000
Overheads	25 650	57 600	83 600

Required

Prepare a combined production report and cost statement. The FIFO method is used in the valuation of inventory.

11.7

Isizwe partnership manufactures a single product in two consecutive processes and uses a process costing system. The wastage arising in the second process takes place at the *end* of the process. All inventory must be valued according to the weighted average method.

The following information for May 2015 applies to the second process:

	Units
Work in progress (opening) (100% complete iro material and 75% iro conversion costs)	6 000
Units received during the month from the previous process	30 000
Increase in units due to material added	10 000
Units completed during the month and transferred to finished products	40 000
Rejected units (normal wastage equal to 5% of units completed)	2 500
Closing inventory work in progress was 100% complete iro material and 25% iro conversion costs	

The following costs were noted for May 2015:

	R
Opening inventory work in progress:	204 000
Cost of previous process	90 000
Material	60 000
Conversion costs	54 000
Costs incurred during the month:	1 497 650
Costs of previous process	609 200
Material	404 600
Conversion costs	483 850

Required

Prepare the following statements for May 2015:

- Production statement.
- Production cost statement.
- Allocation statement.

12 Joint and by-products



LEARNING OUTCOMES

What are joint and by-products?

- Define and describe the concepts of joint and by-products
- Classify costs as joint or by-product costs
- Explain the accounting treatment of joint and by-products

How are joint costs allocated?

- Calculate joint costs according to the physical standards method, relative market value method and the reversal cost method

How are by-products and waste treated?

- Explain the costing methods used to allocate costs to by-products and waste

How is a profit or loss realised from joint and/or by-products?

- Calculate the net income when joint and by-products are part of the production process

CHAPTER OUTLINE

In specific manufacturing processes, more than one product may be produced. During such manufacturing processes, by-products, or waste products are often produced. It is crucial to allocate manufacturing costs to all products made, be they joint, by- or waste products. It is sometimes possible to sell by-products and waste to obtain an income.

This chapter introduces specialised methods and techniques used to accurately identify and cost products produced simultaneously with others. The accounting treatment of these products and the costing and accounting treatment of by-products and waste are also discussed.

INTRODUCTION

From previous units, it is obvious that the collection and allocation of costs occur so that manufacturing costs can be allocated to products, as is evident from the following diagram:



Diagram 12.1

In this unit, attention is given to the manufacturing processes in which more than one product results from the same inputs and processes, as illustrated in Diagram 12.2.

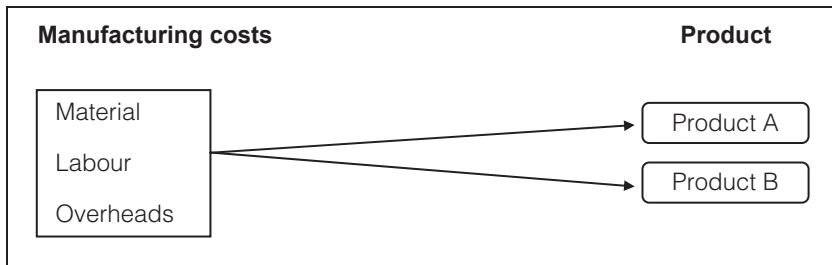


Diagram 12.2

The petroleum industry is a good example of an industry in which such common products occur. The processing of raw oil gives rise to various products such as petrol, power-paraffin, and oil.

CLASSIFICATION INTO JOINT AND BY-PRODUCTS

Common products which arise from the same manufacturing process can be either joint or by-products:

- **Joint products** are common products which are produced in large quantities and make a material contribution to the market value of all the outputs of a manufacturing process.
- **By-products** are products which are incidental to the production of the joint products and contribute a relatively small amount to the total market value of all the outputs of a process.

The classification is not determined by a precise ratio (or percentage) of the value of a product to the total market value. It is a question of sound judgement. For example, when a log is processed in a sawmill, the various grades of planks which result therefrom are joint products, while the bark and sawdust which inevitably result from the same process are by-products.

Changing circumstances (such as a change in the relative market value of a product) can cause a product to be reclassified, for example, the demand for a product that was previously a joint product could possibly decrease so that the selling price thereof must inevitably be adjusted downwards. This could cause the relative contribution of the product to the total market value of all outputs of the same process to decrease so that it must be reclassified as a by-product.

Common costs

In any manufacturing process from which joint or by-products originate, there is a point up to which it is not possible to identify the individual products. After this point they are clearly identifiable. *The point in the process where the individual products are clearly identifiable is known as the **split-off point** (or separation point).*

*The costs incurred up to the split-off point are described as **joint costs**.* Joint costs include all material, labour and overheads incurred to get the product to the split-off point as shown in Diagram 12.3

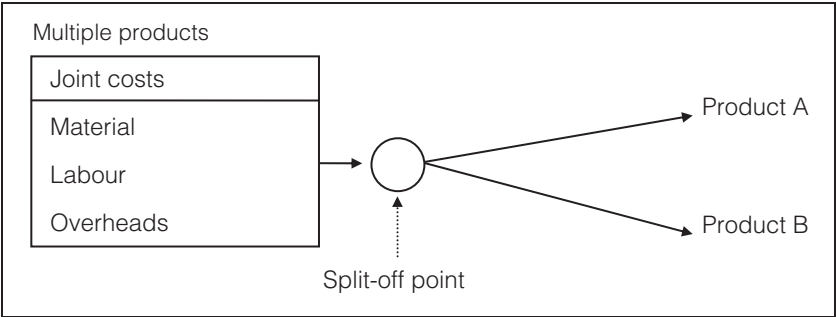


Diagram 12.3

Additional processing costs

Often joint products are not sold directly after the split-off point but are processed further in separate processes. The *additional processing costs incurred by each product are known as **separable costs*** because they can be allocated to the distinguishable products by means of either a job or process costing system. The following diagram illustrates such a situation:

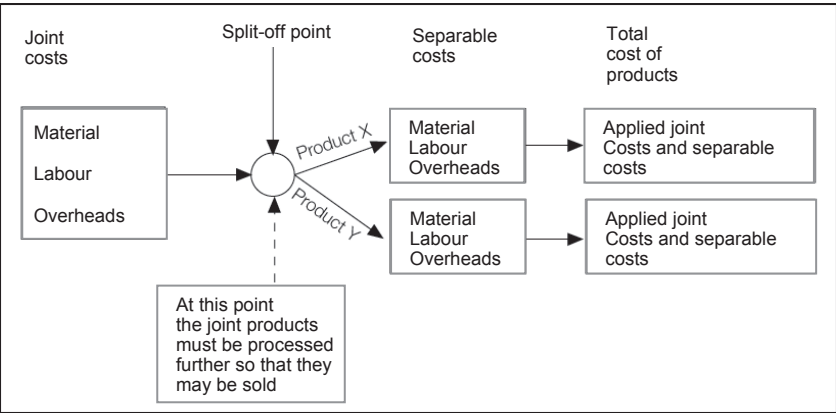


Diagram 12.4

Costing methods for joint products

The underlying costing problem that arises is: How are the joint costs allocated to the multiple products?

The following methods can be applied, *inter alia*, for this purpose:

□ **The physical standard method**

A physical standard is used to make the allocation. The physical standard can be a quantity (units, litres, metres) or a weight (kilograms).

□ **The market value at the split-off point.**

This method uses the market value of the joint products at the split-off point to make the allocation.

□ **Relative market value of the final product method**

According to this method the estimated market value at the split-off point is calculated by working backwards from the market value of the final product.

□ **Reversal cost method**

This method assumes that the expected profit percentage for some products is known. The expected profit percentage for each product is used to calculate the projected net profit. Using this figure as a basis, the income and costs after separation can be reversed to determine what portion of the joint costs each product can absorb.

The following example is used to explain the first two methods:

Example 12.1

Sindiwe (Pty) Ltd process a single material into two separate products, A-ONE and A-TWO. Both products can be sold immediately after their separation at the split-off point, product A-ONE at R20 per litre and product A-TWO at R10 per litre. During March 2015, 9 000 litres of the material input was used at a joint cost of R21 000. The manufacturing process produced 6 000 litres of A-ONE and 3 000 litres of A-TWO.

The total production for March was sold during the month.

The following diagram presents the basic information of the example:

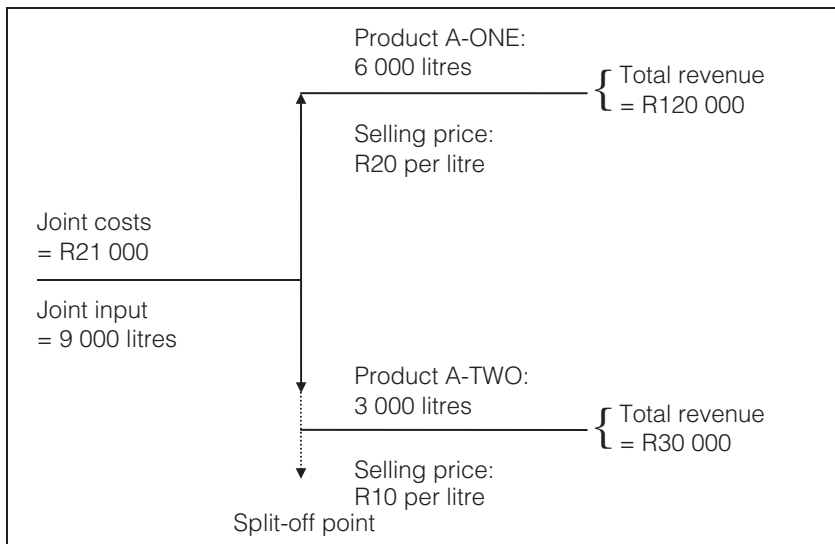


Diagram 12.5

The physical standard method

In this method the joint costs are allocated to each product in relation to the physical quantity of each product produced.

The facts necessary for the application of the method emerge quite clearly from the diagram:

- ☐ 9 000 litres were placed in the joint process; and
- ☐ from this, 6 000 litres of product A-ONE and 3 000 litres of A-TWO were produced.

Product	Quantity produced (litres)	Ratio	Total joint costs	Allocation of joint costs	Cost per litre
A-ONE	6 000	$6\,000 \div 9\,000$	$\times R21\,000$	R14 000	R2.33
A-TWO	<u>3 000</u>	$3\,000 \div 9\,000$		R7 000	R2.33
	<u>9 000</u>			<u>R21 000</u>	
STATEMENT OF PROFIT AND LOSS					
	Products		Total		
	A-ONE	A-TWO	R		
	R	R	R		
Revenue	120 000	30 000	150 000		
Less: Joint costs	<u>(14 000)</u>	<u>(7 000)</u>	<u>(21 000)</u>		
Gross profit	<u>106 000</u>	<u>23 000</u>	<u>129 000</u>		
Gross profit as a % of revenue	88.33%	76.67%	86%		

The physical standard method always produces the same cost per unit for each of the joint products at the split-off point (R2.33 per litre for each of the two products in the above example).

However, due to its higher selling price, Product A-ONE produces a far higher gross profit in total (and as a percentage of revenue) than Product A-TWO. In such a case the use of the physical standard method cannot be recommended.

Market value at the split-off point method

In this method, the joint costs are divided on the basis of the potential market value at the split-off point.

Proponents of the method justify their point of view by reasoning that joint costs are incurred with the expectation that they will be recovered and that a reasonable profit will be made. In this method there is thus a ratio between production costs and selling value.

The method produces the same gross profit percentage for the joint products:

Product	Pro- duction (litres)	Selling price at split-off point	Market value R	Ratio	Total joint costs	Portion of joint costs R	Cost per litre R
A-ONE	6 000	× R20 =	120 000	120 ÷ 150	× 21 000	16 800	2.80
A-TWO	<u>3 000</u>	× R10 =	<u>30 000</u>	30 ÷ 150		4 200	1.40
	<u>9 000</u>		<u>150 000</u>			<u>21 000</u>	
Statement of Profit and Loss							
				Products		Total	
			A-ONE	A-TWO			
			R	R		R	
Revenue			120 000	30 000		150 000	
Less: Joint costs			(16 800)	(4 200)		(21 000)	
Gross profit			<u>103 200</u>	<u>25 800</u>		<u>129 000</u>	
Gross profit as a % of revenue			86.0%	86.0%		86.0%	

Relative market value of the final product method

If the market value of the joint products is not known at the split-off point, it can be estimated by using the separable costs and the market value after the processing of the various products. The estimation is done by taking the eventual selling price of the final product and deducting the separable processing costs incurred after the split-off point from the selling price. The result is the estimated market value at the split-off point. This estimated value can be used to allocate the joint costs.

Example 12.2

Bambanani (Pty) Ltd produces two products, X and Y, by using a single raw material as input in the manufacturing process. The products cannot be sold after the split-off point unless they undergo further processing.

During October 2015, 150 000 kilograms of the raw material was processed at a joint cost of R900 000. All the units were complete at the end of the month. The following information is relevant to the two products:

	Product X	Product Y
Production (units)	75 000	75 000
Less: Revenue (units)	<u>(60 000)</u>	<u>(45 000)</u>
Closing inventory of finished goods (units)	15 000	30 000
Selling price	R24/unit	R42/unit
Separable costs after split-off point	R8.40	R18.60

The facts can be presented schematically as follows:

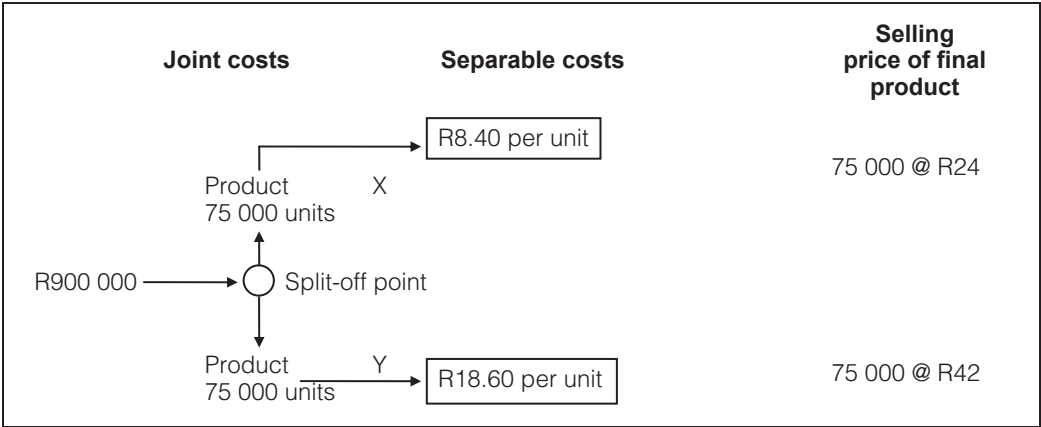


Diagram 12.6

Since no market value is known at the split-off point, it can be estimated as follows:

	Product		Total
	X	Y	
Production volume (units)	75 000	75 000	150 000
	R	R	R
Selling price per unit	24	42	
Total revenue	1 800 000	3 150 000	4 950 000
Less: separable costs	(630 000) ¹	(1 395 000) ²	(2 025 000)
Estimated market value split-off point	1 170 000	1 755 000	2 925 000
Ratio	R1 170 000 R2 925 000 ³	R1 755 000 R2 925 000 ³	
Portion of joint costs	= 40%	= 60%	= 100%
40% × R900 000	360 000		R900 000
60% × R900 000		540 000	

¹ 75 000 × R8.40 = R630 000
² 75 000 × R18.60 = R1 395 000
³ R1 170 000 + R1 755 000 = R2 925 000

continued

Statement of Profit and Loss for October 2015			
	Product		Total
	X R	Y R	R
Revenue (60 000 × R24) (45 000 × R42)	1 440 000	1 890 000	} 3 330 000
Less: Cost of sales:	(792 000)	(1 161 000)	
Joint costs	360 000	540 000	900 000
Separable costs	630 000	1 395 000	2 025 000
	<u>990 000</u>	<u>1 935 000</u>	<u>2 925 000</u>
Less: Closing inventory			
15 000 units × $\frac{R990\,000}{75\,000\text{ units} \times 1}$	(198 000)		} 972 000
30 000 units × $\frac{R1\,935\,000}{75\,000\text{ units} \times 1}$		(774 000)	
Gross profit	<u>648 000</u>	<u>729 000</u>	<u>1 377 000</u>

Reversal cost method

This is an alternative method whereby the joint costs are divided between the various joint products. Although an inaccurate method, it is sometimes found in practice because it is easy to use.

The reversal cost method assumes that the expected profit percentage for some products are known. The percentage can be obtained by drawing a comparison with similar products manufactured by other organisations in the same industry, or by a projected yield rate set as a minimum by management.

If the expected profit percentage is known, the projected net profit for each product can be calculated. With this figure as a basis, the income and costs after separation can be reversed to determine what portion of the joint costs can be absorbed by each product. Thus, it is concerned with what amount each product can absorb, rather than the correct principle of what amount should be allocated to each product. This is illustrated in the following example:

Example 12.3

Boniswa (Pty) Ltd manufactures products A, B and C by using a single raw material as input into the manufacturing process. The following information is available:

	Products		
	A R	B R	C R
Revenue	500 000	30 000	20 000
Costs after split-off	80 000	3 000	2 000
Selling and marketing costs	30 000	2 000	1 000
Opening and closing inventory	—	—	—
Expected profit percentage on revenue		20%	15%
The production costs prior to separation amounted to R200 000			

Required

Prepare a Statement of Profit and Loss by using the reversal cost method.

Solution 12.3

Statement of Profit and Loss

	A R	B R	C R	Total R
Revenue	500 000	30 000	20 000	550 000
Less: Attributable items:	(110 000)	(11 000)	(6 000)	(127 000)
Selling and marketing costs	30 000	2 000	1 000	33 000
Costs after split-up	80 000	3 000	2 000	85 000
Expected profit (% of revenue)		6 000	3 000	9 000
Available income	390 000	19 000	14 000	423 000
Less: Joint costs	(167 000)	(19 000)	(14 000)	(200 000)
Expected profit product A	223 000	–	–	223 000
Total expected profit:				
	R			
Product A	223 000			
Product B	6 000			
Product C	3 000			
	<u>232 000</u>			

COSTING METHODS FOR BY-PRODUCTS

By-products have already been identified as the incidental output of a manufacturing process. Although there are several methods of accounting for by-products, all are variations on the following two methods:

- ☐ A value that corresponds to the net market value of the by-products is allocated to the products. This amount is then used as a reduction of the joint production costs. The net market value of by-products is market value *less* further processing costs (if applicable) *less* administrative costs. This concept is also referred to as 'net realisable value'.
- ☐ No value is allocated to the by-products at the split-off point. The proceeds from the sale of the by-products can be treated in various ways:
 - as a reduction of the joint production costs; or
 - as a separate item in the Statement of Profit and Loss: proceeds of sales of by-products; or
 - as a reduction of the cost of goods sold.

Example 12.4

Suppose that a manufacturer produces two joint products and a by-product from a process and that a typical production run results in the following:

Product	Quantity	Market value at split-off point
X	1 400 units	R40 per unit
Y	600 units	R30 per unit
By-product Z	80 units	R4 per unit

All products are sold after the split-up. The joint costs up to that point are R148 320. The net market value of the by-product is treated as a reduction of the joint costs. The joint costs are allocated according to the market value at split-off point to the joint products.

Calculation of net joint costs:

	R
Total joint costs	148 320
Less: Net realisable value of By-product Z (80 × R4)*	(320)
Net joint costs	<u>148 000</u>

Product	Units	Market value at split-off point	Total market value R	Ratio	Joint costs R	Portion of joint costs R
X	1 400	R40 per unit	56 000	56 ÷ 74	× 148 000	112 000
Y	600	R30 per unit	18 000	18 ÷ 74		36 000
			<u>74 000</u>			<u>148 000</u>

* If no portion of the joint costs is allocated to the by-products, the total joint costs (R148 320 in the previous example) will be allocated to the joint products as if the by-product did not exist.

By-products can be divided into two categories, namely:

- ☐ those that require further processing; and
- ☐ those that can be sold without further processing after separation at the split-off point.

Where no joint costs are allocated to by-products the proceeds from the sale of the by-products are disclosed directly in the Statement of Profit and Loss by means of one of the three methods mentioned above. This is illustrated in the following example:

Example 12.5

The following information is used to show the various ways of dealing with by-products when no joint costs are allocated to them:

	Joint products kg	By-products kg
Production	100 000	40 000
Revenue	96 000	38 000
Closing inventory	<u>4 000</u>	<u>2 000</u>
Selling price	R2 per kg	R0.35 per kg
Cost of further processing (By-product only)		R0.05 per kg
Joint production costs	R90 000	
Marketing and administrative costs	R50 000	
No value is attached to the closing inventory of the by-products.		

Solution 12.5

- 1 Income (net market value) from by-products:
 = Total units sold × (selling price – separable costs)
 = 38 000 × (R0.35 – R0.05)
 = R11 400
- 2 Value of closing inventory of joint products:
 = $\frac{4\,000\text{ kg}}{100\,000\text{ kg}} \times \text{R}90\,000$
 = R3 600

Statement of Profit and Loss

No value allocated to closing inventory of by-products; proceeds from sale treated as:

	1 Reduction of cost of sales	2 Reduction of joint production costs	3 A separate Profit and Loss item
	R	R	R
Revenue:			
Joint products (96 000 × R2)	192 000	192 000	192 000
Add: By-products (Calculation 1)	–	–	11 400
Total revenue	192 000	192 000	203 400
Less: Cost of sales	(75 000)	(75 000)	(86 400)
Joint production costs	90 000	78 600*	90 000
Less: Net proceeds – By-products	(11 400)	–	–
	78 600	78 600	90 000
Less: Closing inventory – Joint products	(3 600)	(3 600)	(3 600)
Gross profit	117 000	117 000	117 000
Less: Marketing and administrative costs	(50 000)	(50 000)	(50 000)
Net profit	67 000	67 000	67 000

* R90 000 – R11 400 = R78 600

BY-PRODUCTS AND WASTE MATERIAL

By-products and waste materials are not always easy to distinguish since both arise from the same manufacturing process. For example, if shirts are cut at a clothes factory, there are always pieces of waste material that might have a minimum market value. However, this is usually so little that there is some doubt as to whether waste material can be referred to as a product. *Any proceeds from the sale of waste material are therefore treated as a reduction of the cost of the main product.*

SUMMARY

Different products sometimes arise as a result of a common manufacturing process or as a result of the use of a common raw material. The different products can be classified as either joint products or by-products. The products with the same grade of importance for the concern are classified as joint products, while the less important ones are classified as by-products. By-products typically are insignificant in quantity and value. They are treated by reducing the total cost of production by the amount of any income from the sales of such by-products.

PERSPECTIVES ON COSTING

Knowledge

You should know:

- ☐ that joint products are common products that make a material contribution to the market value of all the outputs of a manufacturing process;
- ☐ that by-products are products that are incidental to the production of the joint products, and contribute a relatively small amount to the total market value of all the outputs of a process; and
- ☐ the costing methods for joint products include, among others, the physical standard method, the market value at the split-off point, the relative market value of the final product method, and the reversal cost method.

Skills

You should be able to do the following:

- ☐ allocate joint costs according to accepted methods, namely, the physical standard method, the market value at split-off point method, relative market value method, and the reversal cost method; and
- ☐ calculate the net income from joint and by-products.

KEY TERMS AND CONCEPTS

By-products	358	Relative market value of the final product method	360
Joint costs	359	Reversal cost method	360
Joint products	358	Separable costs	359
Physical standard method	360	Split-off point	359

REVIEW PROBLEMS

Problem 12.1

Torsion (Pty) Ltd uses one kind of material to manufacture three different products, namely, A, B and C. During May 2015, joint costs to the amount of R100 000 were incurred. The output from the different products was: A 15 000 kg, B 10 000 kg, and C 25 000 kg. All three products can be sold at the split-off point. The sales prices are: A R2.50 per unit, B R3.00 per unit, and C R2.75 per unit. All units manufactured for the period were sold.

Required

- Allocate the joint costs to every product by using the physical standard method.
- Calculate the gross revenue percentage for each product and in total.

Solution 12.1

Product	Production kg	Ratio	Joint costs R	Amount R	Unit cost R
A	15 000	30%		30 000	2.00
B	10 000	20%		20 000	2.00
C	25 000	50%		50 000	2.00
Total	50 000	100%	100 000	100 000	

	Product A R	Product B R	Product C R	Total R
Revenue (units × unit price)	37 500	30 000	68 750	136 250
Less: Allocated costs	(30 000)	(20 000)	(50 000)	(100 000)
Gross profit	7 500	10 000	18 750	36 250
Gross profit percentage	20%	33.3%	27.3%	26.6%

Problem 12.2

Carltonville Manufacturers (Pty) Ltd use Raw Material One in their production process that eventually delivers Product A and Product B. If 1 000kgs of Raw Material One is used as input, it results in 700kgs of Product A and 300kgs of Product B. Once the products are separated, filtered water is added. The costs in total are as follows:

Raw Material One	R4 per kg of input
Conversion costs	R5 per kg of output
Water	R1 000 in total

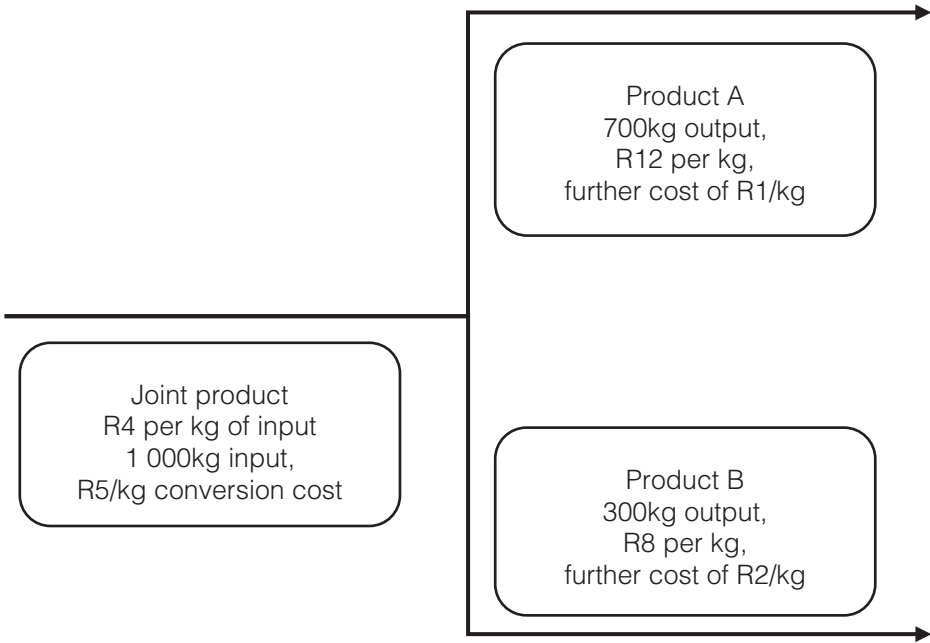
Products A and B incur further processing costs of R1 and R2 respectively. Once the end of the production process is reached, Product A sells for R12 per kg and Product B for R8 per kg.

Required

- Calculate the joint costs per unit using the physical standards method.
- Calculate the joint costs per unit using the relative market value at split off point method.
- Calculate the joint costs per unit using the relative market value of final products method.

Solution 12.2

A joint and by-product question can be confusing; therefore it is advisable to start by drawing the process so that you will have a visual representation of the context given in the question.



(a) Physical standards method

Joint costs incurred:

Raw material	(R4 × 1 000kg) R4 000
Conversion costs	(1 000kg × R5) R5 000
Water	R1 000
Total	R10 000

Product	Kg produced	Proportion	Joint costs	Cost per unit
A	700	70%	R7 000	R10
B	300	30%	R3 000	R10
	1 000	100%	R10 000	

(b) Relative market value at split off point

This method cannot be used as there is no market or market value directly after the products are separated.

(c) Relative market value of finished goods

Using the final selling price and deducting additional conversion costs incurred, one can work back to an estimated market value as at split-off point. This value is then used to allocate the joint costs incurred.

Product	Kg produced	Ultimate selling price less further conversion costs	Relative market value	Proportion	Joint cost allocation	Cost per unit
A	700	$R12 - R1 = R11$	R7 700	81%	R8 100	R11.57
B	300	$R8 - R2 = R6$	R1 800	19%	R1 900	R6.33
	1 000		R9 500	100%	R10 000	

EXERCISES

12.1

Zebra Manufacturers (Pty) Ltd obtain a by-product (shavings) from the manufacturing of two main products, namely, wooden benches, and wooden tables. The manufacturing of the two main products is inseparable because the wood left over after what is required for a table has been cut out of a beam can be used for the manufacturing of benches without wastage.

It is the firm's policy that none of the joint manufacturing costs should be allocated to the by-products, but merely to the main products according to physical measure. It has been found that one table contains the same quantity of material and entails the same conversion work as $1\frac{1}{2}$ benches.

Furthermore, the company follows the policy of not attaching any value to the closing inventory of the by-product and writing off the total costs after split-off of the by-product as a period cost against the income of the by-product. The net income generated by the by-product is shown as other income in the Statement of Profit and Loss.

The following information is available for the previous financial year:

Units completed during the year:

Benches	850
Tables	500

Units sold during the year:

Benches	700
Tables	475
Shavings	1 800 kg

Incomplete units (closing):*

Benches	50
Tables	100

Shavings collected during the year

2 000 kg

Selling price:

Benches	R60 per unit
Tables	R80 per unit
Shavings	R110 per 50 kg

continued

	R
Costs incurred:	
Costs before split-off point:	
Material	30 000
Conversion costs	20 400
Costs after split-off point:	
Conversion costs:	
Benches	8 000
Tables	7 500
Shavings	3 000

* 100% complete in respect of material and 50% complete in respect of conversion costs. No costs have been added after split-off.

Required

Draft a cost statement and Statement of Profit and Loss reflecting the financial results of each product.

12.2

Steeltone Manufacturing Company uses a process costing system. A by-product is obtained out of the primary manufacturing process of the two main products. The contribution generated by the by-product is set off against the cost of sales of the main products. Inventories are valued according to the weighted average method.

The following information for December 2015 is available:

	R
Inventory 1 December 2015:	12 839
Material	7 415
Conversion costs	5 424
Production costs during the month:	
Material	65 114
Conversion costs	50 444
Production for the month (equivalent completed units):	
Main product A	6 900 units
Main product B	5 800 units
By-product	1 100 units
Revenue during the month:	
Main product A	6 200 units @ R14 per unit
Main product B	4 700 units @ R15 per unit
By-product	1 050 units @ R4 per unit

The primary manufacturing costs (costs before separation) are split between the main products according to the physical measuring method.

When an order for the by-product is received it is packed according to a special method and delivered at a cost of R2 per unit.

Required

Prepare a combined Cost Statement and Statement of Profit and Loss for December 2015 which will show the profit/loss for each product separately.

13 Budgets



LEARNING OUTCOMES

What are budgets and what roles do they play in an organisation?

- Define the concept of a budget and budget control
- Explain the functions of budgets and budget control
- Explain the broad aims of budgets and budget control
- Discuss the advantages and disadvantages of budgets and budget control
- Identify important aspects of the preparation of budgets
- List the types of budgets of a manufacturing enterprise

What is zero based budgeting?

- Explain how zero-based budgets work

What are the different responsibility centres in an organisation?

- Explain the three types of responsibility centres

Which costs are managers held accountable for?

- Differentiate between controllable and uncontrollable costs

What are flexed budgets?

- Differentiate between fixed budgets and flexible budgets

How are budgets constructed?

- Compile the master budget from the operating and financial budgets
- Compile a flexible budget by applying both the traditional and activity-based budgeting approaches (ABB)

What measures other than financial, can be used in the planning and controlling of an organisation?

- Explain the use of non-financial measures that can be used in the planning process and to control the functions of an organisation

CHAPTER OUTLINE

An enterprise should coordinate its activities and compile plans for future periods to achieve its long-term strategic objectives. These detailed plans are known as budgets and are discussed and illustrated in this chapter. Enterprises usually control their plans and budgets to ensure that they execute these plans to reach their set goals. Therefore, a budget reflects the short-term actions needed to achieve long-term objectives.

There are many types of budgets, and various methods can be used to construct a budget. This chapter provides a detailed illustration of the budgeting process where a full budget is constructed. The chapter then offers other methods used in different environments to reach the common goal of a budget, namely, planning and control.

Finally, planning and control are not always limited to financial factors, and non-financial factors must be considered. This may be achieved by using tools such as the Balanced Scorecard, which includes financial and non-financial factors.

INTRODUCTION

In modern society, most organisations or entities, be they state, public or private sector, or an individual, use some or other form of budget to manage their finances and assist with the planning function. The goal of most of the entities in the private sector is profit maximisation, and therefore careful planning and effective cost control are essential. Budgets and budget control are among the most important of the management instruments that enable management to fulfil these aims.

Budgets must therefore be designed so that they are helpful to management in the planning, co-ordination, and control of the various functions within the enterprise such as the sales, production, and administration of the entire enterprise.

THE CONCEPTS BUDGET AND BUDGET CONTROL

Describing the concepts 'budget' and 'budget control' more precisely is necessary, since incorrect meanings are often attached to them.

Budgets

A **budget** *can briefly be described as a plan of action for achieving a stated goal.* It is thus the route that must be followed from the current period and situation to a future target.

More scientifically, budgets can be defined as the careful planning of the future performance of all the activities of the enterprise that must be carried out to give substance to the policy of management by attaining a specific goal during a particular period. This plan, expressed in quantitative measurable terms, must be prepared in writing and should be realistic.

From the above definition, a specific goal must, firstly, clearly be set for the enterprise. Secondly, management must clearly spell out plans to achieve this goal.

A comparison between the budgeted and the actual results serves as a basis for evaluating performance and taking corrective steps, if necessary.

Budget control

While the budget indicates the route that must be followed to achieve a specific goal, **budget control** *is the watchdog ensuring that no deviation from the route is unnoticed and that the goal is achieved in good time.*

This is done mainly by measuring, on a continuous basis, the results attained against the budgeted target. It must be determined whether what was planned in the budget can be carried out in practice.

Another important function of budget control is to establish the cause of differences between the planned and actual results, and to take the action necessary to correct or avert the problem in time.

THE FUNCTIONS OF BUDGETS AND BUDGET CONTROL

Briefly, budgets can be viewed as having a planning function and budget control as having a controlling and co-ordinating function. Since budgets and budget control are so closely allied and intertwined, drawing a distinction between them in practice is not always easy. Often it is only a matter of relative emphasis. In the discussion that follows, the common attributes are discussed, with emphasis on what is applicable only to one or the other.

Planning

The **planning function** is a very broad concept. However, it can be *summarised as the proper and scientific planning of how the assets and resources that the enterprise has at its disposal will best be employed so that the greatest advantage is obtained in the short and the long term.* Thus, it embraces a study of what must be done, what is necessary to do it, how it must be done and what the eventual outcome ought to be.

Once a realistic target has been established, the first step is to determine what is necessary to achieve it. The assets and capacity at the disposal of the enterprise must be analysed critically to determine whether they are adequate and satisfactory and whether they will be fully utilised and occupied by the proposed activities.

The employment of raw material and labour must be planned, as must be the administration of the enterprise. Sales strategies must be well thought out. Briefly, every facet and function of the enterprise must be analysed to determine whether the resources and available capacity are employed to the greatest advantage of the enterprise as a whole.

The planning activities must be qualified in physical amounts and monetary values and projections of income and cost must be prepared for the budget period. Eventually, the expected state of affairs as at the end of the period must be incorporated in a budgeted Statement of Financial Position, from which the profitability of the enterprise during the budget period can be inferred.

Although the planning is initially global (say only an expected profit figure as aim), it is refined over time until each aspect is analysed and described in such minute detail that the guideline (not only in quantities but also in monetary values) for future actions, expenditure and income is produced.

Co-ordination

Due to the extent of the planning function and its wide involvement in each facet of the enterprise as a whole, piecing all the underlying aspects together by means of the master plan or master budget is necessary.

Co-ordination implies more than just the piecing together of the underlying or subsidiary budgets (for example, production, sales, and labour budgets); it also incorporates co-ordinating all the activities and production resources of the enterprise as a whole. It is thus a bridging function that involves and unites the subdivisions in one whole. Thus, the inefficiency of the individual, whether a person, division, asset or resource, is kept to a minimum by the synchronisation of all of these separate facets.

Control

As mentioned, **control** takes place mainly *by comparison of the results achieved with those envisaged*. It should be carried out on a continuous basis and any variation should be investigated immediately, the reasons for it established and corrective steps taken. Control leads to further planning.

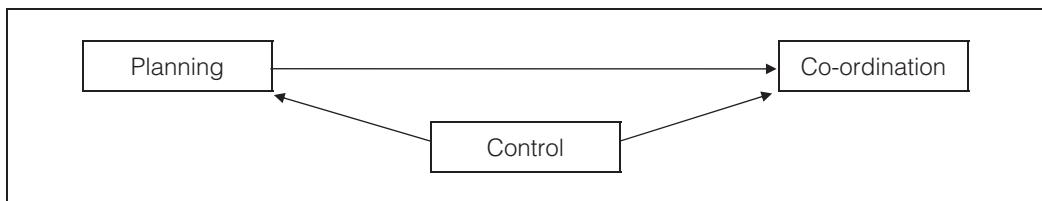


Diagram 13.1

AIMS OF BUDGET CONTROL

Demarcating the responsibility of each person contributing to the budget is absolutely necessary. The broad aims of a system of budgets and budget control are as follows:

- ☐ to focus on the long-term aims of the business;
- ☐ to gather the various ideas of all levels of management in the preparation of the budget;
- ☐ to co-ordinate all the activities of the organisation efficiently;
- ☐ to centralise controls for decentralised activities;
- ☐ to lay a basis for future policy when unforeseen situations affect the budget;
- ☐ to plan costs and income to achieve maximum profits;
- ☐ to use capital expenditure in the most profitable manner;
- ☐ to use production factors in the most economical way;
- ☐ to serve as a standard against which actual results can be compared; and
- ☐ to establish the causes for variances between actual and budgeted results and to advise management to remedy unfavourable deviations or to take advantage of favourable situations.

Budgets and budget control must never be seen as an independent system; on the contrary, they are merely an aid for management in the carrying out of its duties.

ADVANTAGES OF BUDGETS AND BUDGET CONTROL

The advantages of budgets and budget control can be explained as follows:

- ☐ They serve as an aid for achieving the objectives which management has set.
- ☐ Budgets facilitate the establishment of standards if a standard costing system is in use.
- ☐ The costs of the three cost elements in manufacturing are planned and controlled.
- ☐ Budget control leads to effective management principles, and makes the delegation of authority possible.
- ☐ Budgets can determine the relationship between planned profits and planned employment of capital.
- ☐ The occurrence of cost variations exposes the weaknesses in the enterprise.

DISADVANTAGES OF BUDGETS AND BUDGETARY CONTROL

The disadvantages of budgets are, among others, the following:

- ☐ Defining personnel responsibility causes problems due to the overlapping of some duties.
- ☐ Forecasts can never be 100% accurate (the effectiveness of budgets depends on the accuracy of the forecasts).
- ☐ The degree of willingness and co-operation of all the members of management involved in the system determines its success.
- ☐ The budget programme requires additional administrative work and is thus an expensive system to implement.
- ☐ The relaxing of budgets cannot be prevented in total.

The advantages of budgets and budget control clearly outweigh their disadvantages.

IMPORTANT ASPECTS FOR THE PREPARATION OF BUDGETS

The human factor

In a manufacturing enterprise, the emphasis is on people, machines and raw material. Budgets and budget control, which have efficiency and greater productivity as their aim, shine the spotlight on the human factor.

If the personnel understand the purpose of the budgets and are correctly guided and motivated by management to give their wholehearted co-operation to the budget programme, it will be successfully implemented.

Budget period

To understand the budget period, the relationship between the strategic plan (long-term budget) and the budget (short-term budget) must be understood. The strategic plan identifies the desired output, while the budget mainly emphasises the inputs that

are necessary to achieve the desired output. Most strategic plans describe goals, management instructions, and sources that are necessary for the next three to five years or an even longer period. The budget is a plan that indicates how resources in the short term (normally not longer than one year) are procured and used.

The length of the period, which depends on special circumstances, is usually a financial year. For control purposes, the budget period is divided into quarterly or monthly budgets.

The following factors determine the length of the budget period:

- ☐ For enterprises that are subject to seasonal fluctuations, the budget period should cover at least one cycle.
- ☐ The period should be long enough to cover the entire production cycle.
- ☐ As far as possible, the budget period should be linked to the financial period, to facilitate the comparison of the actual results with the budgeted results.

Budget personnel

The budget committee, which usually comprises senior personnel members of the enterprise, is responsible for the preparation and administration of the budget. The committee reviews, discusses and co-ordinates all the budget activities. After the various budgets have been thoroughly reviewed, they are combined into a final budget which is submitted to top management for approval.

Budget factor

In any enterprise certain factors determine the limits of nearly all relevant activities. These factors are not limited to the well-known production factors, but also include factors such as distribution, location, and transport. If material or labour, for example, is not readily available for the manufacture of a product, the production process will be hindered. The availability of capital will determine the production volume because it determines the limit of the operating capital. These scarce factors, collectively described as the budget factor, must be considered in the determination of the entire budget programme.

TYPES OF BUDGETS IN A MANUFACTURING ENTERPRISE

The main or master budget is built up from the operating and financial budgets supported by working papers and analyses of the enterprise's activities for the budgeted periods. The master budget can be presented schematically as follows:

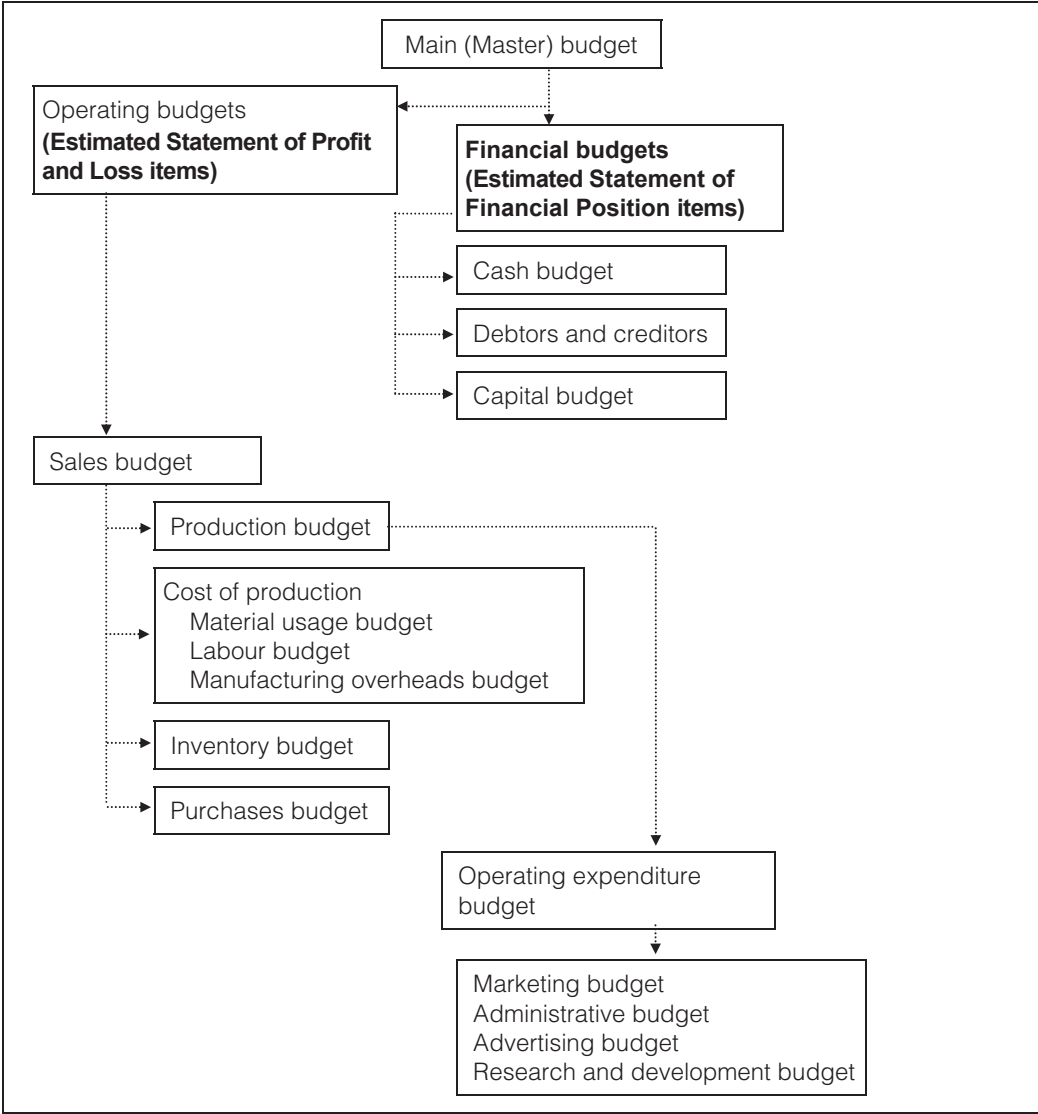


Diagram 13.2

□ Illustrative example

To simplify the discussion of the master budget with its subsidiary budgets, it seems fitting to explain it by means of an example.

Example 13.1 Master budget (Including the different subsidiary budgets)

Natal Company is a manufacturing company also operating a trading division. The following information is available for 2016.

Sales forecast (units):

	January Units	February Units	March Units	April Units	May Units
Product Gim	3 000	4 000	5 000	4 000	4 000
Product Mick	6 000	5 000	5 000	5 000	5 000
Trading goods	R150 000	R200 000	R250 000	R200 000	R200 000

Selling price of manufactured products:

Gim	R50 each
Mick	R65 each

Requirements per unit of finished product:

	Gim	Mick
Material Foe	2 kg	6 kg
Material Fie	4 kg	2 kg
Direct labour	4 hours	6 hours

Material and labour cost information for 2016:

Material Foe	R1 per kg
Material Fie	R2 per kg
Direct labour	R4 per hour

Expected overheads:

Manufacturing overheads:

Variable	R2 per direct labour hour
Fixed	R79 000 per month (including depreciation of R10 000)

Sales and administrative:

Variable	5% of sales (manufacturing only)
Fixed	R40 000 per month (including depreciation of R5 000)

Trial balance as at 31 December 2015:

	Dr R	Cr R
Cash	180 000	
Debtors	373 000	
Inventory on hand:		
Material Foe (40 000 kg × R2)	80 000	
Material Fie (20 000 kg × R4)	80 000	
Product Gim (2 000 × R44)	88 000	
Product Mick (4 000 × R52)	208 000	
Trading inventory	50 000	
Land and buildings	500 000	
Machinery and equipment	650 000	
Accumulated depreciation		320 000
Creditors		270 000
Taxation payable		40 000
Capital		1 000 000
Retained income		579 000
	<u>2 209 000</u>	<u>2 209 000</u>

continued

Additional information

- 1 The company is aiming at keeping its inventory levels at the next month's production and sales requirements (excluding trading inventory).
- 2 The budgeted trading cost of goods sold is 40% of budgeted sales. Closing inventory for January is estimated at R80 000; for February R120 000 and for March R170 000.
- 3 All sales are on credit. About 40% is collected during the month of sale, 50% in the following month and 9% during the second month after the sale. The balance represents bad debts.
- 4 The debtors' balance on 1 January 2016 consists of the following:

	R
November sales	48 500
December sales	324 500
	<u>373 000</u>

- 5 Information in respect of cash payments:
 - (a) Materials as well as trading inventory are paid for in the month after it was purchased.
 - (b) Direct labour is paid during the month in which it arises.
 - (c) Manufacturing, sales, and administrative overheads are spread evenly between the month in which they arise and the following month, in other words, 50% is payable in each month.
 - (d) Income tax for each quarter is supposed to be paid during the month following the end of the quarter.
- 6 The creditors as at 1 January 2016 consist of the following:

	R
Material purchases	120 000
Trading purchases	50 000
Sundry expenses (All manufacturing overheads)	100 000
	<u>270 000</u>

- 7 The income tax rate is 40%.
- 8 The FIFO method of inventory valuation is used. (Take note of the changes in material prices and product costs.)

Required

- (a) Prepare a master budget for the first quarter of 2016 for the enterprise.

In order to compile a master budget, the first step will be to compile a sales budget.

Note: For convenience's sake, during the discussion of a specific budget, all the budgeted information regarding that specific budget (as per the illustrated example) will be repeated.

Sales budget

The sales budget must be a reliable and very accurately forecast because it forms, in most enterprises, the basis of all the budgets. The number of units that can be sold forms the basis of all the budgets and subsidiary budgets, especially if management cannot influence distribution or if the government institutes price control. Once the number of units that may be sold is known, calculating the number of units that must be manufactured is possible. Afterwards, it can be ascertained whether the available production capacity is adequate to manufacture the number of units shown in the production budget.

The sales budget is based on estimated volumes and prices that are in turn based on an analysis of past sales and future market and sales trends and competition.

Because an enterprise makes a profit only if its products are sold, market research plays an important role when things such as seasonal fluctuations, sporadic movements and market potentialities must be taken into consideration.

The sales manager must be very realistic in his preparation of the sales forecast and should take into consideration both internal and external factors. Internal factors are factors such as sales trends, the capacity of the factory, new products, and distribution channels, while external factors include government policy and the buying habits of the public.

When the sales budget is prepared the following factors should be taken into consideration:

- ☐ areas
- ☐ products or groups of similar products
- ☐ salespeople and agents
- ☐ periods
- ☐ types of customers, for example, wholesalers, retailers, and the export trade
- ☐ prices and quality of products.

The sales forecast shows the number of units the enterprise aims to sell during the year. The budget period is often divided into months or quarters.

It is important that the units in the sales budget utilise the capacity of the enterprise optimally.

The number of units shown in the sales forecast is evaluated and then forms the basis for the sales budget. The sales budget is subject to change and the final phase is attained only when it is integrated with the rest of the subsidiary budgets.

In its final phase, the sales budget shows the expected sales, expressed in quantities and monetary values, for the various types of products and areas.

Use the information of **Example 13.1** to assist you, the important information is repeated.

The following sales forecast (units) is available for 2016.

Sales forecast (units):

	January	February	March	April	May
	R	R	R	R	R
Product Gim	3 000	4 000	5 000	4 000	4 000
Product Mick	6 000	5 000	5 000	5 000	5 000
Trading goods	R150 000	R200 000	R250 000	R200 000	R200 000

Selling prices are R50 per unit of product Gim and R65 per unit of product Mick.

Required

- (a) Prepare a sales budget for the first quarter of 2016.
- (b) Prepare an estimated debtors collection report.

Solution 13.1**Table 1: Sales Budget: January – March 2016**

Product	January		February		March	
	Units	R	Units	R	Units	R
Gim	3 000	150 000	4 000	200 000	5 000	250 000
Mick	6 000	390 000	5 000	325 000	5 000	325 000
Trading		150 000		200 000		250 000
		<u>690 000</u>		<u>725 000</u>		<u>825 000</u>

Debtors collection schedule

	Total	January	February	March	Outstand- ing 31 March	Provision for bad debts
	R	R	R	R	R	R
November	48 500	43 650	–	–	–	4 850
December	324 500	270 417	48 675	–	–	5 408
January	690 000	276 000	345 000	62 100	–	6 900
February	725 000	–	290 000	362 500	72 500	–
March	825 000	–	–	330 000	495 000	–
	<u>2 613 000</u>	<u>590 067</u>	<u>683 675</u>	<u>754 600</u>	<u>567 500</u>	<u>17 158</u>

After the sales budget, the production budget is compiled.

Production budget

This budget shows only the number of units that must be manufactured to satisfy the needs of the sales budget. The function of the sales budget is to ensure that sufficient physical inventory is always available to satisfy the expected sales and that inventory is kept at an optimum level.

When planning and preparing the production budget, the production manager prepares for seasonal fluctuations so that a constant production inventory level and a stable labour force can be maintained. In co-operation with his personnel, he prepares production tables that show detailed product specifications of all the products that must be manufactured during the budgeted period.

The ideal is that the sales should fit in with the existing production capacity. If this is not the case and sales exceed the production capacity, additional production factors must be obtained to increase the production correspondingly. If the excess sales are only temporary in nature, the sales can be supplemented from existing inventories. Generally, expanding the production facilities immediately is not possible, and consequently the sales budget must be based on the existing production capacity. The enterprise will be compelled, under these circumstances, to devote itself to the most advantageous production items that provide the greatest contribution per production hour.

The holding of inventories cannot be dispensed with in most enterprises and the estimated number of production units required to satisfy the sales budget is calculated as follows:

$$\begin{aligned}\text{Opening inventory} + \text{production} &= \text{Sales} + \text{closing inventory} \\ \text{Production} &= \text{Closing inventory} + \text{sales} - \text{opening inventory}\end{aligned}$$

Production budget

The following additional production information for 2016 is available:

The company is aiming at keeping its inventory levels at the next month's production and sales requirements.

Table 2: Production budget (units)

	January Units	GIM February Units	March Units
Sales requirements (See Table 1 above)	3 000	4 000	5 000
Required ending inventory (See (1) of question)	4 000	5 000	4 000
Total requirements	7 000	9 000	9 000
Less: Beginning inventory	(2 000) ¹	(4 000)	(5 000)
Required production	5 000	5 000	4 000
		MICK	
Sales requirements	6 000	5 000	5 000
Required ending inventory	5 000	5 000	5 000
Total requirements	11 000	10 000	10 000
Less: Beginning inventory	(4 000) ¹	(5 000)	(5 000)
Required production	7 000	5 000	5 000

¹ Given in the trial balance

Once the enterprise knows how many units to produce (from the production budget), the plant utilisation budget must be compiled.

Plant utilisation budget

This budget shows how the plant availability in the factory will be utilised. All the manufacturing sections complete separate production budgets that show what each department or cost centre can produce at a normal or expected capacity.

The plant utilisation budget is based on the total of all these production budgets. It shows the workload required of each section or machine group to accomplish the total production budget.

This budget is an important aid since it shows the available and utilised plant hours of each cost centre that, for control purposes, can be expressed as a utilisation percentage. Further, it will show whether work must be transferred from one section to another, or machinery must be expanded, or some work must be contracted out.

The plant utilisation budget is valuable since it shows any over- or under-capacity.

Trading purchases budget

Trading companies, in contrast to manufacturing companies, buy and sell completed products, while manufacturing companies buy raw materials and convert these into finished goods and then sell them to wholesalers and retailers.

A trading purchases budget indicates the estimated amount of goods to be purchased for resale during the budget period. The format of this budget is more or less the same as the production budget, but it shows goods to be purchased, and not goods to be manufactured. The information applicable to this budget is as follows:

Trading purchases budget

The following additional trading requirement information for 2016 is available:

Budgeted cost of goods sold is 40% of budgeted sales. The balance as at 31 December 2015 was R50 000. Trading inventory is paid for in the month after it was purchased. Closing inventory for January is estimated to be R80 000; for February R120 000; and for March R170 000.

Required

- Prepare a trading purchases budget for the period January to March 2016.
- Prepare the forecasted disbursements for materials for the period January to March 2016.

Table 3: Trading purchases budget for 2016

	January R	February R	March R
Expected sales	150 000	200 000	50 000
Budgeted cost of goods sold (Sales value × 40%)	60 000	80 000	100 000
Add: Closing inventory	80 000	120 000	170 000
Total needs	140 000	200 000	270 000
Less: Opening inventory	(50 000)	(80 000)	(120 000)
Trading purchases requirements	90 000	120 000	150 000

¹ given in trial balance

Cash disbursements for trading inventory for 2016

	January R	February R	March R
Trading purchases:			
December (Balance on 1 January 2016)	50 000		
January		90 000	
February			120 000
Cash disbursement: Trading inventory	50 000	90 000	120 000

Direct material or raw material budget

The direct material budget shows the estimated quantity and cost of the raw materials required to manufacture the expected quantity of completed or finished goods. Adequate raw materials must be on hand to ensure a constant flow of these to the production process.

It is important that the right sort of material is available at the right place when needed. However, the enterprise must guard against over-investing in inventory, as this will affect its solvency and liquidity.

Some enterprises use standard material specifications to show the quantity of direct material necessary for each job. The specifications include the code number, quantity, and standard value of each type of material necessary for a particular job, and a reasonable provision for wastage and scrap.

When production is not standardised, arbitrary methods must be used to prepare the budget. The direct material budget, which is divided into types and quantities, and expressed in monetary values after provision has been made for the estimated quantities and value of beginning and ending inventories, reflects the value and quantity of raw materials required by the production department for the budgeted period.

Material purchases budget for 2016

The following additional material requirement information for 2016 is available:

	Gim	Mick	R
Material Foe	2 kg	6 kg	R1 per kg
Material Fie	4 kg	2 kg	R2 per kg

Material is paid for in the month after it was purchased. The material creditors at 1 January 2016 were R120 000.

Table 4: Material purchases budget for 2016

	January kg	Material Foe February kg	March kg
Production requirements:			
Gim (2 kg × production units) (See Table 2 above)	10 000	10 000	8 000
Mick (6 kg × production units)	42 000	30 000	30 000
Total (kg)			
Add: Required closing inventory (See (1) in question)	52 000 40 000	40 000 38 000	38 000 38 000
Total requirements (kg)	92 000	78 000	76 000
Less: Opening inventory	(40 000) ¹	(40 000)	(38 000)
Purchase quantity (kg)	52 000	38 000	38 000
Unit cost	R1	R1	R1
Rand value	R52 000	R38 000	R38 000

continued

	kg	Material Fie kg	kg
Production requirements			
Gim (4 kg × production units)	20 000	20 000	16 000
Mick (2 kg × production units)	14 000	10 000	10 000
Total (kg)	34 000	30 000	26 000
Add: Required closing inventory	30 000	26 000	26 000
Total (kg)	64 000	56 000	52 000
Less: Opening inventory	(20 000) ¹	(30 000)	(26 000)
Purchase quantity	44 000	26 000	26 000
Unit costs	R2	R2	R2
Rand value	R88 000	R52 000	R52 000
Total (Foe and Fie)	R140 000	R90 000	R90 000

¹ Given in trial balance

Cash disbursements for materials for 2016

	January R	February R	March R
Material purchases:			
December (Balance on 1 January 2016)	120 000		
January		140 000	
February			90 000
Cash disbursement: Material	120 000	140 000	90 000

Labour budget

Before a labour budget can be prepared, a job analysis that shows the labour requirements per job, per department and for the whole factory must be done.

The determination of the estimated number of hours for the budgeted period is based on the number of units that must be produced. The budgeted number of hours divided by the standard hours per employee gives the standard number of employees required for the period.

When the various labour rates are established, all the factors that can affect the rates must be considered. Finally, the labour budget is made up of the number of labour hours required for each grade of labour multiplied by the standard labour rate.

In its completed form, the labour budget will show:

- ☐ the type and quantity of employees needed to do the various jobs; and
- ☐ the expected costs linked to such labour.

The labour budget represents a forecast of the direct and indirect labour required to satisfy the demand of the production budget.

The monetary values associated with indirect labour are, among others, included in the manufacturing overheads budget and the sales and administration budgets.

Pension fund contributions, medical fund contributions and all other labour-related costs of direct labourers not recovered as part of the direct labour cost, can also be treated as manufacturing overheads.

Table 5: Direct labour budget for 2016

Labour cost information for 2016 is as follows:

Requirements per unit of finished products:

Gim	Mick	Hourly rate
4 hours	6 hours	R4

Direct labour is paid during the month in which it arises.

	January Hours	February Hours	March Hours
Production requirements:			
Gim (4 hours × production) (See Table 2 above)	20 000	20 000	16 000
Mick (6 hours × production)	42 000	30 000	30 000
	<u>62 000</u>	<u>50 000</u>	<u>46 000</u>
Direct labour hours needed	62 000	50 000	46 000
Labour cost per hour	R4	R4	R4
	<u>R248 000</u>	<u>R200 000</u>	<u>R184 000</u>
Total direct labour cost	R248 000	R200 000	R184 000

Cash disbursements for labour for 2016

	January R	February R	March R
Labour purchases:	<u>248 000</u>	<u>200 000</u>	<u>184 000</u>

Manufacturing overheads budget

This budget consists of a summary of the various budgets of all the cost items in the production section that do not fall under direct material or direct labour. Because accounting reports and related information form the basis for budget control, the manufacturing overheads budget must be prepared within the framework of the accounting system.

To facilitate the preparation of the manufacturing overheads budget all the costs must be classified as either fixed or variable. Further, the enterprise must be divided into production and service cost centres, with a person responsible for each centre.

It is important for the figures in this budget to be forecast as accurately as possible, because they serve as a basis for calculating the predetermined overhead rate.

In the manufacturing industry, most enterprises use variable budgets rather than fixed budgets, because fixed costs have an influence on the fixed overheads rate at various operating volumes. When an enterprise uses standard costing along with budget control, the fixed overheads rate is usually based on the normal operating volume for the period.

Table 6: Manufacturing overheads budget for 2016

Manufacturing overheads information for 2016 is as follows:

Expected overheads:

Manufacturing overheads:

Variable R2 per direct labour hour

Fixed R79 000 per month (Including depreciation of R10 000)

Manufacturing overheads are spread evenly between the month in which they arise and the following month; in other words, 50% is payable in each month. Sundry creditors at 1 January 2016 are R100 000 (all manufactory overheads).

	January	February	March
Direct labour hours (See 4 above)	62 000	50 000	46 000
	R	R	R
Variable (R2 per labour hour)	124 000	100 000	92 000
Fixed (given)	79 000	79 000	79 000
Total manufacturing overheads	<u>203 000</u>	<u>179 000</u>	<u>171 000</u>
1 Depreciation of R10 000 per month is still included.			

Cash disbursements for manufacturing overheads for 2016

	January R	February R	March R
Overheads:			
December (opening balance)	100 000		
January (R203 000 – R10 000 depr) over 2 months	96 500	96 500	
February (R179 000 – R10 000 depr) over 2 months		84 500	84 500
March (R171 000 – R10 000 depr) over 2 months			80 500
Cash disbursement: Overheads	<u>196 500</u>	<u>181 000</u>	<u>165 000</u>

Production cost budget

Once the production budget and the separate production costs budgets (material, labour, and overheads) have been prepared, the entire production costs budget is drawn up. It is a summary of the direct material, direct labour and manufacturing overheads budgets of the production plant and is also usually prepared per production department for the period. In order to determine the cost of goods available to be sold, the budgeted beginning inventory of finished goods is included. When the budgeted ending inventory of finished goods is deducted from this amount, the cost of goods manufactured and sold remains.

Ending finished goods inventory budget

The ending finished goods inventory budget is a budget presenting the monetary value of an estimate of unsold finished goods to be recorded on the Statement of

Financial Position at the close of the budgeted period. The ending goods inventory budget supplies information needed for the determination of the amount of the cost of sales on the budgeted Statement of Profit and Loss, and the closing balances of the inventory accounts to be recorded in the Statement of Financial Position. To prepare this budget, unit costs must be calculated using information from Tables 2, 4, 5 and 6.

Table 7: Ending finished goods inventory budget for 2016

	Gim	Mick	Table
Ending inventory 31 March (units)	4 000	5 000	2
	R	R	
Unit cost:	40.00	55.00	
Material Foe (R1 per kg)	2.00	6.00	4
Material Fie (R2 per kg)	8.00	4.00	4
Labour (R4 per hour)	16.00	24.00	5
Overheads [(R2 + R1.50) × hours required]	14.00	21.00	6
Total value	160 000	275 000	

1 Fixed overhead rate for the period $(3 \times R79\,000) \div (62\,000 + 50\,000 + 46\,000) \text{ hours} = R1.50$.

Marketing cost budget

All the expenses such as advertising, transport, storage, insurance, collection costs, and the salaries, bonuses and commissions of the sales staff, are reflected in the marketing budget.

For control purposes, the fixed and variable costs must be kept separate from each other, as with manufacturing overheads.

The marketing budget analyses all the sales and distribution costs for every product or group of products in respect of each sales agent and area to exercise effective control.

Advertising budget

It is important that finished goods are sold as quickly as possible. This is only possible with the aid of an effective advertising campaign. Various methods can be used to determine what amount must be spent on advertising per annum, among others:

- ☐ percentage of sales;
- ☐ a fixed amount per unit; and
- ☐ forecast of expected costs.

The advertising budget is prepared in co-ordination with all the budgets, especially the sales budget.

Administrative budget

This budget does not have a direct connection with the sales and production budget and represents only an estimate of the expenditure concerning the formulation of the policy, the leadership, and the administration of the organisation.

Table 8: Sales and administrative expenses budget

Selling and administrative overheads information for 2016 is as follows:

Expected overheads:

Selling and administrative overheads:

Variable 5% of sales

Fixed R40 000 per month (Including depreciation of R5 000)

Selling and administrative overheads are spread evenly between the month in which they arise and the following month; in other words, 50% is payable in each month.

Expected turnover for 2016			
	January R	February R	March R
Gim	150 000	200 000	250 000
Mick	390 000	325 000	325 000
	<u>540 000</u>	<u>525 000</u>	<u>575 000</u>
Variable (5% of sales)	27 000	26 250	28 750
Fixed	40 000	40 000	40 000
	<u>67 000</u>	<u>66 250</u>	<u>68 750</u>
Note: Depreciation of R5 000 per month is still included.			
Summary			
	January R	February R	March R
Sales and administrative overheads (Tables 6 and 8)	67 000	66 250	68 750
Less: Depreciation (R5 000)	<u>(5 000)</u>	<u>(5 000)</u>	<u>(5 000)</u>
Amount payable in cash	<u>62 000</u>	<u>61 250</u>	<u>63 750</u>

Research and development budget

To stay at the forefront of technological and economic development, it is necessary for an enterprise to have a regulated and orderly research and development budget. Dividing the budget ensures effective control of the different projects to which attention is being given. Expected completion dates must be indicated and progress reports should be presented regularly.

Capital budget

This budget is compiled to provide for new investments in fixed assets – usually land, buildings and/or equipment. The investment in fixed assets is relatively large and must be seen as long-term planning. That is why its evaluation and planning are functions of top management.

The unpredictability of the future makes investment decisions extremely difficult.

The plant utilisation budget will show if the existing equipment is adequate to provide for the needs of the production budget.

The capital budget must be prepared in minute detail, and capital additions must be classified as identifiable projects, each with its own project number.

Since most enterprises have limited financial resources at their disposal, projects requiring capital investment decisions must be weighed up against each other. The time value of money plays an important role and modern techniques like the discounted cash flow method should be used in making the decision.

Cash budget

Adequate liquidity is necessary for the survival of any enterprise. The cash budget provides an estimate of all receipts and payments and the manner and period in which they will be received or employed. This budget is prepared once all the other budgets are complete.

The cash budget usually shows the monthly cash position of the enterprise, but it can be subdivided into weekly or daily periods.

When the cash budget is prepared, attention must be paid to the following aspects:

- ☐ The distinction between cash and credit sales.
- ☐ The credit policy followed for the collection of cash from credit sales, and also discounts allowed to encourage prompt payment and provision for any bad debts.
- ☐ The policy in respect of the payment of creditors.
- ☐ All cash requirements as required by the operating and long-term budgets.

Tables 9, 10 and 11: Cash flow budget for 2016

1 All sales are on credit. About 40% is collected during the month of sale, 50% in the following month and 9% during the second month after the sale. The balance represents bad debts.

2 The debtors' balance on 1 January 2016 consists of the following:

	R
November sales	48 500
December sales	324 500
	<u>373 000</u>

3 Information in respect of cash payments:

- (a) Material is paid for in the month after the month in which it was purchased.
- (b) Direct labour is paid during the month in which it arises.
- (c) Manufacturing, sales and administrative overheads are spread evenly between the month in which they arise and the following month; in other words, 50% is payable in each month.
- (d) Income tax for each quarter is supposed to be paid during the month following the end of the quarter. The income tax rate is 40%. Taxation payable amounts to R40 000.

4 The creditors as at 1 January 2016 consist of the following:

	R
Material purchases	120 000
Trade purchases	50 000
Sundry expenses	100 000
	<u>270 000</u>

Table 9: Debtors collection – Refer Table 1
Cash flow budget for 2016

	Total	January	February	March	Outstand- ing 31 March	Provision for bad debts
	R	R	R	R	R	R
November	48 500	43 650	–	–	–	4 850
December	324 500	270 417	48 675	–	–	5 408
January	690 000	276 000	345 000	62 100	–	6 900
February	725 000	–	290 000	362 500	72 500	–
March	825 000	–	–	330 000	495 000	–
	<u>2 613 000</u>	<u>590 067</u>	<u>683 675</u>	<u>754 600</u>	<u>567 500</u>	<u>17 158</u>

Table 10: Cash payments for 2016

	January	February	March
	R	R	R
Material purchases: (Table 4)			
December	120 000		
January		140 000	
February			90 000
Trading purchases: (Table 3)			
December	50 000		
January		90 000	
February			120 000
Manufacturing overheads: (Table 6)			
December	100 000		
January	96 500	96 500	
February		84 500	84 500
March			80 500
Labour (Table 5)	248 000	200 000	184 000
Sales and administrative expenses: (Table 8)			
January	31 000	31 000	
February		30 625	30 625
March			31 875
Income tax	40 000		
	<u>685 500</u>	<u>672 625</u>	<u>621 500</u>
		R	
Creditors closing balance: 31 March 2016			
Material & trading purchases: March (R90 000 + R120 000)		210 000	
Overheads: March (R80 500 + R31 875)		112 375	
		<u>322 375</u>	

Table 11: Cash flow projection for 2016

	January R	February R	March R
Opening balance	180 000	84 567	95 617
Add: Receipts (See debtors collections above)	590 067	683 675	754 600
	<u>770 067</u>	<u>768 242</u>	<u>850 217</u>
Less: Payments (See cash payments above)	(685 500)	(672 625)	(621 500)
	<u>84 567</u>	<u>95 617</u>	<u>228 717</u>

Budgeted Statement of Profit and Loss

This budget is prepared after the various operating budgets have been drawn up. It includes the sales budget, purchases budget, production budget and expenses budget.

The budgeted Statement of Profit and Loss shows the projected income (profit) according to the estimates for the planned period.

Table 12: Projected Statement of Profit and Loss for the three months until 31 March 2016

	R	Reference to tables
Sales (R690 000 + R725 000 + R825 000)	2 240 000	1
Less: Cost of sales	(1 676 000)	
Raw material:	390 000	
Beginning inventory	160 000	
Add: Purchases (R140 000 + R90 000 + R90 000)	320 000	4
	480 000	
Less: Ending inventory	(90 000)	4
Direct labour (R248 000 + R200 000 + R184 000)	632 000	5
Manufacturing overheads (R203 000 + R179 000 + R171 000)	553 000	6
	<u>1 575 000</u>	
Less: Increase in finished goods inventory	(139 000)	
Ending inventory (R160 000 + R275 000)	435 000	7
Less: Beginning inventory (R88 000 + R208 000)	(296 000)	
Add: Trading cost of sales	240 000	
Beginning inventory	50 000	
Add: Purchases	360 000	
	410 000	
Less: Ending inventory	(170 000)	
Gross profit	<u>564 000</u>	
Less: Sundry expenses	(219 158)	
Sales and administrative (R187 000 + R15 000 depreciation)	202 000	8
Bad debts	17 158	9
Net profit	<u>344 842</u>	

Budgeted Statement of Financial Position

This budget exercises control over the accuracy of all the other budgets. It shows the closing balances of all the assets, liabilities and owners' interests as reflected in the budgets prepared by the different departments. Once the budgeted Statement of Profit and Loss and Statement of Financial Position are complete, the necessary ratios for analysis and interpretation purposes can be calculated.

Table 13: Budgeted Statement of Financial Position as at 31 March 2016

	R	Reference to sub-budgets
Share capital	1 000 000	
Add: Retained income (R579 000 + R344 842)	923 842	12
Shareholder's interest	<u>1 923 842</u>	
Represented by:		
Fixed assets	785 000	
Land and buildings	500 000	
Machinery and equipment	285 000	
Cost price	650 000	
Less: Depreciation (R320 000 + R45 000)	<u>(365 000)</u>	
Net current assets	1 138 842	
Current assets	1 491 217	
Cash	228 717	11
Debtors	567 500	1 & 9
Raw materials	90 000	4
Finished goods (R160 000 + R275 000)	435 000	7
Trading inventory	170 000	
Less: Current liabilities (Creditors) Note 1	<u>(352 375)</u>	10
	<u>1 923 842</u>	
Note 1 Current liabilities as at 31 March 2016:		R
Trading inventory not paid for		150 000
Raw materials not paid for		90 000
Manufacturing costs not paid for		80 500
Sales and administrative overheads		31 875
		<u>352 375</u>

Master budget

Co-ordinating all the budgets into one main budget creates the master budget. It is a combination of all the subsidiary budgets in Tables 1–13. The master budget is management's proposed programme of action for the organisation during the budgeted period.

ZERO-BASED BUDGETING (ZBB)

As the name infers, the **zero-based budget** *is prepared from scratch each year*. It has a dynamic character in that historical figures are not relevant and only estimated data that will be important in the future are taken into consideration. This means that the incremental method of merely making price adjustments to last year's figures to provide for inflation is eliminated and that each year every situation must be budgeted for and accounted for again. Because the zero-based budget is prepared from scratch each year, it requires a document (also called a decision packet) which identifies each function or activity to enable management to evaluate the necessity of this activity and to determine its position on the priority scale of the budget.

The general opinion of the zero-based budget is that each manager must prepare an alternative budget for each activity within his area of responsibility, and these are integrated into a decision packet. As an example, an alternative method can include the following:

- ☐ What will happen if an activity is eliminated?
- ☐ What will happen if the budget is cut by a certain amount?
- ☐ What will be achieved with the existing budget if more money is provided?

Every alternative effort represents a separate decision level, and the rankings thereof take place with the assistance of a cost-advantage analysis. From the discussion of this topic it can be implied that zero-based budgets should rather be installed in enterprises without a profit motive. This system will also not be useful to enterprises that use standard costing systems.

RESPONSIBILITY ACCOUNTING AND COST CONTROL

Responsibility accounting *is an internal communication system that supplies accounting information for management, planning and control purposes to each responsibility centre or section in the enterprise*. The system can also be used to evaluate performance. To achieve this authority must be delegated from the highest level to the different supervisors. The system must be reasonable; it must motivate the employees to achieve the goals of the enterprise while furnishing adequate information to top management so that each responsible person's performance can be evaluated.

Responsibility centres

A **responsibility centre** *is a defined unit or units of an enterprise for which the manager is responsible for the activities, cost and possibly also the profit and investments*. The implementation of responsibility accounting requires the division of the enterprise into responsibility centres where performance can be controlled and evaluated effectively. These centres are:

- ☐ cost centres;
- ☐ profit centres; and
- ☐ investment centres.

Cost centres

A **cost centre** represents a section or segment of an enterprise where managers are responsible for the costs that originate there. Cost centres are discussed in chapter 3. All costs that originate directly from the cost centre are identified with the supervisor or manager responsible for control over such cost centres. These costs are known as controllable costs and must be kept separate from non-controllable costs, which are allocated from other sections.

Profit centres

Profit centres are where managers are held responsible for the control of costs and income. A profit centre can consist of different cost centres, each of which has its own supervisor who is responsible to the manager in control of the profit centre.

Where a section markets its production mainly to another section in the enterprise such selling prices are known as transfer prices. Net income serves as a measure for evaluating the performance of a manager in a special profit centre. It also includes ratios such as net income to turnover, gross profit to turnover and the inventory turnover ratio.

Investment centres

In these **investment centres** it is the responsibility of the manager to control not only the income and costs, but also all investments. Returns on amounts invested are the usual measures for effective control.

This unit focuses on cost control and cost centre levels.

Responsibility budgets

As the period budgeted for progresses it is the duty of the managers of the responsibility centres to compare the actual information with the budgeted information. Differences must be analysed and, if controllable factors cause them, corrective steps must be taken. One of the aims of the budget process is to ensure that the enterprise as a whole earns a satisfactory return on capital. To achieve this, an effective system of planning and control is necessary for each centre in the enterprise.

Responsibility reports are indispensable for responsibility budgets as they show all the variances between budgeted and actual figures. Favourable and also unfavourable variances must be analysed further. The type of item that is analysed will determine how often responsibility reports must be presented.

Controllable and uncontrollable costs

It would be unfair to expect that a manager be held accountable for costs over which he/she has no control. **Uncontrollable costs** are all costs that a manager cannot control directly. Allocated head office overhead and depreciation charges are examples of uncontrollable costs. The ideal would be for responsibility accounting to exclude all uncontrollable costs from a manager's performance report or separate such costs from the controllable costs.

Controllable costs are all costs that the manager can influence directly and he or she should be held accountable for only those costs.

Reporting

A **cost report** is a report that provides suitable cost information at the appropriate level of responsibility. Normally the actual and budgeted information per cost item are compared with each other and the difference is known as the variance. Some enterprises differentiate between the controllable and uncontrollable costs on the cost report. Cost reports may be provided at monthly, weekly, or even daily intervals.

An example of performance reports is as follows (Note the different types of information management levels are provided with):

Example 13.2

Performance reports to cost centres

(a) Report to supervisor – drilling

	Month			Year to date		
	Actual	Budget	Variance	Actual	Budget	Variance
	R	R	R	R	R	R
Direct materials	29 250	28 000	(1 250)	89 350	92 400	3 050
Direct labour	19 250	20 000	750	56 200	62 000	5 800
Indirect labour	3 600	3 800	200	13 200	11 400	(1 800)
Consumables	6 150	6 000	(150)	25 200	19 800	(5 400)
Electricity	2 200	2 000	(200)	7 800	6 000	(1 800)
Small tools	1 410	1 100	(310)	5 200	3 300	(1 900)
Total	61 860	60 900	(960)	196 950	194 900	(2 050)

(b) Report to factory manager – Factory 1

Controllable costs:

Drilling	61 860	60 900	(960)	196 950	194 900	(2 050)
Grinding	35 210	35 700	490	111 110	110 000	(1 110)
Cutting	58 030	51 700	(6 330)	161 380	150 800	(10 580)
Assembly	48 610	45 000	(3 610)	135 480	132 160	(3 320)
	203 710	193 300	(10 410)	604 920	587 860	(17 060)

Uncontrollable costs:

Head office allocation	11 000	11 000	–	33 000	33 000	–
Depreciation	23 120	22 000	(1 120)	67 120	66 000	(1 120)
Total	237 830	226 300	(11 530)	705 040	686 860	(18 180)

(c) Report to managing director

Factory 1	237 830	226 300	(11 530)	705 040	686 860	(18 180)
Factory 2	231 710	227 900	(3 810)	701 880	701 880	14 720
Factory 3	290 130	301 110	10 980	897 160	907 000	9 840
Administration	76 030	67 120	(8 910)	214 390	195 150	(19 240)
Sales office	45 140	40 000	(5 140)	133 520	120 000	(13 520)
	880 840	862 430	(18 410)	2 637 270	2 610 890	(26 380)

The brackets indicate unfavourable variances.

A cost report is an instrument used by managers to identify activities that are not going according to plan so that timely action can be taken to solve the problem.

FLEXIBLE BUDGETING

The budgets discussed thus far have had a fixed character because a fixed amount is predetermined for each cost item. In a manufacturing enterprise where the volume of business fluctuates continuously, it is important that a variable budget is used.

As the name suggests, a *variable budget* is one that restates the position if a variation from the expected volume occurred on which the fixed budget is based. It usually consists of a number of budgets prepared for various volumes of business.

A disadvantage of fixed budgets is that they are not adjusted for changes in activity levels. Using a flexible budget can solve this problem. A **flexible budget** is a budget calculating budgeted revenue and costs based on the actual level of output achieved.

Flexible budgets are also useful during the controlling process since they provide budget variance information after comparing actual and budgeted results. This approach is based on cost behaviour. The budget formula is as follows:

- $y = a + bx$, where
- y = total cost
- a = total fixed cost for the period
- b = variable cost per unit
- x = activity level for the period

Example 13.3 illustrates some flexible budgets at output levels of 9 000, 10 000 and 11 000 units.

Example 13.3				
Cost item	Welding department Budget formula ($y = a + bx$)	Activity levels (units)		
		9 000	10 000	11 000
		R	R	R
Direct labour	R5 per unit	45 000	50 000	55 000
Direct material	R4 per unit	36 000	40 000	44 000
Indirect labour	R60 000 + R2 per unit	78 000	80 000	82 000
Indirect material	R1 per unit	9 000	10 000	11 000
Energy	R10 000 + R2 per unit	28 000	30 000	32 000
Maintenance	R8 000 + R1 per unit	17 000	18 000	19 000
Depreciation	R10 000	10 000	10 000	10 000
Miscellaneous	R 6 000	6 000	6 000	6 000
		<u>229 000</u>	<u>244 000</u>	<u>259 000</u>

The actual activity levels can be compared to the budget that is based on the same activity levels. Assume 9 000 units are manufactured:

Example 13.4				
	Actual (9 000 units) R	Budget (9 000 units) R	Variance R	
Controllable costs	221 000	213 000	8 000	A
Direct labour	48 000	45 000	3 000	A
Direct material	35 000	36 000	1 000	F
Indirect labour	76 000	78 000	2 000	F
Indirect material	10 000	9 000	1 000	A
Energy	33 000	28 000	5 000	A
Maintenance	19 000	17 000	2 000	A
Uncontrollable costs	16 100	16 000	100	A
Miscellaneous	6 100	6 000	100	A
Depreciation	10 000	10 000		–
Total costs	237 100	229 000	8 100	A

A = adverse variance; F = favourable variance

A **variance** is the difference between the budgeted cost and the actual expense. Variances are attributable to one of two causes. The first is the difference between budgeted costs of inputs and actual expense, which is known as the *price variance*. The second is the difference between estimated inputs and actual inputs used to produce the actual output, which is known as the **efficiency variance**. The variance between the flexible budget and the fixed budget is attributable to differences in volume and is known as the **volume variance**. Variance analysis will be discussed in detail in the following chapter.

ACTIVITY-BASED BUDGETING (ABB)

The traditional costing systems are not really suitable for controlling fixed costs because supporters of it assume that production volume causes all costs. **Activity-based budgeting** is developed to manage fixed costs better. The supporters of ABB assume that activities cause costs and that products consume activities. Costs consumed by significant activities can be reported on and controlled more effectively. The aim of ABB is to control cost drivers directly rather than costs. By doing so, the costs will be managed in the long term.

Example 13.5 illustrates ABB as follows:

Example 13.5		Welding department		
Cost item	Budget formula ($y = a + bx$)	Activity levels (units)		
		9 000	10 000	11 000
		R	R	R
Direct cost:				
Direct labour	R5 per unit	45 000	50 000	55 000
Direct material	R4 per unit	36 000	40 000	44 000
Consumables	R1 per unit	9 000	10 000	11 000
Sub-total		<u>90 000</u>	<u>100 000</u>	<u>110 000</u>
Cost driver:				
labour hours		7 000 hrs	8 000 hrs	9 000 hrs
		R	R	R
Indirect labour	R11 per hour	<u>77 000</u>	<u>88 000</u>	<u>99 000</u>
Sub-total		<u>77 000</u>	<u>88 000</u>	<u>99 000</u>
Cost driver:				
Machine hours		1 400 hrs	1 500 hrs	1 600 hrs
		R	R	R
Energy	R20 per machine hour	28 000	30 000	32 000
Maintenance	R3 000 + R10 per hour	<u>17 000</u>	<u>18 000</u>	<u>19 000</u>
Sub-total		<u>45 000</u>	<u>48 000</u>	<u>51 000</u>
Cost driver: Set-ups		30 set-ups	35 set-ups	40 set-ups
		R	R	R
Set-ups	R333.33 per batch	10 000	11 667	13 333
Inspection	R3 000 + R100 per batch	<u>6 000</u>	<u>6 500</u>	<u>7 000</u>
Sub-total		<u>16 000</u>	<u>18 167</u>	<u>20 333</u>
Total		<u>228 000</u>	<u>254 167</u>	<u>280 333</u>

NON-FINANCIAL PERFORMANCE INDICATORS

Enterprises have a variety of goals and objectives. It is unlikely that a single financial measure will effectively assess all of those goals and objectives. A primary goal is usually to be financial solvent. Because solvency is determined by the relationship between cash inflows and cash outflows, cash flow is often used as a performance measure. Some measurement of income is usually added to gain clarity on the performance.

Financial measures are used generally; however, they do not address some of the new issues of competitive reality essential to business survival in a global economy. Many enterprises use established goals relative to customer satisfaction rates, product defect rates and, lead-time to market. Such goals are not measured directly by income.

The quality of service delivered by an enterprise is important, and needs to be measurable.

Enterprises producing inferior goods, responsible for tardy delivering or abusing the environment will eventually lose market share and insolvency will be reached. Non-financial performance measures are important to measure the performance of the enterprise on all terrains. (Refer to chapter 15 for a more in-depth discussion of the Balanced Scorecard.)

The **Balanced Scorecard**, a performance report, combines financial and non-financial critical success factors in the following four areas: Financial performance, customer satisfaction, internal business process performance and innovation and learning performance. An action plan to achieve competitive success by focusing management's attention to critical success factors (CSFs) can diagrammatically be expressed as follows:

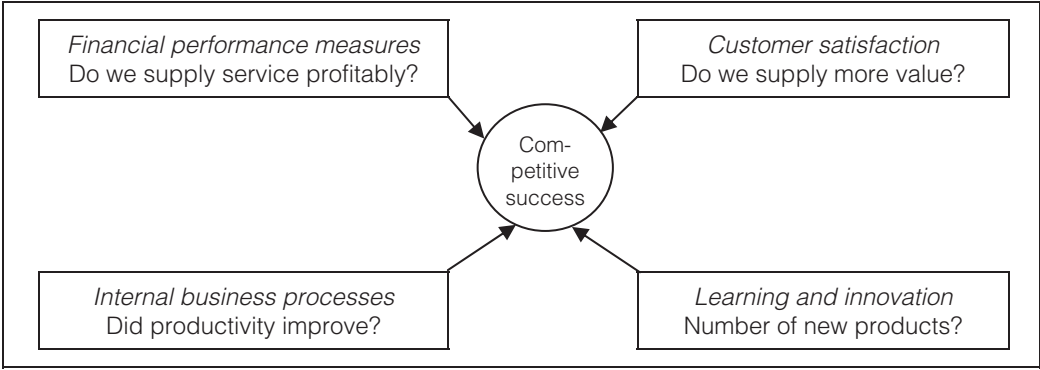


Diagram 13.3

When deciding on performance measured, the following steps should be adhered to:

Step 1: The performance measures should be consistent with the enterprise's strategies. For example, if the enterprise's strategy concerns continual improvement, the information system should record and report concise quantitative information to indicate the success of the improvement.

Step 2: The scorecard should not have too many or too few performance measures. Having too many measures may lead to a clumsy system that would be difficult to manage and may also cause confusion as to the achievement of some targets. Too few performance measures may result in the underachievement of some important goals of the enterprise.

While the enterprise as a whole will have the overall Balanced Scorecard, each organisational segment will have its own items that can be influenced by each specific segment. The following table lists some critical success factors (CSFs) and ways in which they might be measured:

Example 13.6

Critical success factor	Performance measure	Change
	<i>Financial performance</i>	
Profitability	Earnings per division, earnings trend	–
Liquidity	Trend in cash flow, receivable turnover, asset turnover, inventory turnover	+
Sales	Sales trend, Sales variances, sales from new products	–
Market value	Share price	+
	<i>Customer satisfaction</i>	
Customer satisfaction	Customer complaints, product returns, market survey	+
Dealer and distributor	Customer growth	+
Marketing and selling	Sales performance, marketing costs to sales ratio	–
Deliveries on time	Delivery cycle time (customer order to delivery of goods)	+
Quality	Customer complaints, warranty expenses	–
	<i>Internal business processes</i>	
Quality	Scrap amount, reworks, number of returns	+
Productivity	Throughput time (production until goods are delivered), labour efficiency, machine efficiency	+
Flexibility	Set-up time, throughput time	+
Equipment readiness	Downtime, breakdown maintenance hours, tabled maintenance hours	–
Safety	Number of accidents, safety awards	+
	<i>Learning and innovation</i>	
Product innovation	Number of design changes, number of new products or services	–
Time of new product	Time from approving of the project to the launching date	–
Skill development	Training hours, learning curve ratio	–
Employee morale	Employee turnover, number of complaints	+
Competence	Training hours, employee turnover rate	+

Some concepts relating to Internal Business Process Performance

Reducing the delivery cycle time may give an enterprise a key competitive advantage and it may be necessary for survival. Thus, many enterprises would include this performance measure on their balanced scorecard. **Delivery cycle time** is the amount of time from the moment an order is placed by a customer to when the completed order is dispatched. Delivery cycle time is therefore a key concern, taking the customer's need for efficiency into consideration.

Throughput time, or manufacturing cycle time, is the rate at which a manufacturing plant converts raw materials into completed goods. The relationship between the

delivery cycle time and the throughput (manufacturing cycle) time may be illustrated as follows:

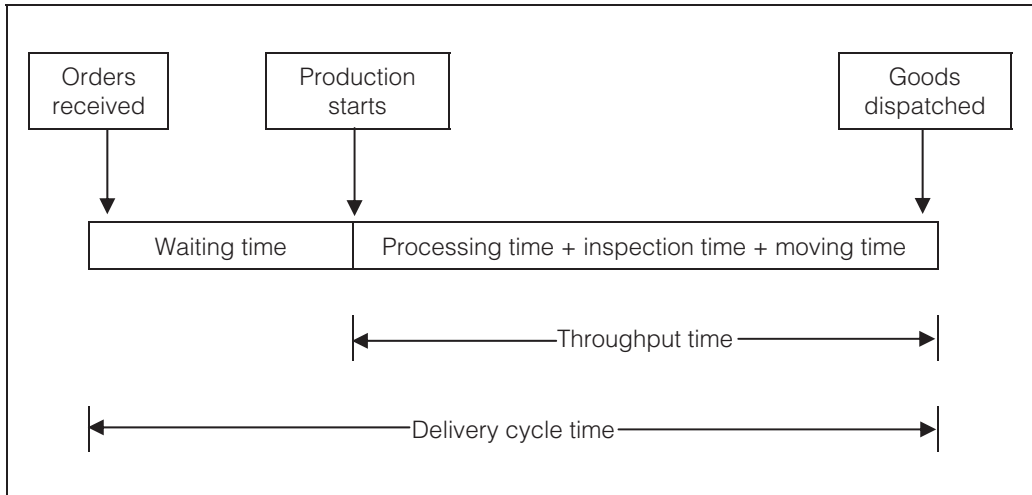


Diagram 13.4

Only processing time adds value to products, while the others are regarded as non-value-added activities, and should be reduced as far as possible.

Throughput time consists of processing time, inspection time, moving time, and waiting time. **Processing time** is the time taken to convert raw materials into finished goods. **Inspection time** is the time taken to perform quality control. **Moving time** is the time taken to move materials or work in progress from process to process. **Waiting time or a bottleneck** occurs when capacity is not sufficient at a given moment when products are kept aside before being worked on, moved, inspected, or stored before delivery.

By determined efforts to reduce time spent on the non-value-added activities of inspecting, moving, and waiting, some enterprises managed to reduce their throughput time significantly. Throughput time is considered to be a key measure in delivery performance. By relating the value-added time to the throughput time, the manufacturing cycle efficiency (MCE) can be calculated. The formula for MCE is as follows:

$$\text{MCE} = \frac{\text{Value-added time}}{\text{Throughput time}}$$

There is non-value-added time present in a production process when the MCE is less than 100%. For example, an MCE of 50% would mean that half of total production time consists of non-value-added activities. Enterprises are able to reduce non-value-added activities by monitoring the MCE, and as a result, deliver products to customers faster and more economically. The following example illustrates measuring internal business process performances:

Example 13.7

Focus (Pty) Ltd keeps time-related records of orders and production. The following average times were recorded for each production batch (one batch includes 100 products):

	Time
Process time	5 hours
Moving time	1 hour
Inspection time	1 hour
Waiting time	2 hours

Required

- (a) Calculate the throughput time.
- (b) Calculate the manufacturing cycle efficiency (MCE).
- (c) Calculate the percentage of the non-value-added activities included in the throughput time.
- (d) Calculate the delivery cycle time.

Solution 13.7

$$\begin{aligned}
 \text{(a) Throughput time} &= \text{Processing time} + \text{inspection time} + \text{moving time} \\
 &= 5 \text{ hours} + 2 \text{ hours} + 1 \text{ hour} \\
 &= 8 \text{ hours}
 \end{aligned}$$

$$\begin{aligned}
 \text{(b) MCE} &= \frac{\text{Value-added time}}{\text{Throughput time}} \\
 &= \frac{5 \text{ hours}}{8 \text{ hours}} \\
 &= 0.625
 \end{aligned}$$

Only 62.5% of the time units spent in the factory are physically being spent on work.

- (c) The remainder of the activities in the factory are considered as non-value-added time activities and = 37.5% (100% – 62.5%).

$$\begin{aligned}
 \text{(d) Delivery cycle time} &= \text{Waiting time} + \text{throughput time} \\
 &= 2 \text{ hours} + 8 \text{ hours} \\
 &= 10 \text{ hours}
 \end{aligned}$$

SUMMARY

Budgeting with care is essential for reaching organisational goals. Budgets can be viewed as having a planning function, and budget control as having a controlling and co-ordinating function.

Important aspects of the preparation of budgets include, among others, a human factor, budget period, budget personnel and budget factor. The master budget is drawn up from the operating and financial budgets, supported by working papers and analyses of the enterprise's activities for the budgeted periods.

Responsibility accounting is the gathering and reporting of information used to control operations and evaluate performance. The three types of responsibility centres are cost centres, profit centres and investment centres.

Controllable costs are costs that the manager can influence significantly, while uncontrollable costs are costs over which the manager has little or no control. Different amounts and information are reported to various levels of management.

PERSPECTIVES ON COSTING

Knowledge

You should know the following:

- ☐ the functions of budgets and budget control include planning, co-ordination, and control;
- ☐ the advantages and disadvantages of using budgets for control purposes;
- ☐ the important aspects of the preparation of budgets include the human factor, budget period, budget personnel, and budget factor;
- ☐ the main or master budget includes the operational financial budgets;
- ☐ the sales budget must be reliable and very accurate since it forms the basis of all budgets;
- ☐ the differences between controllable and uncontrollable costs;
- ☐ that flexible budgets adjust for changes in activity levels;
- ☐ that Activity-Based Budgeting (ABB) is developed to manage fixed costs better, by directly controlling cost drivers, rather than costs; and
- ☐ that the balanced scorecard (BSC) is a business model of business performance evaluation that balances the measures of financial performance, customer satisfaction, internal business processes, learning, and innovation.

Skills

You should be able to do:

- ☐ analyse data and prepare fixed operational budgets, such as the sales budget, production budget, material budget, labour budget and manufacturing overhead budget;
- ☐ analyse data and prepare cash budgets;
- ☐ analyse data and prepare fixed and flexible operational budgets;
- ☐ analyse data and prepare activity-based budgets;
- ☐ compile a performance report; and
- ☐ compile a BSC business model.

KEY TERMS AND CONCEPTS

Activity-based budgeting	400	Cost report	398
Budget control	375	Delivery cycle time	403
Budgets	374	Efficiency variance	400
Control	376	Flexible budget	399
Controllable costs	397	Inspection time	404
Co-ordination	376	Investment centre	397
Cost centre	397	Moving time	404

continued

Planning function	375	Throughput time	404
Processing time	404	Uncontrollable costs	396
Profit centre	397	Variance	400
Responsibility accounting	396	Volume variance	400
Responsibility centre	396	Waiting time	404
The Balanced Scorecard	402	Zero-based budgets	396

REVIEW PROBLEMS

Problem 13.1

Cash budget

The management of Budgets Ltd prepared a cash budget for May and June 2015. The following information is available:

	Actual			Budgeted	
	February R	March R	April R	May R	June R
Sales:					
Cash	250 600	290 500	305 700	300 000	320 000
Credit	410 500	500 500	585 800	580 000	600 000
Purchases	595 400	685 700	700 800	690 000	710 000
Salaries and wages	65 800	65 800	65 800	65 800	65 800
Sundry expenses	18 700	19 400	25 400	20 500	21 500

Additional Information

- Cash in respect of credit sales is collected as follows:
50% within 30 days
30% within 60 days
15% within 90 days
5% is uncollectible.
- The following discounts are allowed on sales:
10% on cash sales
5% on credit sales if accounts are settled within 30 days.
- All salaries, wages and expenses are paid in cash.
- Sundry expenses include depreciation of R3 000 per month.
- Sixty percent (60%) of all purchases are on credit and are paid during the month that follows the month of transaction.
- On 30 June a dividend of R5 000 was declared.
- The cash in the bank on 30 April 2015 was R15 500.

Required

Prepare a cash budget for the period 1 May to 30 June 2015.

Solution 13.1

Cash budget for May and June 2015:

	May R	June R
Beginning balance	15 500	(4 300)
Estimated receipts:	759 980	814 315
Cash sales after discount	270 000	288 000
Credit sales	489 980	526 315
Total cash available	775 480	810 015
Estimated expenses:	779 780	782 300
Credit purchases	420 480	414 000
Cash purchases	276 000	284 000
Salaries and wages	65 800	65 800
Sundry expenses (less depreciation)	17 500	18 500
Closing balance	(4 300)	27 715

(1) Calculation of receipts in respect of credit sales:

	May R	June R
February (15% × R410 500)	61 575	–
March (30%/15% × R500 500)	150 150	75 075
April (50% – 5%/30% × R585 800)	278 255 ¹	175 740
May (50% × R580 000) – 5%	–	275 500
June	–	–
Total	489 980	526 315

1 R585 800 × 50% less 5% discount

(2) Calculation of expenses in respect of purchases:

	April R	May R	June R
Cash 40%	280 320	276 000	284 000
Credit 60%	420 480	414 000	426 000
Total	700 800	690 000	710 000

Problem 13.2

The following information is available:

	Formula
Variable costs:	
Direct material	R10 per unit
Direct labour	R5 per unit
Consumables	R1 per unit
Indirect labour	R2 per unit
Semi-variable costs:	
Electricity	R1 000 + R2 per unit
Telephone	R1 000 + R1 per unit
Fixed costs:	
Rent	R6 000
Depreciation	R3 000
Insurance on machinery	R1 000
Property taxes	R1 000

Required

Compile flexible budgets for activity levels of 6 000, 7 500 and 9 000 units.

Solution 13.2

Fitting department

	Formula	6 000 units R	7 500 units R	9 000 units R
Variable costs:				
Direct material	R10 per unit	60 000	75 000	90 000
Direct labour	R5 per unit	30 000	37 500	45 000
Consumables	R1 per unit	6 000	7 500	9 000
Indirect labour	R2 per unit	12 000	15 000	18 000
Semi-variable costs:				
Electricity	R1 000 + R2 per unit	13 000	16 000	19 000
Telephone	R1 000 + R1 per unit	7 000	8 500	10 000
Fixed costs:				
Rent	R6 000	6 000	6 000	6 000
Depreciation	R3 000	3 000	3 000	3 000
Insurance on machinery	R1 000	1 000	1 000	1 000
Property taxes	R1 000	1 000	1 000	1 000
Total costs		139 000	170 500	202 000

EXERCISES

13.1 Operational budget

Bee-Gee Ltd made the following forecasts for the financial year ending 30 June 2016:

Finished goods (completed products)

Estimated sales			Inventory on hand	
Finished Product	Units	Unit price R	Beginning inventory	Ending inventory
OM	22 000	150	8 000	11 000
DOM	40 000	160	10 000	12 000
KROM	30 000	220	9 000	8 000

Raw materials

Inventory on hand			Composition of finished products		
Unit price R	Beginning inventory Units	Ending inventory Units	OM Units	DOM Units	KROM Units
X 10	6 000	5 000	1	—	4
Y 8	15 000	12 000	3	2	5
Z 11	8 000	13 000	6	8	1

Direct labour

Finished products	Number of hours	Labour rate R
OM	3	8,00
DOM	6	4,50
KROM	8	9,50

Additional information

- Budgeted manufacturing overheads amount to R2 362 800 in total.
- Overheads are allocated to production on the basis of direct labour costs.

Required

Draft the following for the year ended 30 June 2016:

- Sales budget
- Production budget (units)
- Direct material purchases budget
- Direct labour budget
- Manufacturing overheads budget
- Completed goods budget
- Cost of sales budget.

13.2 A projected Statement of Profit and Loss and Statement of Financial Position

The following is an abridged Statement of Financial Position of Manufacturers Ltd on 31 December 2015:

Statement of Financial Position on 31 December 2015	
	R
Ordinary shares of R1 each	210 000
Retained income	47 000
	<u>257 000</u>
Fixed assets	130 000
Land and buildings	80 000
Machinery	50 000
Net current assets	127 000
Current assets	174 000
Inventory on hand	80 000
Debtors	80 000
Bank	14 000
Less: Current liabilities	(47 000)
Creditors	32 000
Provision for dividends	15 000
	<u>257 000</u>

Additional information

- 1 An analysis of costs reveals the following:

	R
Direct material	192 000
Direct labour	96 000
Variable overheads	48 000
Fixed overheads	104 000

- 2 Gross income amounted to R40 000.
- 3 Budgeted sales for 2016 are as follows:

	First quarter	Second quarter	Third quarter	Fourth quarter
	R	R	R	R
Sales	100 000	110 000	120 000	125 000

- 4 It is estimated that, as in the past, fixed costs will remain the same, while variable costs will vary in the same ratio to sales.
- 5 Fixed costs include depreciation of 10% on machinery. The original cost price of the machinery is R80 000.
- 6 The dividend will be paid during June 2016.

- 7 The company plans extensions to the factory to the value of R30 000. The contractor will be paid an amount of R10 000 monthly until the work is completed on 31 December 2016. No depreciation will be written off on the new extension until the work has been completed.
- 8 Experience has shown the amount due to creditors is usually equal to two months' purchases of direct materials, while inventory and debtors should remain equal to the value of two months' sales.

Required

Draft the following:

- (a) A budgeted Statement of Profit and Loss for each quarter of 2016 in columnar form.
- (b) A budgeted Statement of Financial Position on 31 December 2016.

13.3 Operational and financial budgets

The abridged Statement of Financial Position of a manufacturing company on 31 December 2015 is as follows:

Statement of Financial Position on 31 December 2015					
	R		Cost R	Deprecia- tion R	Balance R
Share capital	320 000				
Retained income	26 000	Land and buildings	200 000	–	200 000
Creditors	6 000	Machinery	100 000	40 000	60 000
Provision for taxation	20 000	Furniture	20 000	8 000	12 000
		Vehicles	50 000	10 000	40 000
			<u>370 000</u>	<u>58 000</u>	312 000
		Inventory			23 000
		Raw material A			5 000
		Raw material B			2 000
		Completed goods			16 000
		Debtors			30 000
		Bank			7 000
	<u>372 000</u>				<u>372 000</u>

The following details are planned for 2016:

Only a single product is manufactured and the composition of it according to standard is as follows:

				R
Material	A	2 kg @ R2.50	=	5.00
	B	4 litre @ R0.50	=	2.00
Labour		2 hrs @ R3.00	=	6.00
Overheads		2 hrs @ R1.50	=	3.00
Total				<u>16.00</u>

Estimated sales 11 000 items @ R20 each	
Desired ending inventory: Raw material A	6 000
Raw material B	3 000
Work in progress	–
Completed goods	25 600
Selling costs	4 400
Administration costs	10 000

Provision for depreciation is calculated as follows:

- Machinery 10% on cost
- Furniture 5% on cost
- Vehicles 10% on cost

Company tax 50%

The credit period granted by suppliers and the delay in payment of debtors can be taken as one month.

Required

- (a) Sales budget
- (b) Production budget (units)
- (c) Purchases budget
- (d) Cost of sales budget
- (e) Completed goods budget
- (f) Budgeted Statement of Profit and Loss
- (g) Cash flow budget
- (h) Budgeted Statement of Financial Position

13.4 Cash budget

The following items were extracted from the trial balance of Quickthink Ltd on 30 November 2015:

	R
Bank (favourable)	2 000
Debtors	40 000
Inventory on hand	24 000
Creditors	18 000

The following analysis is available:

	Sales	Selling and administrative costs	Salaries and wages
	R	R	R
October 2015 (actual)	30 000	9 000	5 000
November 2015 (actual)	40 000	10 000	6 000
December 2015 (estimated)	50 000	11 000	7 000
January 2016 (estimated)	30 000	9 000	5 500
February 2016 (estimated)	35 000	9 500	4 500

The enterprise encourages debtors to pay invoices within two weeks of sales by granting a cash discount of 4%. Debtors are expected to settle their accounts as follows:

- ☐ 60% within the period in which discount is granted
- ☐ 20% within 30 days after the goods have been sold
- ☐ 15% within 60 days after the goods have been sold
- ☐ 5% irrecoverable

Creditors are paid as follows for purchases:

- ☐ 50% on delivery
- ☐ The balance 30 days after the invoice.

Ending inventory is calculated as follows:

- ☐ Six hundred (600) units plus 40% of the sales estimated for the following month (units).

Salaries and wages and selling and administration costs are paid in the month incurred. Fixed selling and administration costs, including depreciation amounting to R2 000 per month, amount to R6 000 per month. The remainder varies directly in relation to sales. Inventory is purchased at R15 per unit and sold at a profit of 33⅓% on cost.

Required

Draft a cash budget for December 2015 and January 2015.

13.5 Cash budget

Cashflow Ltd decided to draft a cash budget for three months, namely, March, April and May 2015.

The following information is available:

- 1 Favourable bank balance on 1 March 2015 – R10 000.
- 2 Sales before taking any discounts in respect of credit sales into account:

	Total R	Cash R	Credit R
December 2014 (actual)	20 000	12 000	8 000
January 2015 (actual)	22 000	13 000	9 000
February 2015 (actual)	26 000	14 000	12 000
March 2015 (budgeted)	27 000	15 000	12 000
April 2015 (budgeted)	24 000	14 000	10 000
May 2015 (budgeted)	23 000	12 000	11 000

- 3 To encourage prospective buyers, the following discounts on sales are granted:
 - ☐ 10% on cash sales
 - ☐ 5% on credit sales if accounts are settled within 30 days
- 4 Debtors are expected to settle their accounts as follows:
 - ☐ 65% within 30 days after the goods have been sold
 - ☐ 25% within 60 days after the goods have been sold
 - ☐ 8% within 90 days after the goods have been sold
 - ☐ 2% irrecoverable

- 5 Creditors are paid as follows for purchases:
☐ 60% on delivery
☐ 40% 30 days after date of invoice
- 6 Delays in payment of overhead costs and selling and administration costs average one month.
- 7 Because wages are paid on specific days, you can assume that only $\frac{3}{4}$ of one month's budgeted wages are paid in that month and the remainder in the following month.
- 8 On 31 March 2015, furniture was sold for R200, resulting in a loss of R50. Payment was received on 31 May.
- 9 The production records in respect of finished goods show the following:

	Actual February R	March R	Budgeted April R	May R
Beginning inventory	7 000	10 000	9 000	8 000
Production:				
Material	10 000	8 000	7 000	7 500
Labour	8 000	6 000	5 000	4 000
Overheads	4 000	3 000	2 500	2 000
	<u>29 000</u>	<u>27 000</u>	<u>23 500</u>	<u>21 500</u>
Less: Ending inventory	(10 000)	(9 000)	(8 000)	(7 000)
Cost of sales	<u>19 000</u>	<u>18 000</u>	<u>15 500</u>	<u>14 500</u>

Required

- (a) Draft a cash budget for March, April, and May 2015.
- (b) Calculate the amount of outstanding debtors on 31 May 2015 before bad debts have been written off.

13.6 Cash budget, budgeted Statement of Profit and Loss and Statement of Financial Position

The management of Planning Ltd supply you with the following information:

- 1 Actual and budgeted sales:

	R
July 2015	160 000
August 2015	180 000
September 2015	200 000
October 2015	210 000
November 2015	190 000
December 2015	180 000

2 An abridged Statement of Financial Position on 30 September 2015:

	R
Shareholder's equity	322 500
Fixed assets	100 000
Net current assets	222 500
Current assets	342 500
Inventory	120 000
Debtors	220 500
Bank	2 000
Less: Current liabilities	(120 000)
Creditors	120 000
Capital employed	322 500

- 3 Rent and insurance amounts to R120 000 per annum, payable monthly.
- 4 Variable selling and administration expenses are estimated at 20% of sales. It is payable during the month of sale.
- 5 The gross profit percentage is 40% on sales.
- 6 Depreciation on fixed assets amounts to R14 400 per annum.
- 7 Cash sales are estimated at 10% of total sales. Debtors are expected to settle their accounts as follows:
 - ☐ 75% within the first month of sale
 - ☐ 25% within two months of sale.
- 8 The purchases for each month are based on the sales of the following month, whereas creditors are paid in the month after sales.

Required

Compile the following:

- (a) A monthly cash budget for October, November, and December 2015 in columnar form.
- (b) A budgeted Statement of Profit and Loss for the three months ending on 31 December 2015.
- (c) A Statement of Financial Position sheet on 31 December 2015.

13.7 Operational and financial budgets

The following represents an abridged Statement of Financial Position of Sak and As Ltd on December 2015.

	R
Share capital – ordinary shares	229 000
Retained income	35 000
Creditors	12 000
Provision for taxation	10 000
	<u>286 000</u>

continued

	R
Land and buildings	150 000
Machinery:	60 000
At cost	100 000
Accumulated depreciation	40 000
Furniture and fittings:	14 000
At cost	30 000
Accumulated depreciation	16 000
Inventory	42 575
Raw material O	9 900
Raw material P	7 200
Finished Products – As	13 400
Finished Products – Sak	12 075
Debtors	11 000
Bank	8 425
	<u>286 000</u>

The following details are planned for 2016:

- 1 Two types of products, namely, product AS and product SAK, are to be manufactured. The standard composition of each is as follows:

Finished product AS

		R
Raw material O	5 units @	2.20 each
Raw material P	4 units @	3.60 each
Direct labour	12 units @	5.05 per hour
Manufacturing overheads	12 hours @	4.00 per hour

Finished product SAK

		R
Raw material O	11 units @	2.20 each
Raw material P	6 units @	3.60 each
Direct labour	14 hours @	5.05 per hour
Manufacturing overheads	14 hours @	4.00 per hour

- 2 Expected sales:

Product AS	8 000 units @	R150 each
Product SAK	2 000 units @	R210 each

- 3 Inventory on hand:

	Opening inventory Units	Expected closing inventory Units
Product AS	100	110
Product SAK	70	80
Raw material O	4 500	5 000
Raw material P	2 000	3 000

- 4 The budgeted manufacturing overheads, after being classified as fixed and variable, are as follows:

	R
Fixed	150 000
Variable	347 040
Total	<u>497 040</u>

- 5 The following cash flow items are budgeted for the year:

	R
Sales	1 619 000
Goods purchased	310 000
Sundry costs	430 000
Wages and salaries	677 000
Selling and administration expenses	150 000
Receiver of Revenue	10 000

- 6 Provision for depreciation as in the past:

Machinery	10% on cost price
Furniture and fittings	5% on cost price

- 7 Company tax 45%

Required

Draft the following budgets for 2016:

- (a) Sales budget
- (b) Production budget (units)
- (c) Direct material usage budget
- (d) Direct material purchases budget
- (e) Direct labour budget
- (f) Ending inventory budget
- (g) Cost of sales budget
- (h) Budgeted Statement of Profit and Loss
- (i) Cash budget
- (j) Budgeted Statement of Financial Position.

13.8 Operational and financial budgets

The SA Company uses the following information to compile the annual budget:

- 1 Statement of financial position at 30 June 2015.

	R
Cash	72 000
Debtors	225 000
Net fixed assets	240 000

continued

	R
Inventory:	
Direct material	287 640
Work in progress	145 000
Finished goods	441 000
Share capital	600 000
Retained earnings	648 640
Creditors	162 000

2 Basis for compiling the budget:

	Units
(a) Quarterly sales forecasts:	
3rd Quarter 2015	15 000
4th Quarter 2015	12 000
1st Quarter 2016	12 000
(b) Selling price per unit	R125.00
(c) Inventory holding policy:	
Finished goods – 30% of the following quarter’s requirements should be on hand at the end of each quarter.	
Direct material – 40% of the following quarter’s requirements should be on hand at the end of each quarter.	

(d) Manufacturing costs (per unit)	R
Direct material	51
2 kg material A	36
1 kg material B	15
Direct labour (2 hours)	24
Overheads	23
Variable (based on direct labour hours)	16
Fixed (based on normal monthly activity of 5 000 units)	7

- (e) Administrative and marketing costs:
- | | |
|----------------|---------------------|
| Advertising | R12 000 per quarter |
| Commission | R6.25 per unit |
| Administrative | R90 000 per quarter |
- (f) Cash payment policy:
- All direct materials are purchased on credit. 65% of these purchases are paid for during the quarter of acquisition and the remainder is paid for in the following quarter. All other payments are made when the obligation is incurred.
- (g) History of debt collection:
- 25% of sales are for cash and the remainder on credit. 50% of all credit sales are paid for during the month of sale and the remainder during the month following the month of sale. (Assume that the monthly sales within each quarter are equal.)

(h) Additional information:

- (i) Prices, costs, and the production process remain the same.
- (ii) Income tax rate: 50%.
- (iii) Depreciation is provided for at 20% per annum according to the reducing balance method and is included in the fixed manufacturing overheads.
- (iv) The company plans to buy and install new equipment to the amount of R10 000 at the end of September 2015.
- (v) Work in progress remains the same throughout the year.
- (vi) Variances in production cost are written off against the cost of sales, while inventories are always valued at standard cost.

Required

Draw up the following budgets:

- (a) Sales budget (3rd and 4th quarter)
- (b) Production budget in units (3rd and 4th quarter)
- (c) Material purchase budget (3rd quarter)
- (d) Cash budget (3rd quarter)

Draw up (i) a projected Statement of Profit and Loss for the third quarter and (ii) a budgeted Statement of Financial Position as at 30 September 2015.

13.9 Flexible budgets, production sector

Govender Ltd is a manufacturer of radios. The managing director has become aware of the disadvantages of fixed budgets and asks you to prepare a flexible budget for the next accounting period. The following actual information for 2015 is available:

Radios manufactured and sold	4 000 units
	R
Direct material	80 000
Direct labour	60 000
Fixed manufacturing overheads	40 000
Fixed marketing and administrative costs	80 000
Variable marketing costs	8 per unit
Average selling price per radio	75 per unit

No beginning or ending inventory is expected.

A 33⅓% increase in the selling price is expected in the next accounting period. Variable marketing expenses of R8 per unit are paid to salespersons. Royalties of R5 per radio are paid to the previous owner. Expected increases for the following accounting period are as follows:

Direct material – price increase	10%
Salary increase – indirect labour	R12 000
Salary increase – sales manager	R15 000
Direct labour	no change

Required

Prepare a flexible budget for 2016 at output levels of 5 000 units, 6 000 units and 7 000 units. Show all calculations.

13.10 Flexible budget, service sector, variance reporting

RDP Ltd arranges low-cost financing for prospective homeowners who have a job. RDP charges 1% of the loan amount it arranges.

During 2014 the average loan per customer was R60 000 and in 2015 the average loan amount was R70 000. RDP Ltd assumes an average loan of R75 000 for 2016. Budgeted cost information per loan application for 2016 is as follows:

- Professional fees per application: 6 labour hours at R120 per hour.
- Administrative cost per application R300.
- Verification of credit worthiness: R100 per application.
- Mailing services: R50 per application.
- Fixed overheads were budgeted at R30 000 per month for 2016.

Actual loan applications for May 2016 were 100. Other actual information is as follows:

- Consultation fees: 7.2 hours per loan at R125 per hour.
- Administrative cost per application: R100.
- Verification check for credit worthiness: R75 per application.
- Postal services: R40 per application.
- Other overheads were R27 500.
- Average loan amount was R80 000.

RDP receives 1% on all loans.

Required

- (a) Prepare a fixed budget for May 2016 assuming 90 loan applications.
- (b) Prepare a variance report for RDP for May 2016.

13.11 Activity-based budgeting, reporting

XYZ Ltd is using an ABC approach to costing and budgeting. The following fixed budget information for the Production Department is available:

	Fixed R	Formula Variable	Activity level 10 000 units R
Direct cost:			
Direct material		R10 per unit	100 000
Direct labour		R8 per unit	80 000
Indirect material		R2 per unit	20 000
Sub-total			<u>200 000</u>

continued

Cost driver: Machine hours

			Activity level 8 000 machine hours R
Maintenance	20 000	R5 per machine hour	60 000
Energy	15 000	R2 per machine hour	31 000
Sub-total			<u>91 000</u>

Cost driver: Number of batches

			Activity level 25 batches R
Set-ups	80 000	R800 per batch	20 000
Inspections		R2 000 per batch	130 000
Sub-total			<u>150 000</u>

Cost driver: Number of orders

			Activity level 120 orders R
Receiving	6 000	R200 per order	30 000
Total			<u>471 000</u>

The actual activities for 2015 were:

Actual production	20 000 units
Actual machine hours	16 000 hours
Actual batches processed	30 batches
Actual number of orders	150 orders

Actual costs for 2015 were as follows:

	R
Direct materials	204 000
Direct labour	158 000
Supplies	44 000
Maintenance	114 000
Energy	39 000
Set-ups	27 000
Inspections	154 000
Receiving	31 000

Required

- Compile a flexible budget based on the actual activities achieved during the period.
- Compile a cost report for the production department.

14 Standard costing



LEARNING OUTCOMES

What is a standard cost?

- Explain the objectives and characteristics of a standard costing system
- Calculate and apply a standard cost
- Discuss the advantages of a standard costing system
- Implement a standard costing system

How is a material variance calculated?

- Explain the working of material standards
- Distinguish between price and quantity standards
- Calculate the sub-variances in respect of material, including the mix and yield variance
- Record material costs and variances in the ledger accounts

How is a labour variance calculated?

- Explain the working of labour standards
- Distinguish between labour rate and efficiency variances
- Calculate the sub-variances in respect of labour, including the mix and yield variance
- Record labour costs and variances in the ledger accounts

How is a manufacturing overhead variance calculated?

- Explain the working of overhead standards
- Distinguish between fixed and variable overhead variations
- Calculate the different overhead variances
- Record overheads and overhead variations in the financial records

How is a sales variance calculated?

Can the standard costing system be used for accounting?

- Explain the logic behind sales standards
- Calculate the different sales variances
- Record transactions and variances in the financial records where a standard costing system is used

CHAPTER OUTLINE

Standard costing is a system developed to assist management in accounting for transactions throughout the year and exercising control over an entity. Standard prices and quantities are decided upon by management, generally during the beginning of a financial year when the budgets are set up. Transactions throughout the year are then recorded at these standard prices and quantities. When the end of the financial year (or any period under consideration) has been reached, the actual prices incurred and quantities used are compared to those decided upon during the beginning of the year, that is, during the budgeting process. Any differences identified between actual and standard is called a variance. Should a variance be large enough or concerning to management in some way, then the variance can be investigated to identify and correct the cause of the variance.

Standard costing is most easily applied in a manufacturing environment; however, it is very suitable for any type of goods or service industry. Generally speaking, four broad categories exist where variances can be calculated: material, labour, manufacturing overheads, and sales. Each variance is calculated in total, but can be split into its price and quantity components. It is possible to calculate a more advanced variance, such as the mix and yield variance, which forms part of the quantity variances, especially where more sophisticated products are made, and services are delivered.

A standard costing system integrates with the accounting system of an enterprise. Before variances can be calculated at the end of a period, it will be necessary to flex the budget, that is, to replace budgeted quantities with actual quantities. The results of this are that actual results are compared to a budget built upon actual production and not a target production set at the beginning of the year. The budgeted flexed profit is then reconciled with the actual profit achieved for the period under review. The variances that exist between price and quantity make up the reconciliation items.

INTRODUCTION

Today all sectors of industry are characterised by fierce competition, technological innovation and ever-escalating manufacturing and marketing costs. Only companies which are effectively managed can succeed. Accurately costing products and managing costs down is essential to achieve this.

The cost of manufacturing a product or providing a service can be calculated in two ways, namely, before a job is begun (pre-calculated) or after a job is completed

(post-calculated). The latter method, known as the historical cost method, has the following limitations:

- ☐ The use of historical costs is limited when measure performance in the enterprise or to bring about any cost savings.
- ☐ At the time that historical costs are first known it is already too late to take corrective steps to counter inefficiency.
- ☐ Historical costs do not give an employee any incentive or motivation to improve his productivity.
- ☐ Historical costs are of little importance to management with regard to planning, control and decision-making.

The limitations of historical costing gave rise to the development of pre-calculated methods. In addition, the acceptance and use of predetermined recovery tariffs for overheads in the determination of product costs logically gave rise to the development of standards for direct material and direct labour.

Overheads recovery tariffs represent a predetermined rate based on an estimated cost and a normal level of business activity. The use of these rates makes it possible to value production when the actual historical costs are not known.

In contrast to actual rates, normal (pre-calculated) rates reflect the expected cost at a certain level of business activity and not the actual costs at the level of activity achieved.

Standard costs correspond, in many respects, with predetermined normal overheads recovery tariffs – they indicate norms or standards of what costs should be.

Standard costs are *the costs of the efficient employment of production resources under current business circumstances by a reasonably competent management.*

Standard costing is a system whereby a comparison is drawn between:

- ☐ what should have been done at standard cost; and
- ☐ what was done at actual cost.

AIMS

The purpose of a system of standard costing is to furnish relevant information to management in good time by means of cost reports. This information should immediately show which cost centres or departments are functioning inefficiently, thus enabling management to concentrate on those areas where large differences between actual information and established standards arise.

Standard costing improves cost control in the enterprise by:

- ☐ establishing standards for each cost element;
- ☐ determining actual costs for each cost element;
- ☐ comparing actual costs with standard costs and determining the differences (variances); and
- ☐ analysing the variances and facilitating measures to correct them where these are necessary.

CHARACTERISTICS OF STANDARD COSTING

Because standards are often confused with budgets, the characteristics of standard costing are best highlighted when the two systems are compared to each other.

Budget control has to do with the comparison of the actual results with the budgeted results of all the facets of the enterprise for a given period. Standard costing controls only the cost aspect of the production and distribution of products. Budgets establish the maximum permissible costs while the minimum allowable costs are established by standard costing. If a standard costing system is already in use, it facilitates the preparation of such budgets, while a budget control system is of great help in controlling costs. One system can function without the other, but it is a fact that one system supplements the other.

THE USES OF STANDARDS AND STANDARD COSTS

Standard costing is generally applied in enterprises which manufacture homogeneous products. It can also be used successfully in enterprises doing piecework (jobs).

Briefly, standard costs are used in the manufacturing process as follows:

Cost control

Standards enable management to draw periodic comparisons between actual and standard costs to measure efficiency.

Stock valuation

If stocks are valued at standard cost, it is easy to convert them to actual cost for Statement of Financial Position purposes.

Planning for budget purposes

The standard costing system facilitates the preparation of the production and the cost and sales budget in its entirety.

The fixing of prices

In general, there is a close connection between the selling price and the unit cost of a product. Standard unit costs enable management to achieve the best combination of prices and volumes for a given period.

The keeping of records

Whenever a standard costing system is used together with actual costs, the detailed keeping of records can be reduced, for example, stock registers will only have to show quantities.

THE CLASSIFICATION OF STANDARDS

Before standards can be established, it is necessary to decide at which level of business activity the budgets and standards are going to be based. There is no fixed rule as to the level of business activity that management should use in the standard costing

system. In addition, more than one basis can be used in the establishment of a standard for a single cost element (for example, labour hours and machine hours). If standard hours are chosen as a basis, it represents the amount of work that should be completed in an hour.

There are four different methods for setting the standard level of business activity within an enterprise:

Expected actual level of business activity

This is *the level of business activity actually expected for the budgeted period based on the prevailing conditions*.

Basic level of business activity

This is *the level of activity that was set in the past and against which the expected and actual performance can be compared*. This method is especially important for statistical purposes.

Ideal or theoretical level of business activity

As the name indicates, *this level of activity is achieved only if all the conditions are ideal*. Naturally this method is impractical, since the conditions can never all be ideal.

Normal level of business activity

This is *the level of business activity that can be achieved with efficient performance under prevailing conditions*. It represents an average figure which aims to absorb and cover total costs, considering economic and seasonal conditions. This level is especially suited to establishing a standard for manufacturing overheads.

ADVANTAGES OF STANDARD COSTING

- ☐ Standard costs serve as a yardstick against which actual costs can be measured.
- ☐ The analysis of variations necessitates consistent control over the entire production process. Standard costing might give rise to cost reduction programmes, since it draws attention to aspects which are not being controlled efficiently.
- ☐ The use of standard costs reduces clerical work, since the value and quantities of the cost elements of each completed product that must be manufactured are already available on a standard cost card and production orders need only be recorded on standard forms.
- ☐ The analysis of cost reports by management is simpler and takes less time.
- ☐ With standard costing greater control is exercised over costs. The object is always to improve work performance and have more efficient material usage. It has everything going for it in that the entire enterprise becomes cost conscious.
- ☐ If a standard costing system is introduced it makes the task of valuing raw materials, half-complete products and completed products easier.
- ☐ When standards are first established, they may serve as a stimulus to further planning which will lead to greater efficiency.

THE IMPLEMENTATION OF A STANDARD COSTING SYSTEM

Before a standard costing system is introduced it is necessary to pay attention to the following aspects:

- ☐ the division of production departments into cost centres in order to get greater efficiency and responsibility;
- ☐ the classification of accounts so that they make provision for actual costs, standard costs and variations;
- ☐ the level of business activity that will be used as a basis for determining standard costs; and
- ☐ the establishment of standard quantities, standard times and costs for each cost element.

In order to establish costing standards for each cost element, there must be a standard cost card for each product manufactured or service provided. This cost card shows the following:

- ☐ standard quantities and standard prices of each raw material;
- ☐ standard labour rate and standard hours;
- ☐ standard variable manufacturing overheads;
- ☐ standard fixed manufacturing overheads; and
- ☐ total standard costs allowed, according to the standard, to manufacture a completed product.

It is essential that all possible factors which could exercise any influence are taken into consideration when standards are established, since they must be set with the greatest degree of accuracy possible.

As soon as any changes arise as a result of, for example, economic factors, standards must be adapted accordingly, since it is senseless to work with outdated standards. The success of a standard costing system lies in the standards being as accurate and reliable as possible.

In the next four sections the variances between the different elements are discussed in the light of Diagram 14.1:

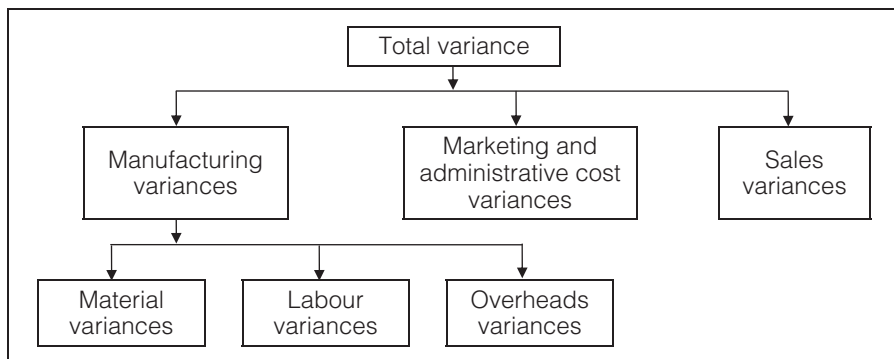


Diagram 14.1

An important principle to grasp in standard costing calculations is the notion of 'flexed budgets'. As previously discussed in the budgeting chapter, it is essential to update the budget, that is, 'flex' it with the actual quantity produced, prior to commencing with the variance calculations. The reason for this is simply because it allows for accurate comparison between the budget and actual results for a specified accounting period.

Consider the situation where a company manufactured more product than it budgeted for. If all other variables remained the same, it would have used a higher quantity of materials than budgeted for. It would be incorrect to calculate an unfavourable variance on the quantity because it is logical that the company would have used more material.

Comparing a flexed budget with the actual results will provide the total variances for each line item. It is these total variances that are broken down into price and quantity variances for further analysis.

Most variances can therefore be summarised as follows:

Price variance:

$$(\text{Actual price} \times \text{Actual quantity}) - (\text{Standard price} \times \text{Actual quantity})$$

Quantity variance:

$$(\text{Standard price} \times \text{Actual quantity}) - (\text{Standard price} \times \text{Standard quantity})$$

MATERIAL STANDARDS AND VARIANCES

Standard specifications must be prepared for the establishment of standard material quantities according to size, mass, or any other yardstick. Sometimes these specifications are simple in nature, but often, if the product in question is complex, the specifications will be intricate. In most cases the business will have knowledge and experience about the composition of its products and will be able to state upfront what the material specification will be. Attention must be paid to quantities, prices, rates, quality and grades, and provision must be made for, among others, normal scrap, losses, wastage, and breakages.

Thus, when standards are established, there will be a price and quantity standard for material. The purchasing division establishes the standard prices for material in conjunction with the factory accountant. Market factors, suppliers' quotations and optimum purchase quantities must be taken into consideration. The prices are usually based on historical, current, and expected future prices.

The standard material quantity specifications serve as a basis for the determination of the standard quantities required to manufacture one unit of each completed product.

If the actual quantity of material used and the costs incurred differ from the standard quantity and costs allowed, this is known as a variance or variation.

With regard to material two main variances can occur. These relate to the:

- ☐ price of the material; and
- ☐ quantity of material used.

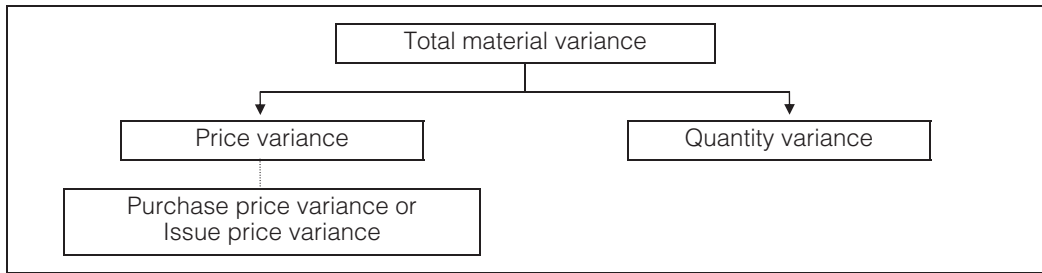
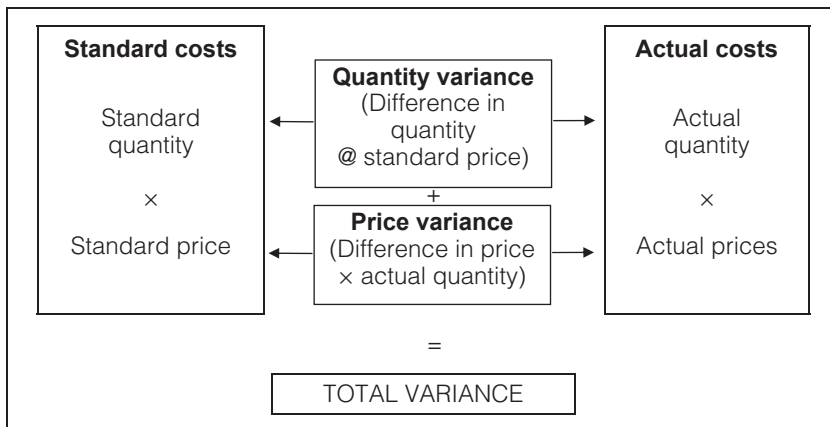
**Diagram 14.2**

Diagram 14.3 provides a clear illustration of the use and determination of the two main variances in respect of material.

**Diagram 14.3**

MATERIAL PRICE VARIANCE

The material price variance can be calculated by means of one of the following two methods:

- ☐ purchase price variance, based on the number of units purchased, or
- ☐ issue price variance, based on the number of units issued and used.

Purchase price variance

The variance is determined when material is purchased and received and occurs whenever the actual price differs from the standard price. The variance is calculated by taking the difference between the actual cost of the amount purchased and the standard cost (amount purchased × standard price) thereof.

Formula: $(AP \times AQ) - (SP \times AQ)$, or $(AP - SP) \times AQ$

where: AP = actual price
 SP = standard price
 AQ = actual quantity purchased

Issue price variance

This variance is determined when the raw materials are issued. It is the difference between the actual quantity issued at actual cost and the actual quantity issued at the standard price. The formula is:

Formula: $(AP \times AQ) - (SP \times AQ)$, or $(AP - SP) \times AQ$
 where: AQ = actual quantity issued

The purchase price variance usually is of greater value, since it is known at the time that the goods are received.

By far the most commonly used variance is the purchase price variance, which results in less complication when recording the journal entries for material. The issue price variance is only calculated on material *actually issued* to production, ignoring the stock remaining in storage. Therefore, the variance is incomplete and additional adjustments would have to be made to account for the variance remaining in unissued materials. If a question is silent on the issue, it can be assumed that the purchase price variance is needed.

Material price variances can be attributed to:

- ☐ faulty standards (mistakes made when establishing the standard prices); and/or
- ☐ price increases or reductions as a result of unforeseen changes in market prices, good/poor conditions in the purchase department, incorrect calculation of discounts and delivery costs, or bad timing of purchases.

MATERIAL QUANTITY VARIANCE

The material quantity variance is also sometimes known as the usage, efficiency, or volume variance.

This variance is calculated by taking the difference between the actual amount of material used at the standard price and the standard quantity of material allowed at the standard price. The concept 'standard quantity of material allowed' means the standard quantity allowed for the actual production and is calculated as follows:

Suppose 5 kg of raw material is the standard set for the manufacture of one unit of a finished product. If 100 units of the finished product are made, the standard quantity of material allowed is 500 kg, being 100 units $\times$ 5 kg.

The formula for the calculation of the variance is as follows:

Formula: $(AQ \times SP) - (SQ \times SP)$, or $(AQ - SQ) \times SP$
 where: AQ = actual quantity of material used
 SQ = standard quantity of material allowed for actual production
 SP = standard price

Material quantity variances can be attributed to:

- ☐ faulty standards (mistakes made when establishing the standard quantity);
- ☐ good/poor controls over the use of material;
- ☐ better/poorer quality material which results in a better/poorer output; and/or

- ☐ efficient/inefficient working conditions, equipment, supervision, and skills of the employees.

The total of the material price variance and the material quantity variance is known as the total material variance and can also be calculated as follows:

$$(AQ \times AP) - (SQ \times SP)$$

Variances can be favourable (F) or unfavourable (U). If the standard costs are greater than the actual costs, the variance is favourable because fewer actual costs were incurred than the standard requires, and if the standard costs are less than the actual costs, the variance will be unfavourable because more actual costs were incurred than the standard requires.

Example 14.1

The standard material costs of finished product X are as follows:

2 kg raw material Y @ R10 per kg

Actual information:

Purchase of raw material Y: 1 000 kg @ R9.50 per kg

Issues of raw material Y: 600 kg

Units of product X manufactured: 290 units

Required

Calculate the following variances in respect of material:

- Purchase price
- Issue price
- Quantity
- Total material variance, if an issue price variance is used.

Solution 14.1

- Material purchase price variance:

$$\begin{aligned} & (AP - SP) \times AQ \\ &= (R9.50 - R10) \times 1\,000 \\ &= R500 (F) \end{aligned}$$
- Material issue price variance:

$$\begin{aligned} & AP - SP \times AQ \\ &= (R9.50 - R10) \times 600 \\ &= R300 (F) \end{aligned}$$
- Material quantity variance:

$$\begin{aligned} &= (AQ - SQ) \times (SP) \\ &= (600 - 580^*) \times R10 \\ &= R200 (U) \end{aligned}$$

* Standard quantity: $290 \times 2 = 580$:
- Total material variance:

$$\begin{aligned} & (AQ \times AP) - (SQ \times SP) \\ &= (600 \times 9.50) - (580 \times 10) \\ &= 5\,700 - 5\,800 \\ &= R100 (F) \end{aligned}$$

Alternatively:

$$\begin{aligned} & (ii) + (iii) \\ &= R300 (F) + R200 (U) \\ &= R100 (F) \end{aligned}$$

The variances can also be presented diagrammatically as follows:

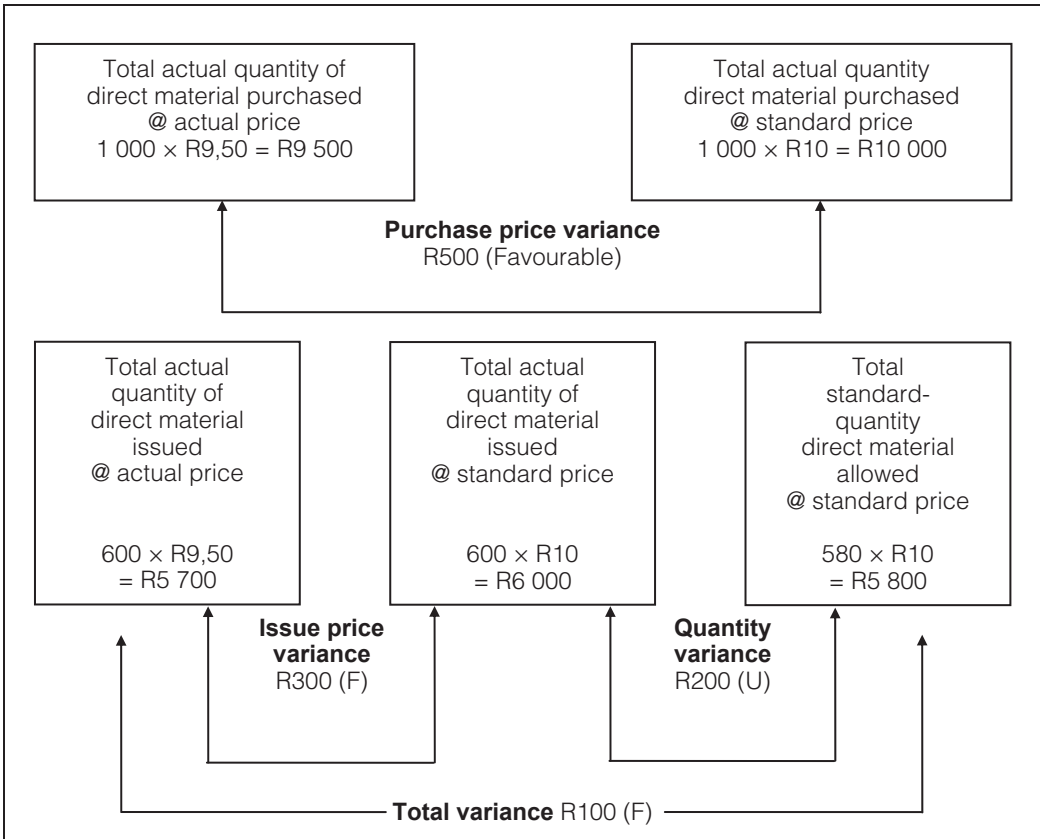


Diagram 14.4

MATERIAL SUB-VARIANCES

When more than one type of material is used in the manufacture of a product and the ratio or composition differs from the standard ratio according to the standard material specifications, it is divided into:

- ☐ a mix variance; and
- ☐ a yield variance.

The mix variance is focused on the standard specification of materials required to manufacture a particular product. Therefore, the mix variance is focused on the 'input' materials.

If the input mix is different from the standard specification, one of three outcomes are possible. Either the yield stays the same, yield is increased, or yield is decreased. In addition, if the mix is changed, it may also affect the quality of the product, again either positively, negatively or no effect. If the mix variance is unfavourable, then it means that the new mix used resulted in a lower yield.

The mix variance therefore represents the variance between the actual quantity of input materials used according to the actual mix, versus the actual quantity used redistributed into the predetermined standard mix.

Conversely, the yield variance is focused on the output achieved during the manufacturing process. Given the output that was achieved it is possible to determine how much material “should” have been used according to the standard mix. This theoretical amount that “should” have been used is then compared the amount that was “actually” used and then multiplied by the standard cost of material.

The formula for the calculation of the variance is as follows:

Materials mix variance: $[AQ - (SQ \div SM \times AM)] \times SP$

where: AQ = actual quantity of material used
 SQ = standard quantity of material allowed for actual production
 SM = total quantity of materials used in mix proportion
 AM = total actual materials used
 SP = standard price for material

Materials yield variance: $[(SQ \div SM \times AM) - SQ] \times SP$

Where: SQ = standard quantity of material allowed for actual production
 SM = total quantity of materials used in mix proportion
 AM = total actual materials used
 SP = standard price for material

The sum of the two variances would then be equal to the material quantity variance and can be presented as follows:

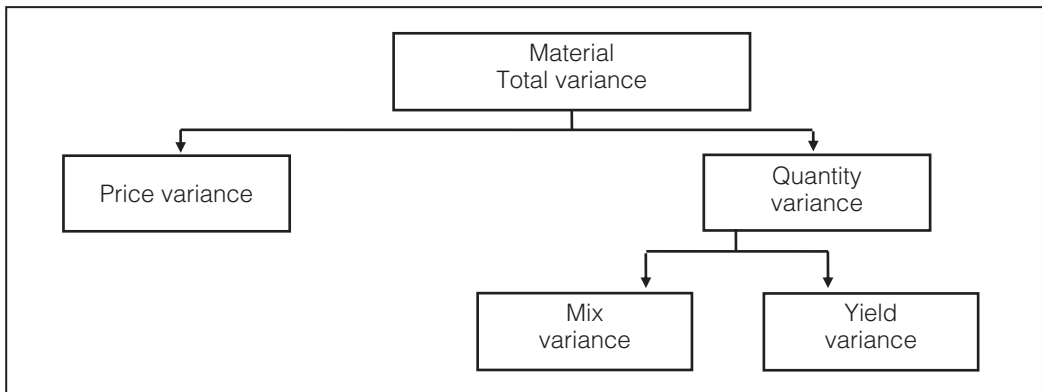


Diagram 14.5

Example 14.2

The material specifications for product K show that one completed unit is made from the following raw materials:

Standard mix in respect of one completed product:

			R
Material A	2 kg @ R1.00	=	2.00
Material B	2 kg @ R1.50	=	3.00
Material C	4 kg @ R0.75	=	3.00
			8.00

Materials purchased and issued to produce 100 units of product K:

Material A	210 kg @ R0.95
Material B	205 kg @ R1.40
Material C	395 kg @ R0.80

Required

Calculate the following in respect of materials:

- (a) Total variance
- (b) Price variance
- (c) Quantity variance
- (d) Mix variance
- (e) Yield variance

Solution 14.2

(a) Total material variance: Actual cost – Standard cost

	R
A: 210×0.95	199.50
B: 205×1.40	287.00
C: 395×0.80	<u>316.00</u>
	802.50 – (100 × R8)
=	802.50 – 800
=	<u>R2.50 (U)</u>

(b) Material price variance: $(AP - SP) \times AQ$

A: $(0.95 - 1.00) \times 210$	10.50 (F)
B: $(1.40 - 1.50) \times 205$	20.50 (F)
C: $(0.80 - 0.75) \times 395$	<u>19.75 (U)</u>
	<u>11.25 (F)</u>

(c) Material quantity variance: $(AQ - SQ) \times SP$

A: $(210 - 200) \times 1.00$	10.00 (U)
B: $(205 - 200) \times 1.50$	7.50 (U)
C: $(395 - 400) \times 0.75$	<u>3.75 (F)</u>
	<u>13.75 (U)</u>

(d) Material mix variance: $\{AQ - (\frac{SQ}{SM} \times AM)\} \times SP$

A : $\{210 - (2/8^1 \times 810^2)\} \times 1.00 = (210 - 202.50) \times 1.00$	=	R7.50 (U)
B : $\{205 - (2/8 \times 810)\} \times 1.50 = (205 - 202.50) \times 1.50$	=	R3.75 (U)
C : $\{395 - (4/8 \times 810)\} \times 0.75 = (395 - 405) \times 0.75$	=	<u>R7.50 (F)</u>
Total	=	<u>R3.75 (U)</u>

(e) Material yield variance: $\{(\frac{SQ}{SM} \times AM) - SQ\} \times SP$

A : $(202.50 - 200^3) \times 1.00$	=	R2.50 (U)
B : $(202.50 - 200) \times 1.50$	=	3.75 (U)
C : $(405 - 400) \times 0.75$	=	<u>3.75 (U)</u>
		<u>R10.00 (U)</u>

¹ According to the standard mix, 2 units of material A is needed. A total of 8 kg of materials is used in the mix (2 + 2 + 4 = 8)

² Actual materials used is as follows: 210 + 205 + 395 = 810. Note how the total actual materials used is "redistributed" according to how it 'should' have been made up of if the standard mix was applied.

³ Actual production was 100 units, and if the standard mix is applied to actual yield, then 200 kg of material A "should" have been used (100 × 2 = 200).

Diagrammatically, the variances can be solved as follows:

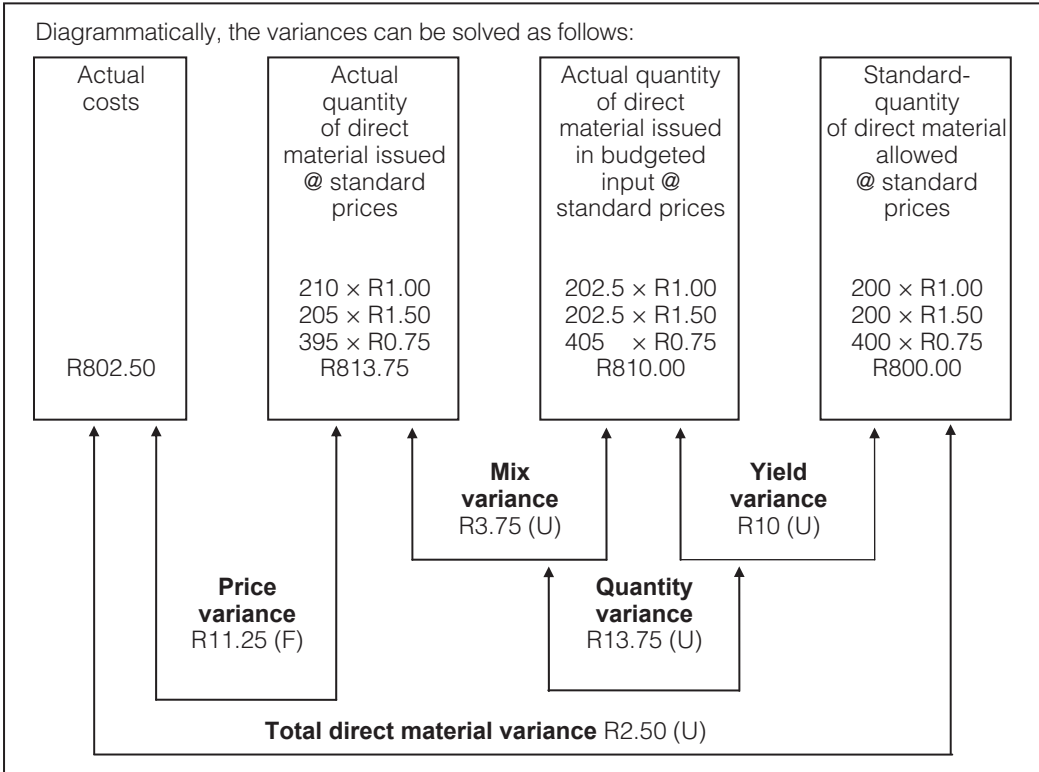


Diagram 14.6

The sub-variances have the following uses:

- ☐ The material mix variance enables management to obtain the optimum composition of material.
- ☐ The material yield variance shows the over- or under-usage of raw material. It helps to ensure that the individual raw materials are utilised to the maximum.

RECORDING OF MATERIAL COSTS

The purchase of material can be recorded in the books by means of the following two methods:

- ☐ The material is recorded at standard cost and the price variance is recorded on receipt of the material.
- ☐ The material is recorded at actual cost and the price variance is recorded upon issue.

The first method is recommended, since controls are exercised on receipt of the material. The recording of material according to the two methods can be illustrated as follows using the information about finished product X in Example 14.2:

First method: Purchase price variance

The recording of the material purchases at standard cost:			
Trade payables		Material control	
	AQ × AP (1 000 × 9.50) = 9 500	AQ × SP (1 000 × 10) = 10 000	
		Purchase price variance	
			AQ × Difference in price: [1 000 × (10 – 9.50)] = 500
The recording of material issues at standard cost:			
Material control		Production account	
10 000	AQ × SP (600 × 10) = 6 000	SQ × SP (580 × 10) = 5 800	
		Quantity variance	
			Difference in quantity × SP [(600 – 580) × 10] = 200

Second method: Issue price variance

The recording of material purchases at actual cost:

Trade payables		Material control	
	AQ × AP (1 000 × 9.50) = 9 500	AQ × AP (1 000 × 9.50) = 9 500	

The recording of material issues at standard cost:

Material control		Production account	
9 500	AQ × AP (600 × 9.50) = 5 700	SQ × SP (580 × 10) = 5 800	
		Issue price variance	
			(AP – SP) AQ [(9.5 – 10) × 600] = 300
		Quantity variance	
			(AQ – SQ) × SP [(600 – 580) × 10] = 200

True to the accounting principles, the favourable variances in the above accounts are credited and the unfavourable variances debited.

LABOUR STANDARDS AND VARIANCES

As is the case with material, a price and a quantity standard are established in respect of labour. With regard to labour the word price is preferably replaced by rate or tariff, while the word quantity is replaced by efficiency. In essence the calculation remains the same though.

Rate standards are usually based on the established wage scales paid for the specified type of labour. Time standards for the manufacture of a product are determined with the aid of time and motion studies. When standards are established, provision must be made for idle time, which is unavoidable.

The two main variances relating to labour are:

- ☐ the labour rate variance; and
- ☐ the labour efficiency variance.

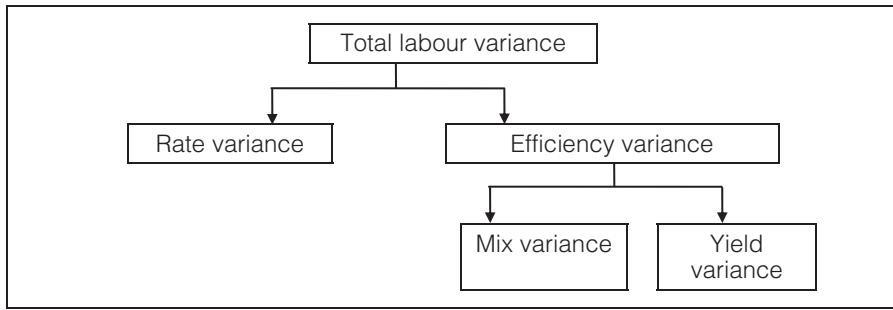


Diagram 14.7

LABOUR RATE VARIANCE

This variance is calculated by multiplying the difference between the actual and the standard rate by the actual hours worked. The **labour rate variance** shows how effectively labour was remunerated. The formula for its calculation is as follows:

Formula: $(AR - SR) AT$, or $(AR \times AT) - (SR \times AT)$

where: AR = actual rate paid
 SR = standard rate
 AT = actual hours worked

The labour rate variance can be caused by:

- ☐ the establishment of incorrect labour rates;
- ☐ changes in wage tariffs;
- ☐ poor scheduling of production which gives rise to overtime (overtime is calculated at a higher rate than normal time); and
- ☐ the use of better/poorer qualified personnel with higher/lower pay.

LABOUR EFFICIENCY VARIANCE

The labour efficiency variance is related to the amount of time necessary to manufacture one unit of a product. It is calculated by taking the difference between the actual hours worked at the standard rate and the standard time (hours) allowed for the actual production at the standard rate.

The formula for determining the variance is as follows:

Formula: $(AT - ST) SR$, or $(AT \times SR) - (ST \times SR)$

where: AT = actual time worked
 ST = standard time allowed for actual production
 SR = standard rate

The **labour efficiency variance** shows how efficiently labour is employed. Variances may be due to:

- ☐ the establishment of standard times (hours);
- ☐ properly/poorly trained employees;
- ☐ good/poor supervision;
- ☐ the use of good/poor quality material; and
- ☐ problems with machinery and equipment which result in longer manufacturing hours than budgeted for.

Example 14.3

The following information is available about the labour of the manufacturing department of Proud Labour Ltd:

Actual hours worked:	510 @ R4.50 per hour
Units manufactured:	
Complete	450 units
Incomplete	200 units (100% complete in respect of material and 25% complete in respect of labour and overheads)

Standard labour cost per unit according to the standard cost card 1 hour @ R4.75 per hour

Required

Calculate the following:

- (a) Labour rate variance
- (b) Labour efficiency variance
- (c) Total labour variance

Solution 14.3

$$\begin{aligned}
 \text{(a) Labour rate variance:} & \quad (AR - SR) \times AT \\
 & = (4.50 - 4.75) \times 510 \\
 & = R127.50 \text{ (F)}
 \end{aligned}$$

$$\begin{aligned}
 \text{(b) Labour efficiency variance:} & \quad (AT - ST) \times SR \\
 & = (510 - 500^*) \times 4.75 \\
 & = R47.50 \text{ (U)}
 \end{aligned}$$

* Standard hours allowed for actual production:

$$\begin{aligned}
 & = [450 + (25\% \times 200)] \times 1 \text{ hour per unit} \\
 & = [450 + 50] \times 1 \\
 & = 500 \text{ hours}
 \end{aligned}$$

$$\begin{aligned}
 \text{(c) Total labour variance:} & \quad R127.50 \text{ (F)} + R47.50 \text{ (U)} \\
 & = R80 \text{ (F)}
 \end{aligned}$$

$$\begin{aligned}
 \text{Alternative:} & \quad (AT \times AR) - (ST \times SR) \\
 & \quad (510 \times 4.50) - (500 \times 4.75) \\
 & = 2\,295 - 2\,375 \\
 & = R80 \text{ (F)}
 \end{aligned}$$

The variance can be shown diagrammatically as follows:

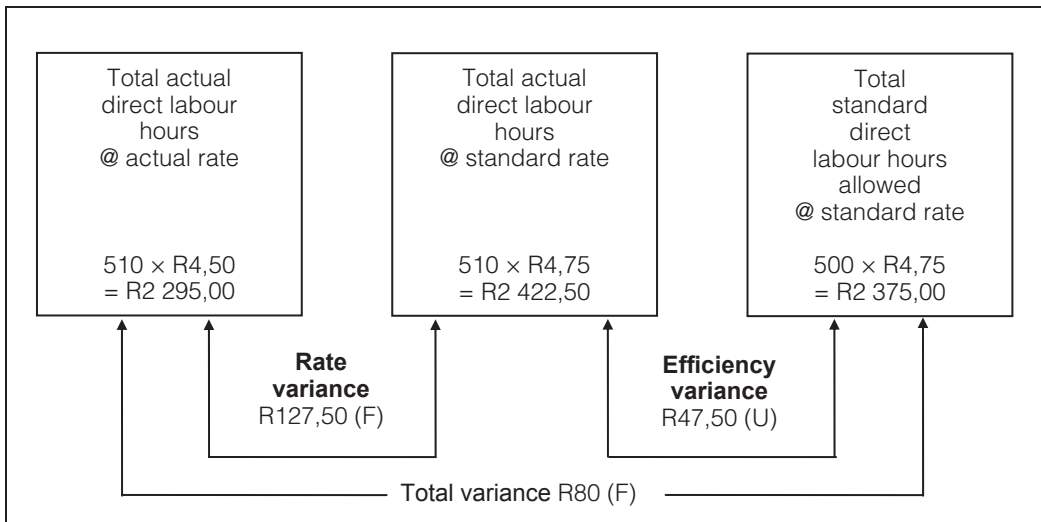


Diagram 14.8

SUB-VARIANCES

No matter how accurately standards are established, there is still the possibility of idle time due to power failures, raw material shortages and defective machines. This idle time variance must be calculated separately and must not be included in the labour efficiency variance, otherwise the employees can be wrongly blamed for inefficiency in respect of problems which are beyond their control.

The formula for idle time is as follows:

Idle time variance: (Idle time) $\times$ SP

Where: SP = standard price for material

As is the case with material, the labour efficiency variance can also be divided into two sub-variances, namely:

- ☐ a mix variance; and
- ☐ a yield variance.

If the composition (ratio between the different types of grades of labour) that is used differs from the standard ratio, then a labour composition or labour mix variance exists. The variance is calculated by multiplying the difference between the actual composition and the standard composition of the actual total hours worked and multiplied by the standard rates.

The yield variance represents the difference between the standard time allowed for the actual production (units manufactured) and the actual time spent multiplied by the standard labour rate.

The formula for the mix variance is as follows:

Labour mix variance: $(SM - AM) \times SR$
 where: SM = actual time according to standard mix
 AM = actual time according to actual mix
 SR = average standard rate

The formula for the yield variance is as follows:

Labour yield variance: $(SH - AH) \times SR$
 Where: SH = standard time for actual hours used
 AH = actual hours
 SR = average standard rate

Example 14.4

Standard labour costs to manufacture 300 units:

		R
100 hours @ R10 per hour	=	1 000
50 hours @ R6 per hour	=	300
		1 300

Calculations

- 1 150 hours ÷ 300 units = 0.5 hour per unit
- 2 Standard labour rate per hour of standard mix: $R1\ 300 \div 150 \text{ hours} = R8.66 \text{ per hour}$
- 3 Standard labour cost per unit = R4.33

Actual labour costs incurred to produce 290 units:

		R
80 hours @ R9 per hour	=	720
60 hours @ R5 per hour	=	300
		1 020

Idle time represents 10% of the recorded labour hours. Total actual hours equals 140 hours (80 + 60), total standard hours equals 150 (100 + 50).

Calculations

- 1 Standard time allowed for production: $290 \text{ units} \times 0.5 \text{ hours per unit} = 145 \text{ hours}$
- 2 Standard labour costs allowed for actual production: $290 \text{ units} \times R4.33 = R1\ 256$

Required

Calculate the following:

- (a) Labour rate variance
- (b) Idle time variance
- (c) Labour efficiency variance
- (d) Labour mix variance
- (e) Labour yield variance
- (f) Total labour variance.

Solution 14.4

(a) Labour rate variance:

$$\begin{aligned}
 &= AT \times (AR - SR) \\
 &= [80 \times (9 - 10)] + [60 \times (5 - 6)] \\
 &= 80 + 60 \\
 &= R140 (F)
 \end{aligned}$$

(b) Idle time variance:

$$\begin{aligned}
 &= Idle time \times SR \\
 &= [(10\% \text{ of } 80) \times 10] + [(10\% \text{ of } 60) \times 6] \\
 &= 80 + 36 \\
 &= R116 (U)
 \end{aligned}$$

The idle time variance will always be unfavourable as it adversely affects the efficiency of the employees.

(c) Efficiency variance:

$$\begin{aligned}
 &= (\text{Hours worked} \times SR) - (\text{Hours allowed} \times \text{Average SR}) \\
 &= [(80 - 8)^* \times 10 + (60 - 6)^* \times 6] - (145 \times 8.66) \\
 &= 1\,044 - 1\,256 \\
 &= R212 (F)
 \end{aligned}$$

(d) Labour mix variance:

Standard mix of AT worked	Actual mix of AT worked	Differ- ence	SR	Variance
			R	R
84 ¹	72*	12	10	120 (F)
42	54*	-12	6	72 (U)
<u>126¹</u>	<u>126*</u>			<u>48 (F)</u>

(e) Labour yield variance

$$\begin{aligned}
 &= (\text{Hours allowed} - \text{Hours worked}) \times \text{Average SR} \\
 &= (145 - 126) \times 8.66 \\
 &= 19 \times 8.66 \\
 &= R164 (F)
 \end{aligned}$$

Test for correctness of variances:

$$\begin{aligned}
 \text{Efficiency} &= \text{Mix} + \text{Yield} \\
 &= 48 (F) + 164 (F) \\
 &= R212 (F)
 \end{aligned}$$

(f) Total labour variance:

$$\begin{aligned}
 &= \text{Standard cost of actual production} - \text{Actual cost} \\
 &= R1\,256 - R1\,020 \\
 &= R236 (F)
 \end{aligned}$$

Alternatively, the separate variances can be added together, which also serves as a test for correctness [R140 (F) + R212 (F) - R116 (U) = R236 (F)].

* 80 hours - 10%; 60 hours - 10% 1 Standard ratio

$$\text{1 Standard ratio } 100 : 50 \quad \therefore \frac{100}{150} \times 126 = 84$$

Total actual hours for production 80 + 60 = 140. Removing the idle time, 140 × 0.90 = 126. The 126 hours is then redistributed according to the standard mix of 100:50 and then secondly to the actual mix which is 80:60. Therefore 126 × 100/150 = 84 and 126 × 80/140 = 72. This formula applies to both types of labour.

The variances can be presented diagrammatically as follows:

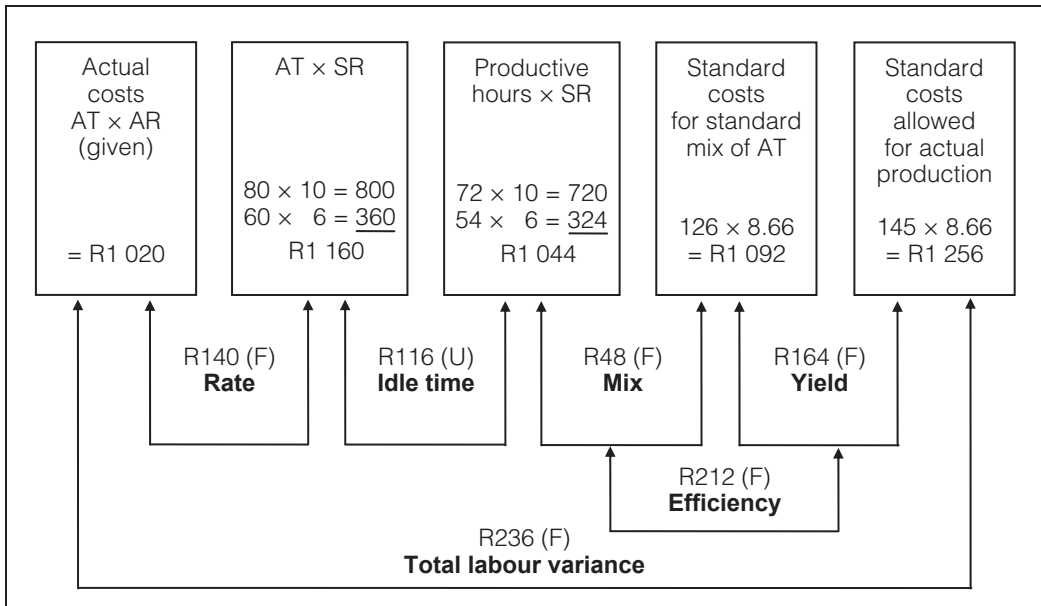


Diagram 14.9

RECORDING OF LABOUR COSTS

The following example is self-explanatory:

Example 14.5

Actual time worked	1 000 hours
Actual rate	R4.50 per hour
Standard time allowed for actual production	950 hours
Standard rate	R4.25 per hour

Required

Show by means of T-accounts how the liability and division of labour are recorded.

Solution 14.5

Method 1:

Wage account		Production account	
	AT × AR 1 000 × 4.50 R4 500	ST × SR 950 × 4.25 → R4 037.50	
		Rate variance	
		(AR – SR) × AT (4.50 – 4.25) × 1 000 → R250	
		Efficiency variance	
		(AT – ST) × SR (1 000 – 950) × 4.25 → R212.50	

Method 2:

The recording of the labour liability:

Wages payable		Wage account	
	AT × AR 1 000 × 4.50 R4 500	AT × SR 1 000 × 4.25 → R4 250	
		Rate variance	
		(AR – SR) × AT (4.50 – 4.25) × 1 000 → R250	

The recording of labour allocation:

Wage account		Production account	
4 250	AT × SR 1 000 × 4.25 R4 250	ST × SR 950 × 4.25 → R4 037.50	
		Efficiency variance	
		(AT – ST) × SR (1 000 – 950) × 4.25 → R212.50	

MANUFACTURING OVERHEADS STANDARDS AND VARIANCE

In some cases, manufacturing overheads have a direct connection with the level of business activity. Thus, it is necessary to divide overheads into the fixed and variable categories before standards can be set. Because of the semi-fixed nature of certain

overheads, they are not readily divisible between fixed and variable overheads. Consequently, a variable budget is prepared for all manufacturing overheads.

The variable budget shows what the budgeted overheads should be at different output levels in order to facilitate the comparison between actual overheads and the determination of variances.

Variable costs are constant per unit because they vary in a direct ratio to the level of business activity while fixed costs are variable per unit. This attribute of fixed costs hampers the establishment of a standard fixed overheads rate when the level of activity differs from month to month.

In order to overcome this problem, the fixed overheads rate is calculated on the basis of the normal level of activity, because this is based on the standard level of activity.

Manufacturing overheads variances may be due to:

- ☐ the actual level of operations differing from the planned level;
- ☐ the actual overheads differing from the budgeted overheads; and
- ☐ the actual hours worked differing from the standard hours.

Different methods can be used to calculate these variances. The method used will depend on the nature of the enterprise and the extent to which controls are being exercised.

The individual variances in respect of fixed and variable overheads can be calculated separately, or the fixed and variable overheads can be combined and the variances calculated collectively. If the fixed and variable overheads are combined the variances can be calculated in different ways, of which only the following two will be dealt with:

- ☐ the two-variance method; and
- ☐ the three-variance method.

SEPARATE VARIABLE AND FIXED MANUFACTURING OVERHEADS VARIANCES

Variable manufacturing overheads variances

Diagram 14.10 provides a schematic representation of the different variances that fall under variable overheads.

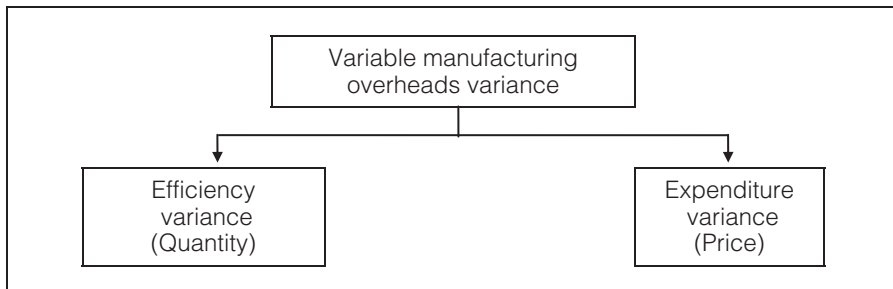


Diagram 14.10

Overheads tariffs are usually based on direct labour hours or machine hours, or are expressed as a percentage of the direct labour costs. However, other bases, as discussed in chapter 7, can also be used. Unless otherwise stated, labour hours are used as the basis throughout this chapter.

The efficiency variance (also called the quantity variance) is calculated by multiplying the difference between the actual hours worked and the standard time allowed by the standard rate for variable overheads.

$(\text{Standard time allowed} - \text{Actual hours}) \times \text{Standard rate}$

The expenditure variance (also called the tariff, rate or price variance) is the difference between the actual and the standard rate for variable overheads multiplied by the actual hours worked.

$(\text{Standard rate} - \text{Actual rate}) \times \text{Actual hours}$

The following example explains variable overheads more fully:

Example 14.6

The following are the budgeted results at normal capacity of Standards Ltd, a manufacturing enterprise, for February 20.2:

Fixed overheads	R27 000
Variable overheads	R22 500
Labour hours	15 000

According to the standard, it takes 7.5 hours to manufacture one product.

Actual results:

Fixed overheads	R27 200
Variable overheads	R22 400
Labour hours worked	16 000
Units manufactured	2 100

Required

Calculate the following variances in respect of variable manufacturing overheads:

- Efficiency
- Expenditure
- Total variable overheads

Solution 14.6

- (a) Efficiency variance:
- $$\begin{aligned}
 &= (\text{AT} - \text{ST}) \times \text{SR or } (\text{AT} \times \text{SR}) - (\text{ST} \times \text{SR}) \\
 &= [16\,000 - (2\,100 \times 7.5)] \times \\
 &\quad (\text{R}22\,500 \div 15\,000) \\
 &= (16\,000 - 15\,750) \times 1.50 \\
 &= \text{R}375 \text{ (U)}
 \end{aligned}$$
- (b) Expenditure variance:
- $$\begin{aligned}
 &= (\text{AR} - \text{SR}) \times \text{AT or } (\text{AR} \times \text{AT}) - (\text{SR} \times \text{AT}) \\
 &= [(22\,400 \div 16\,000) - 1.50] \times 16\,000 \\
 &= \text{R}1\,600 \text{ (F)}
 \end{aligned}$$
- (c) Total variance:
- $$\begin{aligned}
 &= \text{Actual amount} - \text{Standard amount allowed} \\
 &= \text{R}22\,400 - (15\,750 \times 1.50) \\
 &= 22\,400 - 23\,625 \\
 &= \text{R}1\,225 \text{ (F)}
 \end{aligned}$$

where: SR = Variable standard rate (overheads)

AR = Variable actual rate (overheads)

These variances can also be presented diagrammatically:

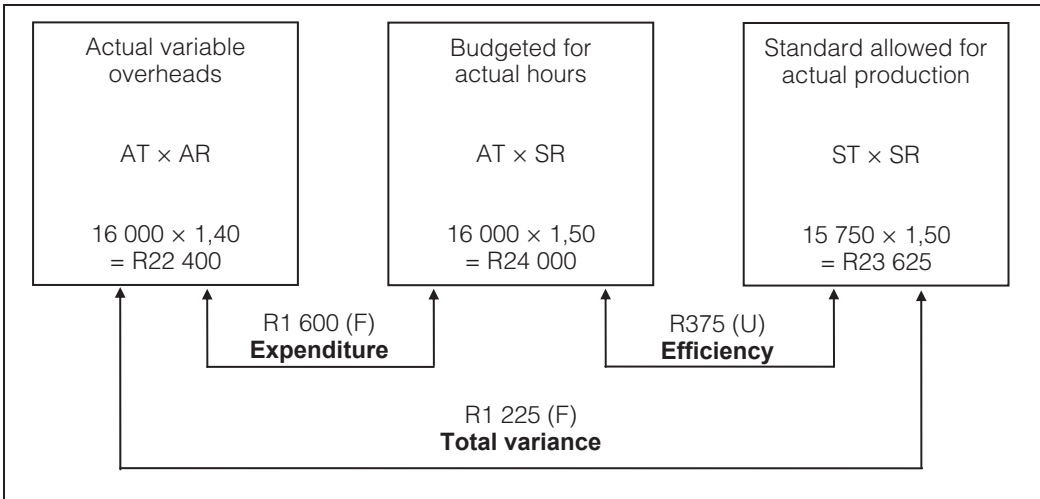


Diagram 14.11

Fixed manufacturing overheads variances

The total fixed overhead variance is the difference between the standard fixed overheads allowed and the actual fixed overheads. The fixed overheads variances (also called the four-variance method) can be presented schematically as follows:

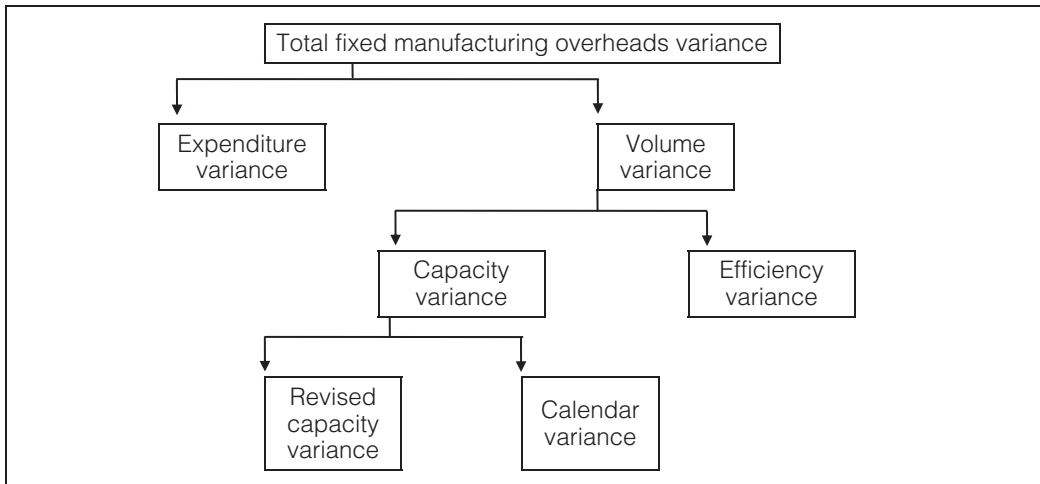


Diagram 14.12

The two main variances in fixed manufacturing overheads are the *expenditure* and the *volume variances*. The expenditure variance is calculated as the difference between the actual and the budgeted fixed overheads. The volume variance is calculated as the difference between the budgeted and the standard fixed overheads, and can be divided into a *capacity* and an *efficiency* variance.

The capacity variance represents the differences between the budgeted time and the actual time valued at the standard fixed recovery rate, while the efficiency variance represents the difference between the actual time and the standard time allowed, multiplied by the total standard rate.

In turn, the capacity variance can be subdivided to make provision for a revised capacity and a calendar variance. The overheads calendar variance represents the difference between the allowable fixed overheads based on the normal capacity and the fixed overheads allowed on the grounds of the calendar factor for the relevant period. The calendar factor represents the ratio of the actual number of work days in a given period to the normal budgeted number of work days in that period.

If a calendar variance is calculated, the revised capacity variance represents the difference between the actual capacity for the period expressed as actual hours $\times$ the fixed standard overheads rate per hour and the revised fixed overheads based on the calendar factor for the period.

Example 14.7

Use the same information as in Example 14.6 and calculate the following fixed overheads variances:

- (a) Expenditure.
- (b) Volume.
- (c) Efficiency.
- (d) Capacity.
- (e) Total variance.
- (f) Test the correctness of your variances.

Solution 14.7

- (a) Expenditure variance: $\text{Actual fixed overheads} - \text{Budgeted fixed overheads}$
 $= \text{R}27\,200 - \text{R}27\,000$
 $= \text{R}200 \text{ (U)}$
- (b) Volume variance: $(\text{BT} - \text{ST}) \times \text{SR}$ or $\text{Budgeted overheads} - \text{Standard overheads}$
 $= [15\,000 - (7.5 \times 2\,100)] \times 1.80$
 $= (15\,000 - 15\,750) \times 1.80$
 $= \text{R}1\,350 \text{ (F)}$
- (c) Efficiency variance: $(\text{AT} - \text{ST}) \times \text{SR}$
 $= (16\,000 - 15\,750) \times 1.80$
 $= \text{R}450 \text{ (U)}$
- (d) Capacity variance: $(\text{BT} - \text{AT}) \times \text{SR}$
 $= (15\,000 - 16\,000) \times 1.80$
 $= \text{R}1\,800 \text{ (F)}$

where BT = Budgeted time
 AT = Actual time
 ST = Standard time for actual production
 SR = Standard fixed overheads rate

- (e) Total variance: $\text{Actual overheads} - \text{Standard overheads}$
 $= 27\,200 - (15\,750 \times 1.80)$
 $= 27\,200 - 28\,350$
 $= \text{R}1\,150 \text{ (F)}$

continued

(f) Test:		
Total variance	=	Volume variance + Expenditure variance
	=	R1 350 (F) – R200 (U)
	=	R1 150 (F)
Volume variance	=	Capacity variance + Efficiency variance
	=	1 800 (F) – 450 (U)
	=	R1 350 (F)

The status of the variances in respect of fixed manufacturing overheads is determined as discussed under material variances; namely, a favourable variance exists when standard costs exceed the actual costs and *vice versa*. The outcome of the capacity variance as determined above raises problems, since it is favourable despite the fact that the actual hours (16 000) worked are more than the budgeted hours (15 000). The reason for this can be explained as follows. Fixed overheads in total are fixed, but vary per unit. If more hours than budgeted are actually worked without any increase in fixed costs, a greater number of products are manufactured. Consequently, the fixed cost per unit will decrease. Fixed costs which are fixed in total, will now be absorbed by a larger production and will be spread over the larger number of products. This will result in a decline in the fixed costs per unit – thus the favourable variance.

When the standard days for a month are 30 and a month like February has only 28 days, then there is a *calendar variance*. If a year is taken in its entirety a calendar variance is sometimes self-eliminating and may exist in only some accounting periods during the year.

If the use of time is normally within management's control but the capacity variance is not easily controllable, it is important that the capacity variance is divided into both a calendar and a revised capacity variance.

Example 14.8

Information for February 2015:

	Actual	Budgeted
Fixed overheads	R27 200	R27 000
Number of days worked	22	20
Production (units)	2 100	2 000
Hours worked	16 000	15 000

Required

Calculate the following:

- Calendar variance.
- Revised capacity variance.
- Capacity variance.

Solution 14.8

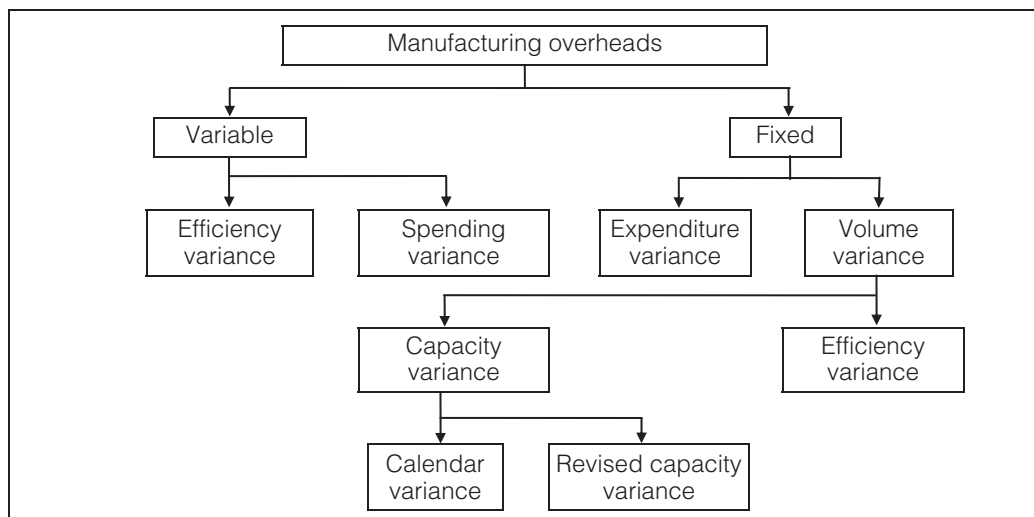
$$\begin{aligned}
 \text{(a) Calendar variance} &= \frac{R27\,000}{20} \times \frac{(22 - 20)}{1} \\
 &= 1\,350 \times 2 \\
 &= R2\,700 \text{ (F)} \\
 \text{(b) Revised capacity variance} &= \frac{(BT^* - AT) \times SR}{1} \times \frac{27\,000}{15\,000} \\
 &= \frac{(16\,500 - 16\,000)}{1} \times \frac{27\,000}{15\,000} \\
 &= 500 \times 1.80 \\
 &= R900 \text{ (U)} \\
 \text{* Budgeted time revised} &= \frac{15\,000}{20} \times \frac{22}{1} \\
 &= 16\,500 \text{ hours} \\
 \text{(c) Capacity variance} &= (BT - AT) \times SR \\
 &= (15\,000 - 16\,000) \times 1.80 \\
 &= R1\,800 \text{ (F)}
 \end{aligned}$$

Alternative solution 14.8

$$\begin{aligned}
 \text{(i) Calendar factor} &= \frac{22 - 20}{20} \times \frac{100}{1} = 10\% \text{ (F)} \\
 \text{(ii) Calendar variance} &= 10\% \times \text{Budget} \\
 &= 10\% \times R27\,000 \\
 &= R2\,700 \text{ (F)} \\
 \text{(iii) Revised capacity variance} &= (AT \times SR) - (\text{Factor} \times \text{Budget}) \\
 &= (16\,000 \times R1.80) - (110\%^* \times R27\,000) \\
 &= R28\,800 - R29\,700 \\
 &= R900 \text{ (U)}
 \end{aligned}$$

* (100% + 10%)

A diagrammatic representation of a consolidation of the variable and fixed manufacturing overheads variances which are calculated separately is:

**Diagram 14.13**

Causes of manufacturing overheads variances

Expenditure variances (fixed overheads)

- ☐ Equipment standing idle due to power failures, defective machinery and raw material shortages
- ☐ Labour problems as a result of unforeseen absenteeism
- ☐ Ineffective planning – incorrect scheduling of work or instructions
- ☐ Material problems as a result of defective material
- ☐ Fluctuations in demand.

Efficiency variances (fixed and variable overheads). The causes of these variances are mainly the same as those of the labour efficiency variance.

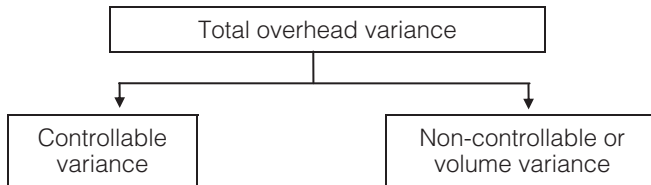
- ☐ The degree of efficiency of employees as a result of selection, supervision, training and skills
- ☐ Working conditions – these cause dissatisfaction
- ☐ The re-designing of products
- ☐ Efficient/inefficient planning and control of production.

COMBINED VARIABLE AND FIXED MANUFACTURING OVERHEADS VARIANCES

With the combined method, no distinction is made between fixed and variable manufacturing overheads. It is important to note that there is a fundamental difference between this method and the method in which the separate fixed and variable overhead variances are consolidated.

The following is a schematic representation of the two methods found under combined variances:

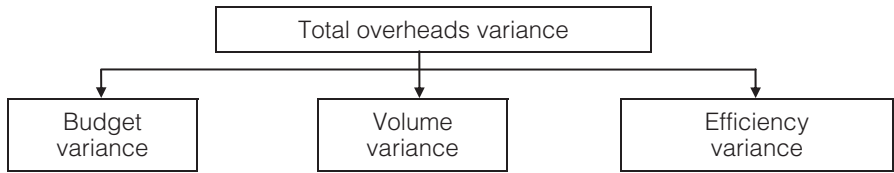
Two-variance analysis method



The controllable variance, so called because of its controllability, represents the difference between the actual total overheads on the one hand and the standard variable overheads allowed for actual production time plus budgeted fixed overheads on the other.

The non-controllable or volume variance is applicable to fixed costs only and represents the difference between the budgeted and the standard amount of fixed overheads allowed for actual production.

Three-variance analysis method



In the three-variance method the *budget variance* represents the difference between the actual total overheads and the variable budget (budgeted fixed and variable cost for actual production); the *volume variance* is the difference between the budgeted and actual fixed overheads; and the *efficiency variance* is the difference between the actual time and the standard time allowed for the actual production multiplied by the standard total overhead rate.

In this method the volume variance can also be divided into a calendar and revised capacity variance.

The above variances are best illustrated by means of a practical problem:

Example 14.9

Using the information given in Example 14.6, calculate the following:

- (a) The two-variance analysis.
- (b) The three-variance analysis.
- (c) Total overheads variance.

Solution 14.9

(a) **Two-variance method:**

Controllable variance: $\text{Actual amount} - [(\text{ST} \times \text{SRv}) + \text{Fixed budgeted overheads}]$
= $(27\,200 + 22\,400) - [(15\,750 \times 1.50) + 27\,000]$
= $49\,600 - 50\,625$
= $\text{R}1\,025 \text{ (F)}$

Volume variance: $(\text{BT} - \text{ST}) \times \text{SRf}$
= $(15\,000 - 15\,750) \times 1.80$
= $\text{R}1\,350 \text{ (F)}$

Diagrammatically:

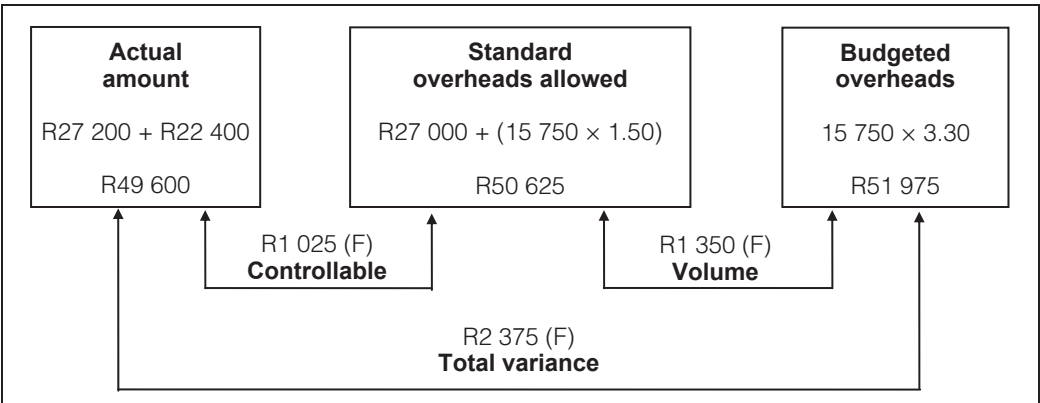


Diagram 14.14

(b) Three-variance method:

$$\begin{aligned}
 \text{Budgeted variance:} &= \text{Actual amount} - [(\text{AT} \times \text{SR}_v) + \text{Budgeted fixed overheads}] \\
 &= 49\,600 - [(16\,000 \times 1.50) + 27\,000] \\
 &= 49\,600 - 51\,000 \\
 &= \text{R}1\,400 \text{ (F)} \\
 \text{Volume variance (only fixed):} &= (\text{BT} - \text{AT}) \times \text{SR}_f \\
 &= (15\,000 - 16\,000) \times 1.80 \\
 &= \text{R}1\,800 \text{ (F)} \\
 \text{Efficiency variance:} &= (\text{AT} - \text{ST}) \times \text{SR}_t \\
 &= (16\,000 - 15\,750) \times 3.30 \\
 &= \text{R}825 \text{ (U)}
 \end{aligned}$$

where v represents variable overheads
 f represents fixed overheads
 t represents total overheads

Diagrammatically:

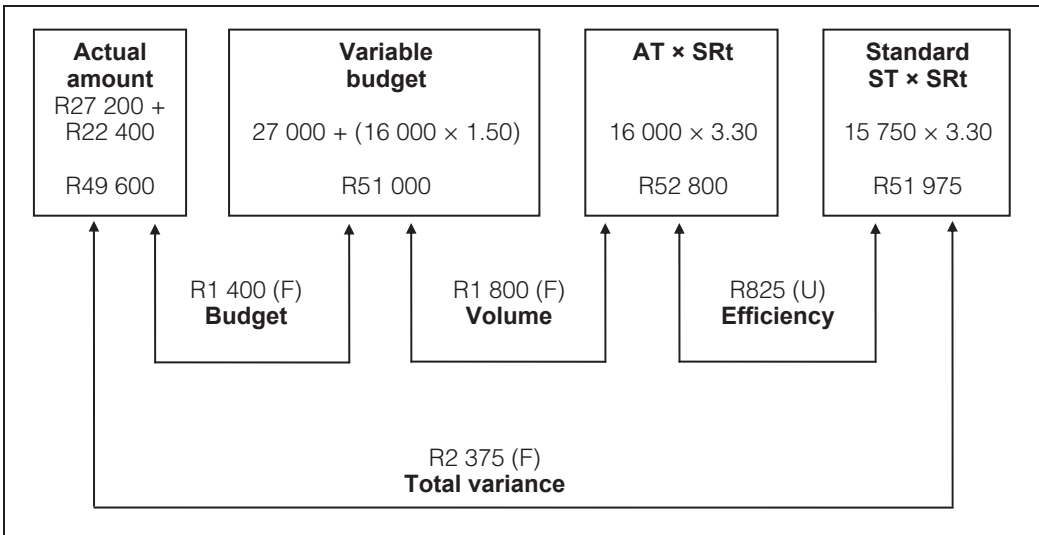


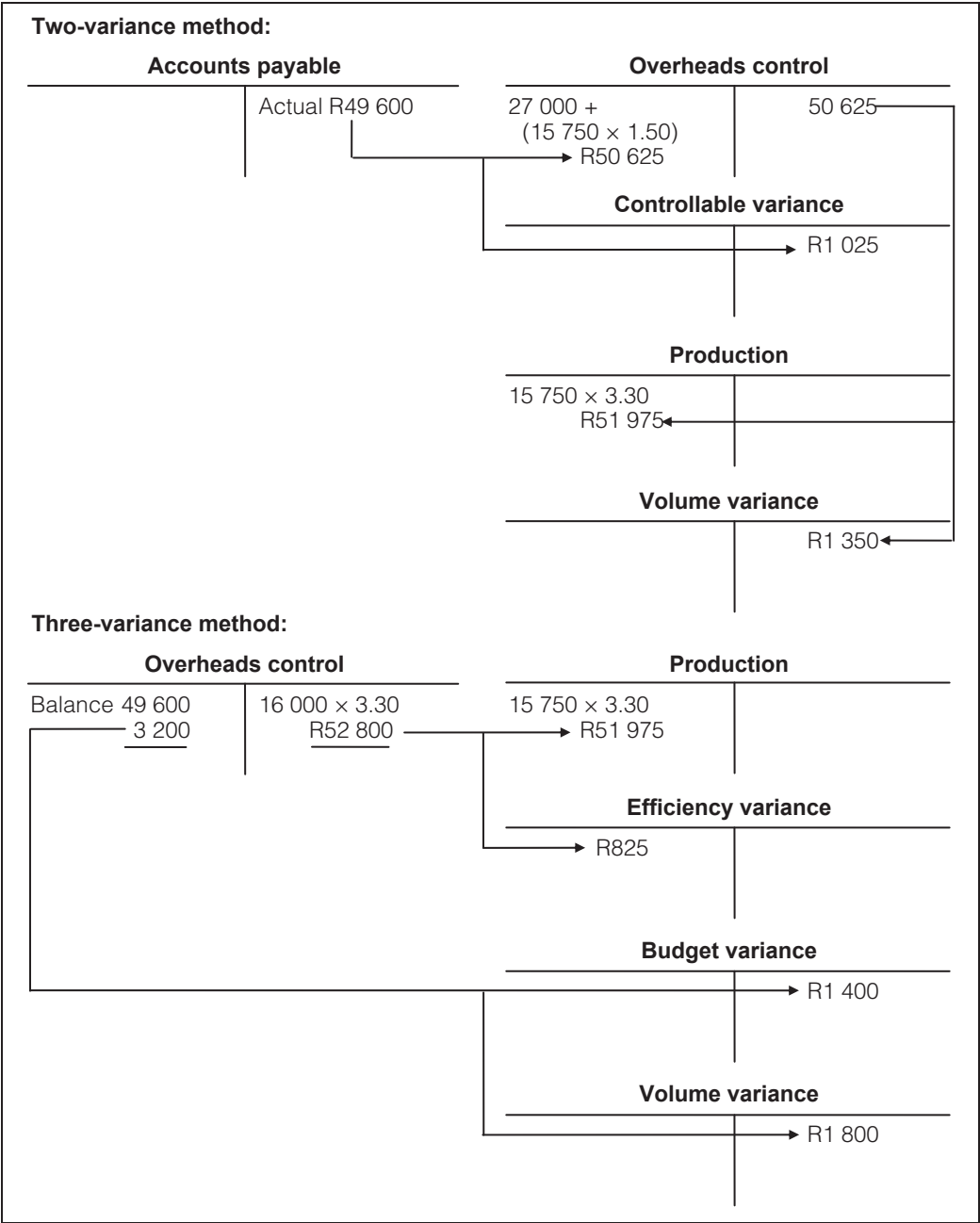
Diagram 14.15

(c) Total overhead variance: Actual amount – Standard amount

$$\begin{aligned}
 &= 49\,600 - (15\,750 \times 3.30) \\
 &= 49\,600 - 51\,975 \\
 &= \text{R}2\,375 \text{ (F)}
 \end{aligned}$$

RECORDING OF MANUFACTURING OVERHEADS

Using the information from Example 14.9, the recording of the two- and three-variance analysis in T-accounts can be illustrated as follows:



It should be noted that if an allocation overheads account is used for allocating overheads to production, the balance on this account at the end of the accounting period must be transferred to the overheads control account.

At the end of the accounting period all the variances in respect of the three cost elements which have arisen between the actual and standard costs, and which have been recorded, must be closed off in one of the following ways:

- ☐ transfer the balance on the variance account directly to the cost of sales; or
- ☐ transfer the balance on the variance account to the cost of sales and the various accounts on which it has a bearing.

If variances are small, they are usually transferred to cost of sales. However, if the variances are material, the latter method must be used.

Example 14.10

Suppose the material quantity variance in respect of material A is an unfavourable R12 000 and the following information is supplied:

Material A is found in the following items:

		R
Closing stock incomplete work (Equivalent units)	4 000 × R10	40 000
Closing stock finished goods	1 000 × R10	10 000
Cost of sales	5 000 × R10	50 000
		<u>100 000</u>

Required

Using the journal entry, close off the unfavourable variance accounts to the various accounts on which they have a bearing.

Solution 14.10

Account	Amount R	Allocation	Variance R
Incomplete work	40 000	$\frac{40\,000}{100\,000} \times \frac{12\,000}{1}$	4 800
Finished goods	10 000	$\frac{10\,000}{100\,000} \times \frac{12\,000}{1}$	1 200
Cost of sales	50 000	$\frac{50\,000}{100\,000} \times \frac{12\,000}{1}$	6 000
	<u>100 000</u>		<u>12 000</u>

Journal entry

Incomplete work	R4 800	
Finished goods	1 200	
Cost of sales	6 000	
Material quantity variance		R12 000
Allocation of material quantity variance		

STANDARD COSTING RATIOS

From the discussion thus far, it is clear that costing standards are an important instrument for evaluating performance and enabling management to control the activities of the enterprise. To do further analysis such as *How efficiently are the actual hours worked utilised? How effectively is the factory's level of activity used*, certain ratios can be calculated as shown in Example 14.11.

Example 14.11

The budgeted and actual information about a factory for March 2015 is as follows:

	Budgeted	Actual
Units manufactured	5 000	4 800
Number of hours worked	10 000	10 500

Required

Calculate the following:

- Level of activity or volume ratio
- Utilisation or capacity ratio
- Efficiency ratio.

Solution 14.11

$$\begin{aligned}
 \text{Standard time to manufacture one product} &= \frac{10\,000 \text{ hours}}{5\,000 \text{ units}} \\
 &= 2 \text{ hours}
 \end{aligned}$$

$$\begin{aligned}
 \text{(a) Level of activity ratio:} &= \frac{\text{Standard time for actual production allowed} \times 100}{\text{Budgeted time}} \\
 &= \frac{(4\,800 \times 2)}{10\,000} \times \frac{100}{1} \\
 &= 96\%
 \end{aligned}$$

$$\begin{aligned}
 \text{(b) Utilisation ratio} &= \frac{\text{Actual time}}{\text{Budgeted time}} \times \frac{100}{1} \\
 &= \frac{10\,500}{10\,000} \\
 &= 105\%
 \end{aligned}$$

$$\begin{aligned}
 \text{(c) Efficiency ratio} &= \frac{\text{Standard time} \times 100}{\text{Actual time}} \\
 &= \frac{9\,600}{10\,500} \times \frac{100}{1} \\
 &= 91\%
 \end{aligned}$$

SALES VARIANCES

It is important to exercise control not only over manufacturing costs, but also over the sales of an enterprise. If only one type of product is manufactured it is usual to calculate only two variances, namely, *price* and *quantity*.

The following example illustrates the sales variances more fully:

Example 14.12

Sales:

Actual	1 000 units @ R18 each
Budgeted	1 200 units
Standard cost per unit	R10.00
Standard selling price per unit	R17.75

Required

Calculate the following:

- Sales price variance
- Sales quantity variance

Solution 14.12

(a) Sales price variance	$(AP - SP) \times AQ$ $= (18 - 17.75) \times 1\,000$ $= R250 (F)$
(b) Sales quantity variance	$(AQ - SQ) \times SP$ $= (1\,000 - 1\,200) \times 17.75$ $= R3\,550 (U)$

where: AP = actual selling price
 SP = standard selling price
 AQ = actual quantity sold
 SQ = standard (budgeted) sales

Sales variances are the opposite of production variances because they represent income and not costs.

However, sales variances are not usually used on their own, but are linked with cost of sales variances because the latter variances have as important an influence on the budgeted gross profit as the sales variances. Therefore, the sales and cost of sales variances are often referred to as the gross profit or sales margin variances.

Diagram 14.16 illustrates the sales and cost of sales variances:

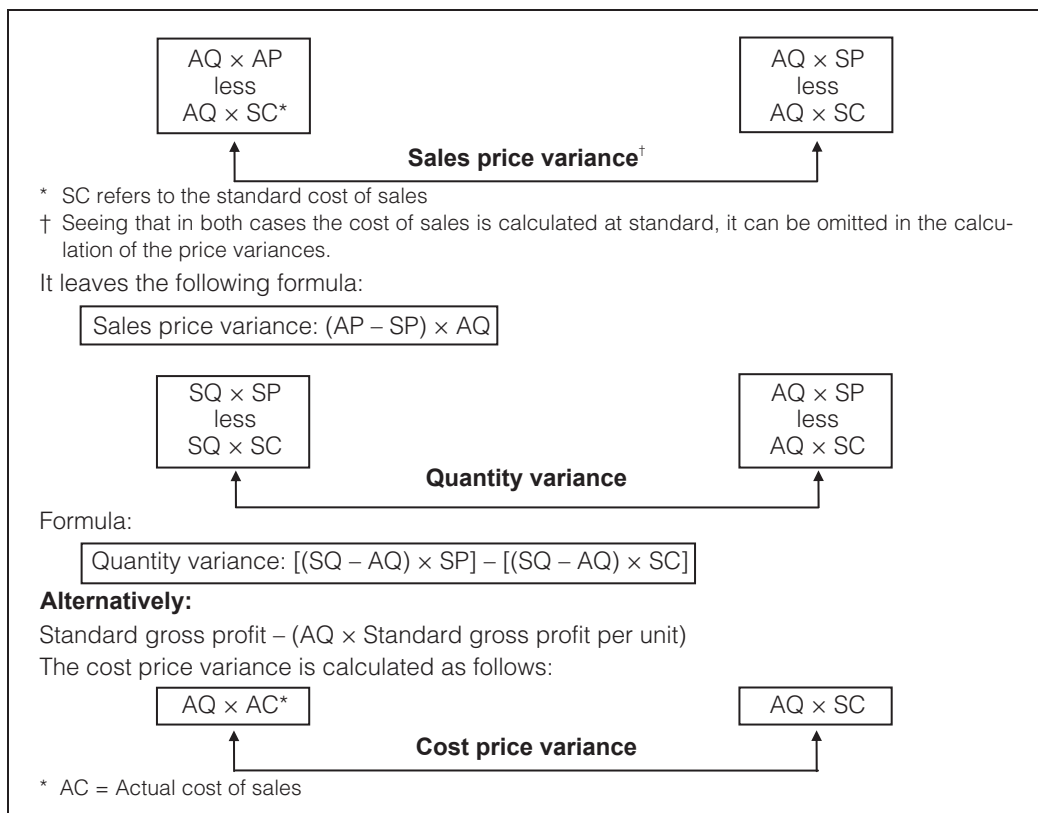


Diagram 14.16

The question that arises is: what will happen if more than one type of product is manufactured and sold?

In such a situation, there is also a mix or composition variance in sales.

The following simple example is used to explain its calculation:

Example 14.13

XY Ltd manufactures products A and B. The following information is relevant to the two products:

	Budgeted sales (units)	Budgeted production cost per unit R	Standard sales price per unit R	Actual sales (units)	Sales R
A	600	10	20	550	9 900
B	400	5	10	360	3 960
	<u>1 000</u>			<u>910</u>	<u>13 860</u>

continued

Required

Calculate the following variances:

- (a) Sales price.
- (b) Sales quantity.
- (c) Sale mix.
- (d) Sales volume.

Solution 14.13

- (a) Sales price variance: Standard sales – Actual sales

$$\begin{aligned} \text{A: } (550 \times \text{R}20) - 9\,900 &= 1\,100 \text{ (U)} \\ \text{B: } (360 \times \text{R}10) - 3\,960 &= 360 \text{ (F)} \\ &\underline{\hspace{1.5cm}} \\ &\text{R}740 \text{ (U)} \end{aligned}$$

- (b) Sales quantity variance: Standard gross income* – (AQ × Standard gross income per unit)

$$\begin{aligned} &= 8\,000 - [(550 \times 10) + (360 \times 5)] \\ &= 8\,000 - 7\,300 \\ &= \text{R}700 \text{ (U)} \end{aligned}$$

* Standard gross income:

$$\begin{aligned} \text{A: } 600 \times (\text{R}20 - 10) &= \text{R}6\,000 \\ \text{B: } 400 \times (\text{R}10 - 5) &= 2\,000 \\ &\underline{\hspace{1.5cm}} \\ &\text{R}8\,000 \end{aligned}$$

Average standard gross income per unit:

$$\begin{aligned} &\text{R}8\,000 \\ &= \underline{\hspace{1.5cm}} \\ &\quad 1\,000 \\ &= \text{R}8 \end{aligned}$$

- (c) Sales mix variance: (AQ × Average standard gross income per unit) – (AQ × Average standard gross income per unit)
- $$\begin{aligned} &= (910 \times \text{R}8) - [(550 \times 10) + (360 \times 5)] \\ &= 7\,280 - 7\,300 \\ &= \text{R}20 \text{ (F)} \end{aligned}$$

- (d) Sales volume variance: Standard gross income – (AQ × Average standard gross income per unit)

$$\begin{aligned} &= 8\,000 \times (910 \times 8) \\ &= 8\,000 - 7\,280 \\ &= \text{R}720 \text{ (U)} \end{aligned}$$

Alternatively, the sales and cost of sales variances can be calculated separately and then consolidated so that the total gross profit variance can be obtained. The following example illustrates such an analysis:

Example 14.14

	Actual R	Budget R	Difference R
Sales	12 000	9 000	3 000
Less: Cost of sales	(8 000)	(6 300)	(1 700)
Gross profit	<u>4 000</u>	<u>2 700</u>	<u>1 300</u>
Selling price per unit	1.20	1.00	
Cost price per unit	0.80	0.70	

continued

Required

Calculate the following:

- (a) Sales price variance.
- (b) Sales quantity variance.
- (c) Cost price variance.
- (d) Cost quantity variance.
- (e) Total gross profit variance.

Solution 14.14

(a) Selling price variance	$(AP - SP) \times AQ$ $= (1.20 - 1.00) \times 10\,000^1$ $= R2\,000\ (F)$
(b) Sales quantity variance	$(AQ - SQ) \times SP$ $= (10\,000 - 9\,000) \times R1$ $= R1\,000\ (F)$
(c) Cost price variance	$(AC - SC) \times AQ$ $= (0.80 - 0.70) \times 10\,000$ $= R1\,000\ (U)$
(d) Cost quantity variance	$(AQ - SQ) \times SC$ $= (10\,000 - 9\,000) \times 0.70$ $= R700\ (U)$
(e) Total gross profit variance	Total of individual variances $= R2\,000\ (F) + R1\,000\ (F) + R1\,000\ (U) + R700\ (U)$ $= R1\,300\ (F)$

¹ $R12\,000 \div R1.20$ per unit

Analysis of variances

To control the manufacturing performance of an enterprise, the actual costs must be compared to the standard costs. Thus, the variances that exist are the starting point for further analysis and investigation. This information must be presented to management in an acceptable way in the form of a report which contains only the essential information, and management must study and analyse it thoroughly.

People in the manufacturing process to whom management has delegated authority can be held directly responsible for certain variances and after the explanations and feedback have been obtained the necessary corrective steps can then be taken.

Management will obviously devote more attention to variances caused by controllable costs than to those caused by uncontrollable costs. Favourable as well as unfavourable variances must be investigated. Unfavourable variances which occur because of high prices, poor raw materials and inefficiencies will usually be more thoroughly investigated, as they cause losses.

Favourable variances may sometimes give rise to unfavourable variances. For example, if cheaper raw materials which are inferior are purchased, the result might give rise to greater usage. It is senseless and time-consuming for management to devote attention to all the variances. The principle of *management by exception*, whereby attention is given only to the variances that are material, should be used.

PROBLEMS IN APPLICATION

It goes without saying that standard costs can be used in almost every sphere of management and in conjunction with all the different costing systems. The following example illustrates the application of standard costs in conjunction with direct and absorption costs:

Example 14.15

The following information was obtained from the books of Boniswa Ltd for Year 1 and Year 2:

Standard cost per unit

	R
Direct material	1.00
Direct labour	1.50
Variable overheads	0.50
Variable sales costs	0.25
Standard production per annum	200 000 units
Budgeted overheads (fixed) per annum	160 000
Selling price per unit	8
Operating statistics	

	Year 1	Year 2
Units sold	160 000	200 000
Units produced	210 000	190 000
	R	R
Actual overheads (fixed)	161 000	162 000
Administrative costs	50 000	50 000
Selling costs	60 000	60 000
Variances from standard costs	20 000 (U)	5 000 (F)

Required

Prepare the Statement of Profit and Loss according to:

- variable costing method.
- the absorption costing method.

Solution 14.15**a)****Statement of Profit and Loss – Variable method**

	Year 1 R	Year 1 R
Sales $160\,000 \times R8$	1 280 000	
$200\,000 \times R8$		1 600 000
<i>Less: Standard variable cost of sales</i>		
$160\,000 \times R3$	(480 000)	
$200\,000 \times R3$		(600 000)
	800 000	1 000 000
<i>Less: Variable sales and administrative costs</i>		
$160\,000 \times 0.25$	(40 000)	
$200\,000 \times 0.25$		(50 000)
	760 000	950 000
<i>Add/(Less): Variances from standard costs</i>	(20 000)	5 000
Marginal income	740 000	955 000
<i>Less: Fixed costs</i>	(271 000)	(272 000)
Overheads	161 000	162 000
Administrative costs	50 000	50 000
Sales costs	60 000	60 000
Net profit	R469 000	R683 000

b)**Statement of Profit and Loss – Absorption costing method**

	Year 1 R	Year 1 R
Sales $160\,000 \times R8$	1 280 000	
$200\,000 \times R8$		1 600 000
<i>Less: Standard cost of sales</i>	(608 000)	(760 000)
$160\,000 \times R3.00$	480 000	
$160\,000 \times R0.80$	128 000	
$200\,000 \times R3.80$		760 000
Standard gross profit	672 000	840 000
<i>Add/(Less): Variances from standard costs</i>	(20 000)	5 000
Gross profit at normal	652 000	845 000
Overheads over-/under-applied	7 000	(10 000)
	659 000	835 000
<i>Less: Sales and administrative costs</i>	(150 000)	(160 000)

continued

	Year 1 R	Year 1 R
Variable		
$160 \times R0.25$	40 000	
$200\,000 \times R0.25$		50 000
Fixed: Sales and administrative costs	50 000	50 000
Sales costs	60 000	60 000
	<u>R509 000</u>	<u>R675 000</u>
Determination of overheads rate:		
$\frac{R160\,000}{200\,000} = 80\text{c per unit}$		
* Actual overheads		
Applied overheads		
$210\,000 \times 0.80$	168 000	
$190\,000 \times 0.80$		152 000
Less: Actual overheads (given)	(161 000)	(162 000)
Over-/under-applied	<u>7 000</u>	<u>(10 000)</u>
Reconciliation of net income according to the two methods:		
	Year 1 R	Year 1 R
Net profit per the variable costing method	469 000	683 000
Add: Fixed costs in stock figure		
$50\,000 \times R0.80$	40 000	(40 000)
$40\,000 \times R0.80$		32 000
Net profit per the absorption costing method	<u>509 000</u>	<u>675 000</u>

RECONCILIATION OF ACTUAL COSTS WITH STANDARD COSTS

As has already been mentioned, a variance exists when the actual situation differs from the standard or budgeted projection. Thus, it is clear that the total of all the variances must be equal to the net difference between the standard that was set and what is actually achieved. The reconciliation is illustrated in the following example:

Example 14.16

The following information was taken from the books of Turf Horse Equipment Ltd, which manufactures a single type of horse saddle:

	Budgeted	Actual
Opening stock	0	0
Closing stock	0	0
Units manufactured	5 600	5 000
Material used (kg)	28 000	26 000
Labour hours	56 000	55 000

continued

	R	R
Material purchased	140 000	133 000
Wages	168 000	170 500
Variable manufacturing overheads	28 000	26 000
Sales	672 000	605 000
Fixed manufacturing overheads	84 000	94 000

Required

- Calculate the budgeted and the actual net profit.
- Calculate the necessary variances to reconcile the budgeted and actual net profit.
- Reconcile the net profit as calculated in (a) above.

Solution 14.16

As there is no opening and closing stock, all the products manufactured are sold. Further, the material usage is equivalent to the material purchases.

(a) Statement of Profit and Loss

	Budgeted R	Actual R
Sales	672 000	605 000
Less: Production costs	(420 000)	(423 500)
Material	140 000	133 000
Labour	168 000	170 500
Overheads – variable	28 000	26 000
– fixed	84 000	94 000
Net profit	252 000	181 500

(b) Calculations

Standard quantities/hours per finished product:

Material: 28 000 kg ÷ 5 600	=	5 kg
Hours: 56 000 ÷ 5 600	=	10 hours
Material: Standard price	=	R140 000 ÷ 28 000
	=	R5
Labour: Standard rate	=	R168 000 ÷ 56 000
	=	R3
Overheads: Variable rate	=	R28 000 ÷ 56 000
	=	R0.50
Fixed rate	=	R84 000 ÷ 56 000
	=	R1.50

Standard cost per finished product:

	R
Direct material 5 kg × R5	= 25
Direct labour 10 hours × R3	= 30
Overheads 10 hours × R2	= 20
	<u>75</u>

Standard income per finished product:

	R
Sales 672 000 ÷ 5 600	= 120
Costs	= <u>75</u>
Income	45

continued

Variances

	F R	U R
Material		
Price $(AP \times AQ) - (SP \times AQ)$ 133 000 – (R5 × 26 000)		3 000
Quantity $(AQ \times SP) - (SQ \times SP)$ (26 000 × R5) – (5 000 × 5 × R5)		5 000
Labour		
Rate $(AR \times AT) - (SR \times AT)$ R170 500 – (R3 × 55 000)		5 500
Efficiency $(AT \times SR) - (ST \times SR)$ (55 000 × R3) – (5 000 × 10 × R3)		15 000
Overheads		
Variable:		
Rate $(AR \times AT) - (SR \times AT)$ 26 000 – (R0.50 × 55 000)	1 500	
Efficiency $(AT \times SR) - (ST \times SR)$ (55 000 × R0.50) – (5 000 × 10 × R0.50)		2 500
Fixed		
Expenditure AA – BA 94 000 – 84 000		10 000
Volume $(BT \times SR) - (ST \times SR)$ 84 000 – (5 000 × 10 × R1.50)		9 000
Sales		
Price $(AP \times AQ) - (SP \times AQ)$ 605 000 – (R120 × 5 000)	5 000	
Volume $(5 000 \times R45) - (5 600 \times R45)$		27 000
	<u>6 500</u>	<u>77 000</u>

(c) Reconciliation

	R
Profit (budgeted)	252 000
Less: Net variances	(70 500)
Favourable	6 500
Unfavourable	77 000
Profit (actual)	<u>181 500</u>

where: AA = actual amount
BA = budgeted amount
BT = budgeted time
ST = standard time
AT = actual time
AP = actual price
SP = standard price
SR = standard rate

SUMMARY

The purpose of a standard costing system is to furnish information to management timeously by means of cost reports. Standard costing is generally applied in enterprises which manufacture homogeneous products, but it can also be used successfully in job costing systems and service industries.

There are four different methods for setting standard levels of business activity within an enterprise, namely, the expected actual level of business activity, the basic level of business activity, the ideal or theoretical level of business activity and the normal level of business activity.

Standard costing cards show standard quantities and prices for each material, standard labour rate and standard hours, standard variable and fixed manufacturing overheads, as well as total standard costs allowed.

When material standards are established, there will be a price and a quantity standard. Two main variances can occur, namely, material price variance, which can be based on the number of units purchased or number of units issued, and a material quantity variance.

Price variances can be attributed to faulty standards and price changes. Material quantity variances can be due to, among others, faulty standards, poor material control, quality of material, working conditions, equipment, and skills of employees.

When more than one type of material is used in the manufacturing process and the ratio or composition differs from the standard ratio according to the standard material specifications, the quantity variance can be divided into a yield variance and a mix variance.

Like material, when labour standards are set, two main variances will be calculated, namely, a labour rate variance and a labour efficiency variance.

Rate variances can be attributed to incorrect labour rates, changes in wage tariffs and overtime. Labour efficiency variances can be due to, among others, faulty standards, properly or poorly trained employees, good or poor supervision, working conditions, equipment, and employee skills.

Labour efficiency variance can be divided into two sub-variances, namely, composition (mix) variance and yield variance.

All overheads need to be divided into fixed and variable categories before standards can be set. This is due to the semi-fixed nature of certain overheads. Variable costs are constant per unit, because they vary in direct ratio to the level of business activity, while fixed costs are variable per unit when the level of activity differs from month to month. Overhead tariffs are usually based on direct labour hours, machine hours or are expressed as a percentage of direct labour costs.

Variable manufacturing overheads variances consist of an efficiency variance and an expenditure variance. The two main variances in fixed manufacturing overheads are the expenditure and the volume variance. The fixed overhead volume variance can be subdivided into a capacity and an efficiency variance. In turn, it can be divided into a revised capacity variance and a calendar variance.

With the combined variable and fixed manufacturing overheads method, no distinction is made between fixed and variable manufacturing overheads. In this method, variances can be analysed under the two-variance analysis method or under the three-variance analysis method.

At the end of an accounting period, the balance of the variance account is directly transferred to the cost of sales account or transferred to the cost of sales and the various accounts on which it has a bearing.

Sales variances are the opposite of production variances, because they represent income and not costs. Usually, if only one type of product is sold, only two variances are calculated, namely, price and quantity. If more than one product is sold, there is also a mix and a volume variance.

However, sales variances are not usually used on their own, but are linked with cost of sales variances, because the latter variances have as important an influence on budgeted gross income as the sales variances.

To control the manufacturing and sales performances of an enterprise, actual costs and prices must be compared to the standards. Thus, the variances that exist are the starting point for further analysis and investigation.

Standard costing can be used in almost every sphere of management and in conjunction with both the direct and absorption costing systems. A variance exists when the actual situation differs from the standard or budgeted projection. The total of all variances must be equal to the net difference between the standard that was set and what was actually achieved.

PERSPECTIVES ON COSTING

Knowledge

You should know the following:

- ☐ key concepts in standard costing theory;
- ☐ key definitions in standard costing theory;
- ☐ manufacturing costs can be determined by historical costs or by pre-calculated methods;
- ☐ standard costing is generally applied in enterprises where homogenous products are manufactured or homogeneous services are rendered; It can also be used successfully in job costing systems;
- ☐ standard costs are mainly used for cost control, stock valuation, planning for budgeting purposes and fixing of prices;
- ☐ standards can be determined when the level of business activity is decided upon;
- ☐ there are four different standard levels of business, namely, the expected actual level of business activity, the basic level of business activity, the ideal level of business activity and the normal level of business activity;
- ☐ the advantages of standard costing;
- ☐ the material price variance can be calculated by the purchase price variance or the issue price variance;
- ☐ two main material variances can occur, namely, the price of material and the quantity of material used;
- ☐ the formula for the total material variance is: $(AQ \times AP) - (SQ \times SP)$;
- ☐ the formula for the price variance is: $(AP \times AQ) - (SP \times AQ)$ or $(AP - SP) \times AQ$;
- ☐ the formula for the quantity variance is: $(AQ \times AP) - (SQ \times SP)$ or $(AQ - SQ) \times SP$;
- ☐ two main variances can occur, namely, labour rate variance and labour efficiency variance;

- ☐ the labour efficiency variance can be divided into the mix variance and yield variance;
- ☐ the formula for the total labour variance is: $(AT \times AR) - (ST \times SR)$;
- ☐ the formula for the labour rate variance is: $(AR \times AT) - (SR \times AT)$ or $(AR - SR) \times AT$;
- ☐ the formula for the labour efficiency variance is: $(AT \times SR) - (ST \times SR)$ or $(AT - ST) \times SR$;
- ☐ the variable manufacturing overheads variance can be divided into the expenditure variance and efficiency variance;
- ☐ the formula for the efficiency variance is: $(AT \times SR) - (ST \times SR)$ or $(AT - ST) \times SR$;
- ☐ the expenditure variance is: $(AR \times AT) - (SR \times AT)$ or $(AR - SR) \times AT$;
- ☐ the fixed manufacturing overheads variance is the aggregate of the expenditure and volume variances;
- ☐ the expenditure variance is: Actual fixed overheads – budgeted fixed overheads;
- ☐ the volume variance is: Budgeted fixed overheads – standard overheads;
- ☐ the sales variance can be divided into the sales price variance and the sales quantity variance;
- ☐ the formula for the selling price variance is: $(AQ \times AP) - (AQ \times SP)$ or $(AP - SP) \times AQ$;
- ☐ the quantity variance is: $(SQ \times SP) - (AQ \times SP)$ or $(SQ - AQ) \times SP$; and
- ☐ standard costs can be used in almost every sphere of management and in conjunction with all different costing systems.

Skills

You should be able to:

- ☐ calculate and interpret all the material-related variances;
- ☐ record material purchases transactions at actual and standard costs;
- ☐ calculate and interpret all the labour-related variances;
- ☐ record labour cost transactions at actual and standard costs;
- ☐ separate variable and fixed manufacturing overheads variances;
- ☐ calculate all the overhead-related variances;
- ☐ apply both the two- and three-variance analysis methods;
- ☐ calculate standard costing ratios;
- ☐ calculate and analyse all the sales-related variances;
- ☐ apply standard costs in conjunction with direct and absorption costs; and
- ☐ reconcile actual with standard costs.

KEY TERMS AND CONCEPTS

Basic activity level	427	Quantity variance	429
Expected activity level	427	Price variance	429
Ideal activity level	427	Standard costing	424
Normal activity level	427	Standard costs	425

REVIEW PROBLEMS

Problem 14.1

Mlibazisi (Pty) Ltd manufactures a single product. Their standard costing information is as follows:

One product needs 2 kg of material A at R20 per kg and 1 kg of material B at R30 per kg.

Actual information:

Material A	210 kg at R19 per kg
Material B	110 kg at R35 per kg
Units produced	100 units

Required

Calculate the:

- Total variance
- Price variance
- Quantity variance
- Mix variance
- Yield variance

Solution 14.1

(a) Total material variance	=	$(AP \times AQ) - (SP \times SQ)$
Material A	=	$(R19 \times 210 \text{ kg}) - (R20 \times 200 \text{ kg}) = R10 \text{ (F)}$
Material B	=	$(R35 \times 110 \text{ kg}) - (R30 \times 100 \text{ kg}) = R850 \text{ (U)}$
	=	$R10 \text{ (F)} + R850 \text{ (U)} = R840 \text{ (U)}$
(b) Material price variance	=	$(AP - SP) \times AQ$
Material A	=	$(R19 - R20) \times 210 \text{ kg} = R210 \text{ (F)}$
Material B	=	$(R35 - R30) \times 110 \text{ kg} = R550 \text{ (U)}$
	=	$R210 \text{ (F)} + R550 \text{ (U)} = R340 \text{ (U)}$
(c) Material quantity variance	=	$(AQ - SQ) \times SP$
Material A	=	$(210 \text{ kg} - 200 \text{ kg}) \times R20 = R200 \text{ (U)}$
Material B	=	$(110 \text{ kg} - 100 \text{ kg}) \times R30 = R300 \text{ (U)}$
	=	$R200 \text{ (U)} + R300 \text{ (U)} = R500 \text{ (U)}$

Verification of the calculation of the total material variance:

Total material variance	=	Material price variance + material quantity variance
	=	$R340 \text{ (U)} + R500 \text{ (U)}$
	=	$R840 \text{ (U)}$
(d) Material mix variance	=	$[AQ - (SQ \div SM) \times AM] \times SP$
Material A	=	$\{210 \text{ kg} - (200 \text{ kg} \div 300) \times 320\} \times R20 = 66.67 \text{ (F)}$
Material B	=	$\{110 \text{ kg} - (100 \text{ kg} \div 300) \times 320\} \times R30 = R100 \text{ (U)}$
	=	$R66.67 \text{ (F)} + R100 \text{ (U)} = R33.33 \text{ (U)}$

- (e) Material yield variance = $\{(SQ \div SM) \times AM - SQ\} \times SP$
 Material A = $[(200 \text{ kg} \div 300 \times 320) - 200] \times R20 = R266.67$
 (U)
 Material B = $[(100 \text{ kg} \div 300 \times 320) - 100] \times R30 = R200$ (U)
 = $R266.67$ (U) + $R200$ (U) = $R466.67$ (U)

Verification of the calculation of the quantity variance:

- Material quantity variance = Material mix variance + material yield variance
 = $R33.33$ (U) + $R466.67$ (U)
 = $R500$ (U)

Problem 14.2

Bambanani (Pty) Ltd manufactures a single product. The standard labour information is as follows:

One product needs an hour's direct labour at R20 per hour and another hour at R25 per hour.

Actual information: Actual hours worked
 90 hours @ R18 and 70 hours @ R30
 Complete units manufactured
 85 units

Required

Calculate the:

- (a) Total labour variance
 (b) Labour rate variance
 (c) Labour efficiency variance
 (d) Labour mix variance
 (e) Labour yield variance

Solution 14.2

- (a) Total labour variance = $(AR \times AH) - (SR \times SH)$
 Labour rate at R20 per hour = $(R18 \times 90 \text{ hrs}) - (R20 \times 85 \text{ hrs}) = R80$ (F)
 Labour rate at R25 per hour = $(R30 \times 70 \text{ hrs}) - (R25 \times 85 \text{ hrs}) = R25$ (F)
 = $R80$ (F) + $R25$ (F) = $R105$ (F)
 (b) Labour rate variance = $(AR - SR) \times AH$
 Labour rate at R20 per hour = $(R18 - R20) \times 90 \text{ hrs} = R180$ (F)
 Labour rate at R25 per hour = $(R30 - R25) \times 70 \text{ hrs} = R350$ (U)
 = $R180$ (F) + $R350$ (U) = $R170$ (U)
 (c) Labour efficiency variance = $(AH - SH) \times SR$
 Labour rate at R20 per hour = $(90 \text{ hrs} - 85 \text{ hrs}) \times R20 = R100$ (U)
 Labour rate at R25 per hour = $(70 \text{ hrs} - 85 \text{ hrs}) \times R25 = R375$ (F)
 = $R275$ (F)

Verification of the calculation of the total labour variance:

- Total labour variance = Labour rate variance + labour efficiency variance
 = $R170$ (U) + $R275$ (F)
 = $R105$ (F)

- (d) Labour mix variance = $[AH - ((SH \div SM) \times AM)] \times SR$
 Labour rate at R20 per hour = $[90 \text{ hrs} - ((85 \text{ hrs} \div 170) \times 160)] \times R20 = R200 \text{ (U)}$
 Labour rate at R25 per hour = $[70 \text{ hrs} - ((85 \text{ hrs} \div 170) \times 160)] \times R25 = R250 \text{ (F)}$
 = $R200 \text{ (U)} + R250 \text{ (F)} = R50 \text{ (F)}$
- (e) Labour yield variance = $[(SH \div SM) \times AM - SH] \times SP$
 Labour rate at R20 per hour = $[(85 \text{ hrs} \div 170) \times 160 - 85] \times R20 = R100 \text{ (F)}$
 Labour rate at R25 per hour = $[(85 \text{ hrs} \div 170) \times 160 - 85] \times R25 = R125 \text{ (F)}$
 = $R100 \text{ (F)} + R125 \text{ (F)} = R225 \text{ (F)}$

Verification of the calculation of the quantity variance:

$$\begin{aligned} \text{Total labour efficiency variance} &= \text{Labour mix variance} + \text{labour yield variance} \\ &= R50 \text{ (F)} + R225 \text{ (F)} \\ &= R275 \text{ (F)} \end{aligned}$$

Problem 14.3

Richards Bay (Pty) Ltd manufactures chain saws. Its standard information is as follows:

Fixed manufacturing overheads	R125 000
Machine hours	25 000 machine hours

Five hours are needed to manufacture one chain saw

Actual results:

Fixed overheads	R128 000
Machine hours	24 500 machine hours
Chain saws manufactured	5 200

Required

Calculate the following variances:

- Total fixed overhead variance
- Expenditure variance
- Volume variance
- Efficiency variance
- Capacity variance

Solution 14.3

- (a) Total fixed overhead variance = Actual overheads – (SR × SQ)
 = $R128\,000 - (R25 \times 5\,200 \text{ units})$
 = $R2\,000 \text{ (F)}$
- (b) Expenditure variance = Actual overheads – Budgeted overheads
 = $R128\,000 - R125\,000$
 = $R3\,000 \text{ (U)}$
- (c) Volume variance = $(BH - SH) \times SR$
 = $(25\,000 - 26\,000) R5$
 = $R5\,000 \text{ (F)}$

Verification of the calculation of the total fixed overhead variance:

$$\begin{aligned} \text{Total fixed overhead variance} &= \text{Expenditure variance plus volume variance} \\ &= R3\,000 \text{ (U)} + R5\,000 \text{ (F)} \\ &= R2\,000 \text{ (F)} \end{aligned}$$

- (d) Efficiency variance $= (AH - SH) \times SR$
 $= (24\,500 - 26\,000) \times R5$
 $= R7\,500 (F)$
- (e) Capacity variance $= (BH - AH) \times SR$
 $= (25\,000 - 24\,500) \times R5$
 $= R2\,500 (U)$

Verification of the calculation of the total volume variance:

- Total volume variance $=$ Efficiency variance plus Capacity variance
 $= R7\,500 (F) + R2\,500 (U)$
 $= R5\,000 (F)$

Problem 14.4

Abantwana Manufacturers (Pty) Ltd manufactures and sells two products, namely, Product A and Product B. The following information is available:

Budgeted sales		Budgeted unit cost	Standard sales price per unit	Actual sales	Sales value
Units		R	R	Units	R
Product A	960	16	32	880	25 344
Product B	640	8	16	576	9 792
	<u>1 600</u>			<u>1 456</u>	<u>35 722</u>

Required

Calculate the following variances:

- (a) Sales price
(b) Sales volume
(c) Sales mix
(d) Sales quantity

Solution 14.4

- (a) Sales price variance $=$ (Actual selling price – budgeted selling price) actual volume
Product A $= [(R25\,344 / 880) - R32] \times 880 = R2\,816 (U)$
Product B $= [(R9\,792 / 576) - R16] \times 576 = R576 (F)$
 $= R2\,240 (U)$
- (b) Sales volume variance $=$ Standard gross income* – (AQ $\times$ standard gross income per unit)
 $= R20\,480 - [(880 \times R16) + (576 \times R8)]$
 $= R20\,480 - R18\,688$
 $= R1\,792 (U)$

* Standard gross income:

Product A $960 \times (R32 - R16)$	$=$	15 360
Product B $640 \times (R16 - R8)$	$=$	<u>5 120</u>
		<u>20 480</u>

Average gross income per unit

	=	$\frac{20\,480}{1\,600}$
	=	R12.80
(c) Sales mix variance	=	(AQ × average actual gross income per unit) – (AQ × average standard gross income per unit)
Product A	=	(1 456 – R12.80) – {(880 × R16) + (576 × R8)}
Product B	=	(R18 636.80 – R18 688)
	=	R51.20 (F)
(d) Sales quantity variance	=	Standard gross income – (AQ × average standard gross income per unit)
Product A	=	R20 480 – (1 456 × R12.80)
Product B	=	R20 480 – R18 636.80
	=	R1 843.20 (U)

Problem 14.5

Ziyaad & Sons (Pty) Ltd bravely ventured into the glue industry and now produce their own brand of industrial-strength glue. After their previous financial manager suddenly resigned, you were appointed to the position.

The previous financial manager prepared the following performance report on a variable costing basis for submission to the Financial Director:

Performance Report for July 2015

	Budget	Standard Flexed	Actual	Variance Report
	R	R	R	R
Sales	4 000 000	3 840 000	3 744 000	96 000 A
Less: Variable cost of sales	(2 450 000)	(2 352 000)	(2 343 110)	(8 890) F
Direct material	1 750 000	1 701 000	1 748 000	47 000 A
Direct labour	300 000	291 600	255 150	36 450 F
Variable overheads	400 000	388 800	369 360	19 440 F
Production costs	2 450 000	2 381 400	2 372 510	8 890 F
+ Opening stock finished goods	0	0	0	
– Closing stock finished goods	0	29 400	29 400	
Contribution	1 550 000	1 488 000	1 400 890	87 110 A
Less: Fixed overhead	(1 400 000)	(1 400 000)	(1 350 000)	(50 000) F
Profit	150 000	88 000	50 890	37 110 A

You decided to investigate the production process further and discovered the following:

Standard Mix to produce 960 ml of Solvent

Chemical Zinex	600 ml @ R11.00 per litre
Chemical Tistex	400 ml @ R20.50 per litre
Bondex	200 ml @ R10.00 per litre

Actual Inputs for July 2015

Chemical Zinex	60 000 litres @ R12.00 per litre
Chemical Tistex	40 000 litres @ R20.50 per litre
Bondex	20 000 litres @ R10.40 per litre

Other information:

1. The budgeted production output for July 2015 was 100 000 litres. There is a loss of 20% on input when calculating the amount of standard output produced.
2. You personally verified that there were 1 200 litres of unsold glue at the end of July 2015, valued at standard cost. There were no stocks of direct material at the beginning or end of July 2015.
3. The standard machine time to make one litre of glue is 30 minutes. Direct labour hours are always equivalent to machine hours. The standard rate for labour is R6 per hour. Actual labour hours were 40 500 hours.
4. Variable overheads are absorbed on a per litre output basis.
5. The solvent was sold at a uniform price throughout July 2015.

The actual hours worked during the month of July was 40 500.

Required

For the purposes of reporting to management, *calculate* the relevant sales, material, labour and overhead variances. Show all workings clearly.

Solution 14.5**Sales Margin Volume:**

$$(AV - BV) \times SM$$

$$\begin{array}{ccc} (96\,000\text{l} - 100\,000\text{l}) \times R15.50 & = & R62\,000\text{A} \\ (W1) & & (W3) \end{array}$$

Sales Margin Price:

$$(AP - BP) \times AV$$

$$\begin{array}{ccc} (R39 - R40) \times 96\,000\text{l} & = & R96\,000\text{A} \\ (W2) & & (W3) \end{array}$$

or taken directly from performance report

Workings

W1 Actual Output = 97 200 litres. Closing stock of 1 200 litres, $\therefore$ Sales = **96 000 litres**

W2 Actual selling price = R3 744 000 $\div$ 96 000 l = **R39**

W3 Standard Product Cost = Closing Stock $\div$ 1 200 l = **R24.50**
 Standard Selling Price = R4 000 000 $\div$ 100 000 litres = **R40.00**
 Standard Contribution = R40 – R24.50 = **R15.50**

Material Price Variances

(SP – AP) $\times$ AQ

Zinex	(R11.00 – R12.00) $\times$ 60 000l	= R60 000A
Tistex	(R20.50 – R20.50) $\times$ 40 000l	= R 0
Bondex	(R10.00 – R10.40) $\times$ 20 000l	= R 8 000A
		<u>R68 000A</u>

Material Efficiency Variance

(SQ – AQ) $\times$ SP

Zinex	(600/1200 $\times$ 121 500) $\therefore$ (60 750 – 60 000) $\times$ R11.00	= R8 250F
Tistex	(400/1200 $\times$ 121 500) $\therefore$ (40 500 – 40 000) $\times$ R20.50	= R10 250F
Bondex	(200/1200 $\times$ 121 500) $\therefore$ (20 250 – 20 000) $\times$ R10.00	= R2 500F
		<u>R21 000F</u>

Std input for 97 200 litres of output = 97 200 litres output $\div$ 0.8 = 121 500 litres

Mix Variances

Nil (AQ used was in standard mix proportions)

Yield Variance

(Actual Yield – Std Yield from actual input) $\times$ std cost per unit of output

Standard Yield = 120 000 litres input – 20% = 96 000 litres

Actual yield	97 200 litres
– Standard yield	<u>96 000 litres</u>
	1 200 A

x std cost per litre $\times$ R17.50 = R21 000F
(W4)

Workings – W4

Standard Cost per 1 200ml input =

Zinex	600 ml @	R11.00 = R 6.60
Tistex	400 ml @	R20.50 = R 8.20
Bondex	200 ml @	R10.00 = R 2.00

R16.80 per 1.2 l of input

Per 1 000ml input = $R16.80 \div 1.2$
= R14.00

Per 1 000ml output = $R14.00 \div 0.80$ (Standard loss = 20%)
= R17.50

or Per 1 000ml output = $R16.80 \times (1000 \div 960) = R17.50$

or Budget Cost $\div$ Budget Output = $R1\ 750\ 000$

$\div 100\ 000$ = R17.50

or Std Cost $\div$ Actual Output = $R1\ 701\ 000 \div 97\ 200$ = **R17.50**

Labour Rate Variance

$(SR - AR) \times AH$

$(R6 - R6.30) \times 40\ 500 = R12\ 150A$

Labour Efficiency Variance

$(SH - AH) \times SR$

$(48\ 600 - 40\ 500) \times R6 = R48\ 600F$

Workings

Note: Labour hours equates to machine hours

Actual Rate = Actual Wages $\div$ Actual Hours
= $R255\ 150 \div 40\ 500 = \mathbf{R6.30}$

Standard Hours = $97\ 200$ litres $\times$ 30 mins per litre
= **48 600 hours**

Variable Overhead Expenditure

$(BVO - AVO)$

$R388\ 800 - R369\ 360 = R19\ 440F$

Variable Overhead Efficiency

Nil Base on actual output

(1)

Fixed Overhead Variance

$BFO - AFO$

$R1\ 400\ 000 - R1\ 350\ 000 = R50\ 000F$

EXERCISES

14.1

Explain how a standard costing system, and especially the different variances which can be calculated, can be used as a management tool to control costs.

14.2

Standards are often confused with budgets. Explain the difference between the two concepts.

14.3

The Springbuck Company uses a standard costing system for recording transactions in respect of the manufacturing of Product Y. The standard costs for one unit of the product are as follows:

	R
Direct material (100 kg)	150
Direct labour (50 hours)	150
Manufacturing overheads (50 hours @ R2 per hour)	100

The operating results for the month were as follows:

- 1 There were no opening stocks
- 2 Material purchased on credit: 250 000 kg @ R1.48 per kg
- 3 Material issued: 198 000 kg
- 4 Direct labour: 91 000 hours @ R3.05 per hour
- 5 Actual factory overheads: R182 598 (Budgeted: Variable R150 000; Fixed R50 000)
- 6 Units completed and transferred: 1 700
- 7 Closing stock work in process: 200 (100% completed in respect of material and 50% completed in respect of labour and overheads)
- 8 Credit sales: 1 500 units @ R600 each
- 9 Selling and administrative costs paid per cheque: R80 000

Required

- (a) Calculate the different variances for the three cost elements. (Only the three-variance analysis is required in respect of overheads.)
- (b) Show the entries in the general ledger accounts in respect of the above transactions.

14.4

Impala (Pty) Ltd manufactures a single product in standard batches of 200 units. The standard costs to manufacture one batch of 200 units are as follows:

	R
Material A (30 litre)	90
Material B (20 litre)	20
Direct labour (30 hours)	75
Factory overheads (25 machine hours)	50

The standard overheads rate is determined as follows:

Fixed overheads (R5 100/3 400)	R1.50
Variable overheads (R1 700/3 400)	R0.50

Transactions during the month were as follows:

- 1 Material purchased on credit:

Material A:	1 000 litre @ R2.90 per litre
	2 000 litre @ R3.10 per litre
	1 500 litre @ R3.25 per litre
Material B:	2 000 litre @ R0.90 per litre
	1 500 litre @ R0.95 per litre

- 2 Direct labour costs: 1 000 hours @ R2.45 per hour
 1 500 hours @ R2.55 per hour
 1 750 hours @ R2.60 per hour
- 3 Actual manufacturing overheads: R6 750
- 4 Material issued according to the FIFO basis:
 Material A: 4 400 litre
 Material B: 3 250 litre
- 5 Machine hours: 3 500
- 6 30 000 units (150 batches) were manufactured.
- 7 There was no stock at the beginning or end of the period.

Required

Calculate the following variances:

Material	Purchase price Issue price Quantity Mix Yield
Labour	Rate Efficiency
Overheads	Two-variance method Three-variance method

14.5

Kashmina (Pty) Ltd manufactures a single type of product and uses a standard costing system to calculate the cost price. The standard cost per unit of the product is compiled as follows:

	R
Material (50 kg @ R20 per kg)	1 000
Direct labour (20 hours @ R5 per hour)	100
Overheads (30 machine hours @ R1.50 per hour)	45

The following variable budget was used to calculate the overheads rate:

		80%	90%	100%
Machine hours	24 000	27 000	30 000	
Overheads:	Fixed	R15 000	R15 000	R15 000
	Variable	R24 000	R27 000	R30 000

Additional information

Material purchased and issued	52 000 kg @ R20.10 per kg
Direct labour cost	19 900 hours @ R5.10 per hour
Actual overheads	R45 500
Finished products completed and transferred	1 000 units

Opening stock work in process	20 units (Material 100%-completed; Labour and overheads 50%- completed)
Closing stock work in process	80 units (Material 100%-completed; Labour and overheads 50%- completed)

Required

Calculate all the variances in respect of material, labour, and manufacturing overheads (only the two-variance method).

14.6

Mandiswa Ltd manufactures a product that has the following standard material composition in respect of 25 200 completed products.

Material	Quantity	Standard price per kilogram R
A	50 kg	2
B	200 kg	3
C	150 kg	5

The following materials were used to manufacture the 25 200 units:

Material	Quantity	Standard price per kilogram R
A	55 kg	2.10
B	230 kg	3.50
C	155 kg	4.75

Additional information

1 Budgeted information:	Fixed overheads	R150 000
	Variable overheads per labour hour	R0.80
	Estimated production capacity	125 000 labour hours
2 Standard to manufacture 1 unit		5 hours
3 Actual information	Units manufactured	25 200 units
	Labour hours	126 710 hours
	Fixed overheads	R150 000
	Variable overheads	R103 200

Required

(a) Calculate the following:

- Material
 - Total variance
 - Price variance
 - Quantity variance
 - Mix variance
 - Yield variance

Overheads Standard overheads per unit
Overheads applied to production
Variances according to the two- and three-variance method

- (b) Record the manufacturing overheads according to the three-variance method in the ledger accounts of the enterprise.

14.7

Shinto Mall (Pty) Ltd uses a standard costing system in the manufacturing of a single type of product. The following information shows the budgeted and actual figures for March 2015:

	Budgeted R	Actual R
Turnover:		
1 250 units @ R1 200 each	1 500 000	
1 180 units @ R1 250 each		1 475 000
Cost of sales (per unit):		
Material		
Budgeted 2.8 kg; Actual 2.5 kg	420	390
Labour		
Budgeted 13 hours; Actual 12 hours	182	174
Variable overheads	182	192
Fixed overheads	226	224

Additional information

- 1 There was no opening or closing stock.
- 2 In determining the standards, an assumption was made that the company operates at full capacity.

Required

- (a) Draft a variable budget for the month.
- (b) Calculate all the different variances.
- (c) Reconcile the standard net profit with the actual net profit.

15 Performance evaluation



LEARNING OUTCOMES

What are the consequences of decentralisation?

What are responsibility centres and what are their objectives?

How can divisional performance be measured?

What role does non-financial performance measurement play in the process of monitoring and controlling?

How are not-for-profit and public sector organisations monitored and controlled?

- Discuss and explain the advantages and disadvantages of decentralisation
- Identify and evaluate the different types of responsible centres
- Calculate and evaluate divisional performances based on profit, return on investment (ROI) and residual income (RI)
- Discuss the importance of non-financial performance measures in the role of performance management
- Evaluate the use of the Balanced Scorecard as a holistic performance management tool
- Discuss the aspects of value for money (VFM) in the context of not-for-profit and public sector organisations

CHAPTER OUTLINE

This chapter recognises the major structural complexities in many large organisations, including multi-national entities. Because of these existing complexities, it becomes ever more important to devise performance measures that ultimately motivate divisional managers to act in the best interest not only of their division but also of the organisation. Therefore, performance measures should be tailored to achieve organisational goals and needs to be more than just generic measurements.

The chapter discusses how an organisation can be structured and demonstrates the relevance of performance measurement tools in organisations as a method of control and improvement. Specific measurement tools are introduced that can be used to achieve this goal.

INTRODUCTION

Business mergers and acquisitions are common phenomena nowadays, resulting in the enormous expansion of some entities. Because of the size and diversity of the activities of some entities, control may be lost. The need to retain control leads to the creation of many levels of positions that may result in clumsy organisational structures. This is associated with bureaucratic red tape and inefficiency. To derive the maximum benefit from the overall size of a large enterprise while avoiding the disadvantages associated with it, decentralisation occurs more and more often.

Decentralisation *may be defined as dividing a large enterprise into more controllable units.*

In a **centralised enterprise**, *management is mainly responsible for their department or section cost.* In a decentralised unit, they are also typically responsible for the profitability of their business unit and are therefore motivated to achieve greater success.

CHOICE OF ORGANISATIONAL STRUCTURE

Segmentation hampers the set-up of an organisational structure. A single organisational structure is rarely the only solution. A structure that was suitable for a specific enterprise in the past is not necessarily adequate now. Changes in an enterprise's management, products, processes, and markets, require that the organisational structure be reviewed periodically for responsibility reporting, operational purposes and shareholder value creation.

The enterprise must decide during the set-up process of its organisational structure whether it will centralise or decentralise its operations. The viewpoints and philosophies of executive management are usually the determinants in this respect. Executive officers who are uncomfortable with delegating authority tend to centralise, while those who are comfortable with delegating authority tend to decentralise.

When an enterprise decentralises, it must decide how the segmentation will happen. The segmentation can be structured along product lines, geographical areas, or markets, depending on the set-up of the manufacturing processes of the enterprise. If the individual factories manufacture almost homogeneous products, but each serves its region, segmentation by region is advisable. If each factory produces a unique product, segmentation by product line may be the best option.

The next decision to be considered is whether business units will be operated as cost, profit, or investment centres. This brings us to the concept of 'responsibility centres'.

RESPONSIBILITY CENTRES

This section is discussed in chapter 13, but for your convenience will briefly be repeated.

A **responsibility centre** *is a defined unit of an enterprise for which the manager is responsible for the activities, costs, profit, and investments.*

The implementation of responsibility accounting requires the division of the enterprise into responsibility centres where performance can be controlled and evaluated effectively. These centres may be the following:

- ☐ cost centres;
- ☐ profit centres; and/or
- ☐ investment centres.

Cost centres

A **cost centre** is section or segment of a business in which managers are held responsible for the costs that originate there (cost centres are also discussed in chapter 7, which deals with overheads). All costs that originate directly from the cost centre are identified, with the supervisor or manager responsible for control over the cost centre. These costs are known as controllable costs and should be kept separate from non-controllable costs, which are allocated from other sections.

Profit centres

In a **profit centre**, managers are held responsible for controlling costs and income. Where a section markets its production mainly to another section in the enterprise, such selling prices are known as transfer prices. Net income is a performance measurement during the evaluation process of a manager of a specific profit centre. It also includes ratios such as net income to turnover, gross profit to turnover and the inventory turnover ratio.

Investment centres

In **investment centres**, it is the responsibility of the manager to control not only income and costs, but also capital allocation. Returns on amounts invested are the usual measures for effective control.

ADVANTAGES OF DECENTRALISATION

The advantages of decentralisation include the following:

- ☐ The quality of decision-making improves, because the official who is familiar with the situation makes the decisions.
- ☐ Speedier decisions occur since the chain of command is reduced.
- ☐ Managers of decentralised units enjoy more autonomy, and the transfer of responsibility makes the workplace challenging and satisfying.
- ☐ Decentralisation frees managers from involvement in daily operational activities and enables them to devote more time to strategic planning.
- ☐ Decentralisation may provide the training ground for future executives.

DISADVANTAGES OF DECENTRALISATION

The disadvantages of decentralisation include, among others, the following:

- ☐ Business units may be mutually competitive at the expense of the company as a whole.
- ☐ Decentralisation may result in duplication of activities, for example, personnel services and accounting services.
- ☐ Executive management loses some control by delegating decision-making to business unit managers.

DIVISIONAL PERFORMANCE MEASUREMENT

The greatest danger of decentralised business units is that managers do not pursue the goals of the enterprise as a whole. Business unit managers sometimes make decisions to improve the profitability of their units at the expense of the entire enterprise. The incremental marginal income that increases a centre's profit may be less than the

incremental costs of another unit due to such actions. Therefore, performance evaluation systems must be developed to motivate business unit managers to support the goals and strategies of the enterprise as a whole. Three approaches are normally considered during performance evaluation:

- ☐ profit;
- ☐ return on investment; and
- ☐ residual income.

Profit

Performance evaluation of profit centres is typically based on profit. Three common profit margins are generally used, namely, gross profit margin, operating profit margin, and net profit margin. Focus is brought to comparing the line item 'net profit' on a Statement of Profit and Loss and the ratio, 'operating profit margin'.

What is important to note here is how enterprises define and measure profit in different ways. Some of these ways will be discussed briefly.

Some view marginal income as profit; however, the problem with this method is that the controllable fixed costs of the unit are ignored. Others use profit before tax, but this method includes uncontrollable costs. This method should not be used for management performance purposes since business unit managers do not have control over uncontrollable costs.

The correct method is to use turnover (which could also be termed 'sales' or 'revenue') less all uncontrollable costs. Refer to chapter 13 for the definition and discussion of controllable and uncontrollable costs.

Example 15.1

Chetty Ltd has decentralised into three business units, namely A, B and C. The units function as profit centres. The following financial information for the period is available:

	Unit A R	Unit B R	Unit C R
Sales	100 000	200 000	250 000
Less: Controllable costs	(75 000)	(160 000)	(205 000)
Operating profit	25 000	40 000	45 000
Less: Uncontrollable costs	(5 000)	(7 000)	(10 000)
Net profit:	20 000	30 000	35 000

Required

Arrange the three units in order of profitability by:

- (a) net profit as measurement
- (b) operating profit to turnover (a percentage ratio) where only controllable costs are defined as operational costs.

Solution 15.1

(a) Net profit

	Net profit R	Classification
Unit C	35 000	①
Unit B	30 000	②
Unit A	20 000	③

(b) Operating profit to turnover

$$\text{Operating profit to turnover} = \frac{\text{Operating profit}}{\text{Sales}} \times \frac{100}{1}$$

Unit A	Unit B	Unit C
$\frac{\text{R25 000}}{\text{R100 000}} \times \frac{100}{1}$	$\frac{\text{R40 000}}{\text{R200 000}} \times \frac{100}{1}$	$\frac{\text{R45 000}}{\text{R250 000}} \times \frac{100}{1}$
= 25%	= 20%	= 18%
Classification ①	②	③

If net profit is used as a performance measurement, then Unit C will be the most profitable and Unit A the least profitable of the three units.

If operating profit to turnover is used as performance measurement, then Unit A will be the most profitable, and Unit C the least profitable unit. Operating profit (where operational costs are defined as controllable costs) to turnover measures relative performance and enables the enterprise to compare units with each other even if the turnover differs.

Return on investment (ROI)

The **return on investment (ROI)** is the ratio between profits and investment (capital invested) and is therefore a combination of income, cost and investment expressed as a single number. The return on investment is calculated as follows:

$$\text{ROI} = \frac{\text{Net profit}}{\text{Investment}} \times \frac{100}{1}$$

When applying the **return on investment** formula, caution must be exercised in respect of the term 'net profit'. In some cases, it is preferred to use net profit as this is the profit attributable to capital providers. However, some prefer operational profit (or profit before interest/finance charges and tax), as interest/finance charges and tax are not controllable costs. The usage of the correct profit figure will be case specific, and personal judgement must be applied.

Enterprises do not define investment in the same way. Some of the ways of defining investment will be discussed briefly. Some enterprises define it as total assets and others as total net assets (total assets less liabilities). Some enterprises only use the assets that the business unit manager controls. Further, the value of the investment may be valued at historical cost, present value, or market value. **Historical value** is

the original purchase price of the asset. **Present value** for these purposes is the original purchase price of the asset that the discounted cash flow method converts to present value. **Market value** is the trade-in value or the resale price of a specific asset.

Since return on investment measures relative profitability, it is usually preferred over the simple profit comparison as a performance measurement. If two business units both earn R1 000 000 net profit for the period with investments of R4 000 000 and R5 000 000 respectively, on a net profit comparison basis, both businesses did the same. However, on a measure relative to their investments, expressed as:

$$\text{ROI} = \frac{\text{R1 000 000}}{\text{R4 000 000}} \times \frac{100}{1} = 25\%$$

and

$$\text{ROI} = \frac{\text{R1 000 000}}{\text{R5 000 000}} \times \frac{100}{1} = 20\%$$

The unit with the smaller investment (R4 000 000) performed better (25% > 20%). Therefore, the return on investment is a measurement that enables the comparison by management of the performances of business units of different sizes.

It is important to note that the return on investment can be influenced by a change in three variables:

- ☐ a change in sales;
- ☐ a change in cost; and/or
- ☐ a change in investment.

You will notice that sales and cost are both variables in the function of the numerator, net profit (namely, sales – cost = net profit) in the return on investment formula.

Example 15.2 will illustrate this as follows:

Example 15.2

	Unit A
	R
Sales	900 000
Cost	(720 000)
Net profit	<u>180 000</u>
Investment	1 500 000
Rate of return	12%
Desired rate of return	15%

Required

Illustrate how the present return can be changed to the desired rate of return by a change in:

- ☐ sales (assuming a constant cost to sales ratio),
- ☐ cost (assuming sales stay constant), and
- ☐ investment.

You may assume that marginal income is defined as net profit.

Solution 15.2

$$\text{Rate of return} = \frac{\text{Net profit}}{\text{Investment}} \times \frac{100}{1}$$

☐ The present situation

$$\frac{180\,000}{R1\,500\,000} \times \frac{100}{1} = 12\%$$

☐ Change in sales

If net profit is defined as marginal income then $R900\,000 - R720\,000 = R180\,000$.

$$\frac{\text{Net profit}}{R1\,500\,000} \times \frac{100}{1} = 15\%$$

Therefore, at a desired rate of return of 15% the profit will be R225 000 ($R1\,500\,000 \times 15\% = R225\,000$).

To get the new sales figure, we observe that the current profit to sales level is 20% ($R180\,000 \div R900\,000 = 20\%$). Maintaining this assumption, the new sales figure will be R1 125 000 ($225\,000 \div 20\%$). For the sake of completeness, the new cost figure will be R900 000 ($80\% \times R1\,125\,000$).

☐ Change in cost

To realise a return on investment of 15%, costs must decrease from R720 000 to R675 000 to generate a net profit of R225 000.

$$\frac{R225\,000}{R1\,500\,000} \times \frac{100}{1} = 15\%$$

☐ Change in investment

The investment must be decreased to R1 200 000 ($R180\,000 \div 15\%$).

$$\frac{R180\,000}{R1\,200\,000} \times \frac{100}{1} = 15\%$$

Advantages and disadvantages of return on investment

The main advantage of using return on investment is that it allows for the comparison between investments of different sizes.

Although many enterprises use return on investment as a performance measurement, the greatest problem with this method is that it may lead managers to not invest in projects with a lower return on investment than their current rate, because their average return on investment will decrease. In many cases, this may lead to short-term decision-making that will be detrimental to the whole organisation.

Residual income

Residual income is used to bridge the shortcomings of ROI by guiding managers to rather invest in projects that exceed the required rate of return i.e. the cost of capital.

Residual income (RI) is a unit's income beyond the required rate of return. RI is calculated as follows:

$$RI = \text{Profit} - (\text{Investment} \times \text{required rate of return})$$

Enterprises typically set a minimum rate of return as a requirement. This is usually the enterprise's cost of capital. All profits earned beyond the cost of capital are a bonus for the enterprise. Thus, the reason for using residual income as a criterion for management performance is to motivate managers to generate the largest possible profit figure with a given investment. Applying the residual income method may prove that a business unit with a lower rate of return is more profitable than a business unit with a higher rate of return.

Once again, it must be pointed out that the 'profit' figure used in the residual income formula is generally understood to be the traditional operation profit figure from a Statement of Profit and Loss (or profit before interest/finance charges and tax). There are cases where this 'profit' figure applied may differ from operating profit and is generally case-specific.

Example 15.3

Business unit A earns R100 000 with an investment of R500 000, while business unit B earns R150 000 with an investment of R1 000 000.

Required

Calculate and compare the residual income of the two business units if:

- (a) the required rate of return is 9%, and
- (b) the required rate of return is 17%.

Solution 15.3

	Required rate of return (9%)		Required rate of return (17%)	
	Unit A R	Unit B R	Unit A R	Unit B R
Investment	500 000	1 000 000	500 000	1 000 000
Profit	100 000	150 000	100 000	150 000
Less: Required return (Investment × required rate of return)	(45 000)	(90 000)	(85 000)	(170 000)
Residual income	55 000	60 000	15 000	(20 000)

The required rate of return of 9% causes the residual income of Unit B to be bigger than Unit A, which therefore generates a bigger contribution to the profit of the enterprise. If the desired return is 17%, then Unit A with the RI criterion will contribute more to the profit of the enterprise.

Advantages and disadvantages of residual income

The advantages of residual income are, among others, the following:

- ☐ The RI performance measurement encourages the achievement of profit over the cost of capital.
- ☐ The required rate of return can be adjusted to match various risk levels.
- ☐ Residual income encourages managers to consider profitable long-term projects that may not be as profitable over the short term.

The major disadvantage of the RI method is that it cannot be used in evaluating investments of different sizes.

Example 15.4 provides an illustrative example of performance measurement and the conflicts between the different methods.

Example 15.4

Randal Ltd has three major areas:

- ☐ Area A
- ☐ Area B
- ☐ Area C

The following financial information is available:

	Area A R'000	Area B R'000	Area C R'000
Sales	1 000	1 200	2 000
Net profit	184	180	270
Investment	800	1 000	1 800

The return on investment is applied to the performance evaluation of managers.

Required

- (a) Calculate the return on investment (ROI) of each area.
- (b) Calculate the residual income (RI) of each area.
You may use net profit as operating profit in the RI calculation and assume a 15% required rate of return.
Use the following new information to answer questions (c) and (d).
Area A considers investing in an additional project of R200 000 with an estimated net profit of R40 000.
- (c) Using the return on investment as a performance measure, why may the area manager not be interested in the additional project? Motivate your comments with the appropriate calculations and comparisons to your answer in question (a).
- (d) Suppose the enterprise uses residual income as a performance criterion. Should Area A invest in the additional project? Motivate your comments with the appropriate calculations.

Solution 15.4

(a) Return on investment

$$\frac{\text{Net profit}}{\text{Investment}} \times \frac{100}{1} = \text{Return on investment}$$

$$\text{Area A: } \frac{\text{R184}}{\text{R800}} \times \frac{100}{1} = 23\%$$

$$\text{Area B: } \frac{\text{R180}}{\text{R1 000}} \times \frac{100}{1} = 18\%$$

$$\text{Area C: } \frac{\text{R270}}{\text{R1 800}} \times \frac{100}{1} = 15\%$$

(b) Residual income

	Area A R'000	Area B R'000	Area C R'000
Net profit	184	180	270
Less: Required return (15% of investment)	(120)	(150)	(270)
Residual income	<u>64</u>	<u>30</u>	<u>0</u>

(c) Return on investment

If invested in the project:

$$\begin{aligned} \text{Estimated rate of return} &= \frac{\text{Net profit} + \text{additional profit}}{\text{Investment} + \text{additional investment}} \\ &= \frac{\text{R184} + \text{R40}}{\text{R800} + \text{R200}} \times \frac{100}{1} \\ &= \frac{\text{R224}}{\text{R1 000}} \times \frac{100}{1} \\ &= 22.4\% \end{aligned}$$

The manager of Area A may not be interested in the additional project as the rate of return will decrease from 23% (calculated in question (a) to 22.4%).

(d)

	Initial investment R'000	New investment R'000	Total R'000
Operating profit	184	40 (R200 × 20%)	224
Desired return (15%)	<u>120</u>	<u>30 (R200 × 15%)</u>	<u>150</u>
Residual income	<u>64</u>	<u>10</u>	<u>74</u>

The residual income increases by R10 000 and therefore the enterprise should invest in the project.

Example 15.4 illustrates the different recommendations given by using different performance measures. Initially, the three areas rank the same under the ROI method and the residual income method.

When an additional project is added to Area A, the rate of return drops to a lower level, discouraging management, yet under the residual income method, the residual income increases by R10 000, encouraging management.

NON-FINANCIAL PERFORMANCE MEASUREMENT

During the 1980s, there was a strong movement towards non-financial performance measurement. Management and executives realised that the traditional financial accounting measures such as return on investment (ROI), residual income (RI) or earnings per share, for example, could provide misleading signals in performance. Furthermore, the financial performance indicators were often regarded as a reactive measure of performance rather than a proactive measure. These measures seemingly emphasised short-term decision-making.

THE BALANCED SCORECARD

The Balanced Scorecard was proposed by Drs Robert S Kaplan and David P Norton in 1992 to address the shortfalls of traditional financial orientated measures and to advance the field of performance management to the global demands of increased competitiveness.

The Balanced Scorecard (BSC) is a strategic performance management framework that enables management to identify, manage and measure their strategic objectives. The BSC allows management to view an organisation from four perspectives, each asking a different question.

Customer perspective: How do customers see us?

The first perspective is focused on the customer, as most managers agree that delivering value to customers is the No 1 mission statement. Thus, the BSC forces management to translate this general mission statement into specific measures indicating the factors that matter to customers.

Internal business perspective: What must we excel at?

This perspective focuses on the core competencies and internal processes most critical to an organisation. It is related to the customer perspective in that it identifies what the organisation must do (and do well at) to meet the expectations set by its customers.

Innovation and learning perspective: Can we continue to improve and create value?

The first two perspectives define the drivers for competitive success, bearing in mind that the objectives for competitive success change continuously. This change requires organisations to continuously improve their products/services and processes. The third perspective, therefore, indicates the future success of an organisation and its ability to increase the organisation's value. The ability to launch new products, create

more value for customers, and improve operational efficiencies, will allow an organisation to enter new markets, increase sales and improve margins. These actions will lead to increased shareholder value. It is important to note that the BSC emphasises training, coaching and mentoring more than simply learning new concepts, and advocates an organisational improvement culture.

Financial perspective: How do we look to shareholders?

The financial perspective is focused on measuring results. It indicates whether or not management focused their attention on the correct areas in the above three perspectives, which should have resulted in an improvement in net profit.

USING THE BALANCED SCORECARD

For each perspective of the BSC, goals (objectives) and corresponding metrics (measures) will be listed. Diagram 15.1 lists examples of objectives and measures that may appear in each of the four perspectives.

Customer		Internal business processes	
Objective	Measure	Objective	Measure
To dominate our major markets	Market Share	To continually challenge competitor products in the market-place	Time to market for next generation of products
To delight our targeted customers	Customer satisfaction survey results	To compete on product reliability	Production defect and return rates
To increase revenue through repeat purchases	Customer repeat sales (typically on account)	To compete on competitive logistics capabilities	Stock replenishment cycle times
To grow our business in a selected target group	Customer Acquisition from target group	To compete on product delivery channel mix	Volumes of transactions conducted through each of our delivery channels
To add margin through image or fashion	Profit margin (increases) on branded products	To capture a unique supply chain	Percentage of supplier's revenue dependent on us
To build customer recognition	Corporate image or brand awareness polls	To reinvent our value creation system	Benchmarking index for supplier of outsourced activities

continued

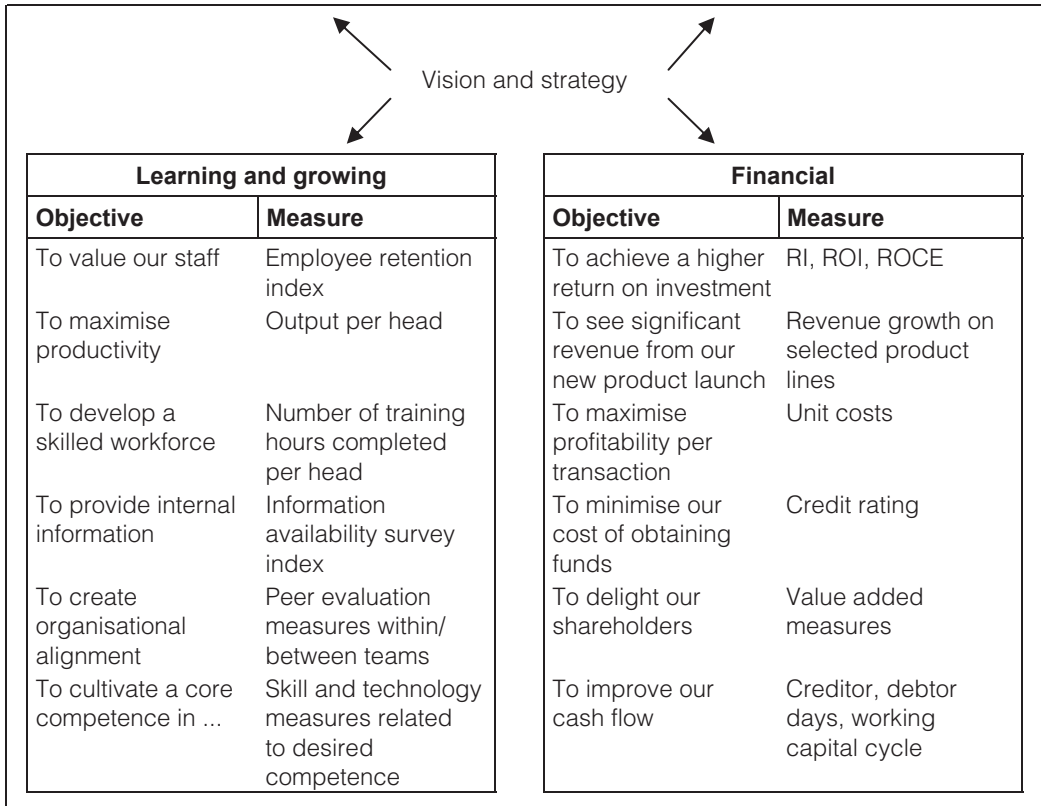


Diagram 15.1: Suggested measures by Kaplan and Norton (1996)

The Balanced Scorecard, more than a performance measurement tool

The BSC has evolved from its original use as a performance measurement tool to a full strategic planning and management system. This 'new' balanced scorecard operationalises an organisation's strategic plan into deliverables, key performance indicators and critical success factors thus directing management and employees to exactly what must be done to achieve competitive success.

Advantages of the Balanced Scorecard

- ☐ The BSC allows management to take a holistic view of an organisation, identifying whether the improvement of one of the quadrants occurs to the detriment of one or more other quadrants. This is known as sub-optimisation. For example, if excessive value creation is made in the customer quadrant at an unjustifiable cost, the financial performance quadrant will be depressed. This allows management to find the optimal balance between customer value added and costs in providing that value.
- ☐ Due to the BSC's holistic approach to performance measurement, the BSC is able to bring together and demonstrate the links between traditionally unrelated elements and functions of an organisation thus aligning all business functions.
- ☐ The BSC allows for additions in the measures to be added as the organisation evolves or changes.
- ☐ The BSC forces management to focus on a handful of critical measures.

Disadvantages of the Balanced Scorecard

- ☐ The implementation of the BSC is both costly and time consuming.
- ☐ The BSC is highly dependent on receiving reliable and accurate information. Therefore, the tool can only work if the input information used is complete, accurate and relevant to the measure being addressed.
- ☐ There is a high risk that organisations may use goals and metrics that are irrelevant to their situation.
- ☐ If too many measurements are created, management may be overburdened with unnecessary tasks and ultimately fail to focus on the essential core elements in each perspective.
- ☐ As with many strategic tools, the BSC does not provide recommendations to address shortfalls.

PERFORMANCE EVALUATION FOR NOT-FOR-PROFITS AND THE PUBLIC SECTOR

Not-for-profit organisations (such as churches, charities, medical foundations, and trade unions) are not created to maximise shareholder wealth, but rather to benefit a prescribed group of people. Similarly, public sector organisations aim to serve the public and are generally funded by the government.

In both cases, the principles of performance management are relevant. Still, due to the different objectives that non-profits and public sector organisations have, performance management is applied differently. Typically, the performance of such organisations is managed according to the '**value-for-money**' (VFM) that they generate, as discussed earlier. VFM is defined as the "performance of an activity in such a way as to simultaneously achieve economy, efficiency and effectiveness" (CIMA, 2005).

VFM has three elements, namely, economy, efficiency, and effectiveness (commonly known as the three Es).

Economy looks to minimise the cost of resources used (inputs), that is, getting the right inputs at the lowest cost. Performance is said to be economical when the least possible amount of money is spent to achieve a particular outcome.

Efficiency means doing things right or getting the most from the inputs. Performance is efficient when the minimum resources are consumed to achieve a particular outcome. This can be measured through the link between inputs and outputs, by analysing how well inputs have been used to achieve outputs.

Effectiveness is doing the right things (as opposed to efficiency referring to 'doing things right'). Thus, performance is achieved when the right objectives are achieved. It is often difficult to measure effectiveness, as the objective set out may be subjectively formulated and interpreted. Effectiveness is the most important of the three Es, as economy and efficiency are irrelevant if the right objectives have not been set or achieved.

In addition to the traditional three Es, a fourth E may be introduced. **Equity** is the extent to which the services are available to all the people that are intended to receive them. Different levels of service may be received for reasons other than differences in their levels of need.

SUMMARY

Decentralisation is the division of a business into more manageable units. A business can decentralise into three types of responsibility centres, namely, cost, profit, and investment centres.

Enterprises often base the performance evaluation of managers on the two most popular performance measurement tools, namely, return on investment and residual income, often called ROI and RI. RI has an advantage over ROI as a performance measurement method since managers can more easily be motivated to consider the interests of the enterprise as a whole.

Financial measures may limit their ability to provide accurate information for planning and controlling. Non-financial performance indicators play a more proactive and strategic role in monitoring the performance of an organisation. The Balanced Scorecard is such a tool, and it empowers management to take a holistic view of the organisation, incorporating both traditional financial measures and non-financial measures.

PERSPECTIVES ON COSTING

Knowledge

You should know:

- ☐ the viewpoints and philosophies of executive management usually determine whether the enterprise will operate as a centralised or decentralised organisation;
- ☐ responsibility centres can be divided into cost centres, profit centres, and investment centres;
- ☐ the advantages and disadvantages of decentralisation;
- ☐ the following divisional performance measures are normally considered, namely, profit, rate of return, and residual income;
- ☐ the importance of non-financial performance measures;
- ☐ the advantages and disadvantages of the Balanced Scorecard; and
- ☐ the principles of value for money, namely, economy, efficiency, and effectiveness.

Skills

You should be able to:

- ☐ calculate and evaluate divisional performances based on profit, rate of return and residual income; and
- ☐ identify key objectives within each of the four perspectives of the Balanced Scorecard and suggest performance measures for each one.

KEY TERMS AND CONCEPTS

Centralised enterprise	484	Market value	488
Cost centre	485	Return on investment	487
Economy	496	Residual income	489
Efficiency	496	Responsibility centre	484
Effectiveness	496	Present value	488
Equity	496	Profit centre	485
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Historical value	487	Value for money	496
Investment centres	485		

REVIEW PROBLEMS

Problem 15.1

Blacklock (Pty) Ltd, a decentralised enterprise, has three divisions, namely, A, B and C. The desired rate of return is 15% on investment. Blacklock's 2015 results were as follows:

Division	Investment R
A	200 000
B	250 000
C	100 000

The enterprise is planning an expansion project in 2016 that will cost R50 000 and return R9 000 per year.

Required

- Determine the return on investment (ROI) for each division for 2015.
- Determine the residual income (RI) for each division for 2015.
- Rank the divisions according to their return on investment (ROI) and residual income (RI).
- Assume other income and investments will remain unchanged, determine the effect of adding the new project on each division's return on investment (ROI) and residual income (RI) for 2016.

Solution 15.1

Income R
30 000
50 000
22 000

- (a) Return on investment = $\frac{\text{Investment centre income}}{\text{Investment centre asset base}} \times \frac{100}{1}$
- Division A = $(R30\ 000 \div R200\ 000) \times 100$
= 15%
- Division B = $(R50\ 000 \div R250\ 000) \times 100$
= 20%
- Division C = $(R22\ 000 \div R100\ 000) \times 100$
= 22%
- (b) Residual income = Investment centre income – (investment center asset base × required return)
- Division A = $R30\ 000 - (R200\ 000 \times 15\%)$
= R0
- Division B = $R50\ 000 - (R250\ 000 \times 15\%)$
= R12 500
- Division C = $R22\ 000 - (R100\ 000 \times 15\%)$
= R7 000
- (c) ROI ranks Division C first, Division B second and Division A third. Residual income ranks Division B first, Division C second and Division A third.
- (d) Return on investment
- Return on investment = $(\text{Income} \div \text{investment}) \times 100$
- Expansion project = $(R9\ 000 \div R50\ 000) \times 100$
= 18%
- Division A = $(R30\ 000 + R9\ 000) \div (R250\ 000 + R50\ 000) \times 100$
= 15.5%
- Division B = $(R50\ 000 + R9\ 000) \div (R250\ 000 + R50\ 000) \times 100$
= 19.67%
- Division C = $(R22\ 000 + R9\ 000) \div (R100\ 000 + R50\ 000) \times 100$
= 20.67%

ROI will increase for Division A, but decrease for Divisions B and C. The project's ROI of 18% exceeds the enterprise's minimum return of 15%.

Residual income:

Residual income:

- Division A = $(R30\ 000 + R9\ 000) - (15\% \times (R200\ 000 + R50\ 000))$
= R1 500
- Division B = $(R50\ 000 + R9\ 000) - (15\% \times (R250\ 000 + R50\ 000))$
= R14 000
- Division C = $(R22\ 000 + R9\ 000) - (15\% \times (R100\ 000 + R50\ 000))$
= R8 500

As the project's ROI exceeds the enterprise's minimum rate of return, the residual income of all divisions will increase.

Problem 15.2

You are the senior Management Accountant for African Mining Ltd. The company has two divisions operating in South Africa. The first division (Division A) extract manganese in the Free State. The second division (Division B) is the steel plant in Durban.

The two divisions are treated as investment centres. Every month, an operating statement is submitted to you at head office. Operating statements for these two divisions for the month of March 2015 are shown below:

	Division A R million	Division B R million
Sales revenue	900	560
Less: Variable cost – Labour	(520)	(116)
Less: Variable cost – Material	(93)	(233)
Less: Variable cost – Material (transferred)	(0)	(52)
Contribution	287	159
Less: Controllable fixed costs (including depreciation on divisional assets)	(85)	(45)
Controllable income	202	114
Less: apportioned head office costs	(90)	(56)
Income before tax	112	58
Total capital employed per division	8 960	4 972

The cost of capital for African Mining Ltd is 12%.

Required

Calculate the annual return on investment (ROI) and annual residual income (RI) for both divisions (A and B) and discuss their relative performances.

Solution 15.2

$\text{ROI} = \text{Divisional Earnings before interest and tax} / \text{Capital Employed} \times 100\%$

$\text{RI} = \text{Profit} - (\text{Capital Employed} \times \text{Cost of Capital})$

Division A:

$$\text{ROI} = 112 \times 12 = 1\,344 / 8\,960 = 15\%$$

$$\text{RI} = 112 \times 12 = 1\,344 - (8\,960 \times 12\%) = \text{R}268.80 \text{ million}$$

Division B:

$$\text{ROI} = 58 \times 12 = 696 / 4\,972 = 14\%$$

$$\text{RI} = 58 \times 12 = 696 - (4\,972 \times 12\%) = \text{R}99.36 \text{ million}$$

Division A has higher ROI and RI, but if transfer price is considered, Division B is better in both performance measurements.

Both Divisions have a ROI higher than the benchmark of 12% required by the Board.

Both Divisions' absolute score is positive for RI, which means that sufficient residual income is left for the shareholders after an imputed interest charge on divisional assets is deducted from net profit.

Problem 15.3

A Private Bank measures its performance by comparing its actual costs against its budgeted costs for the year. Now that the bank is facing increased competition from other private banks, one of its directors has suggested that it needs to consider additional performance measures such as those indicated by the Balanced Scorecard.

Required

- (a) Explain the concepts of the Balanced Scorecard and how this approach to performance measurement could be used by the college.
- (b) Explain two non-financial measures (chosen from different perspectives of the Balanced Scorecard) that the college could use to measure its performance.

Solution 15.3

- (a) The main concepts of the balanced scorecard are that an organisation's performance should not be measured on the basis of its financial results alone. Other key performance indicators are relevant to an organisation's success.

The balanced scorecard typically identifies four groups (or quadrants) of performance indicators that would be suitable for most organisations, though each organisation is free to determine the performance indicators that are most relevant to its own needs. The typical quadrants are customer perspective; internal business perspective; innovation and learning perspective; and financial perspective.

Many people believe that success in the non-financial performance measures will lead to success in the financial performance measures so that these other measures are leading measures whereas the financial measures are lagging measures.

The college could use the balanced scorecard to measure its success in other areas of its business. It is important for service businesses such as colleges to understand the wants of its customers and thus measures connected with the customer perspective are important.

The college may discover that particular types of courses are demanded by its customers, and this may lead the college to develop new courses which can be measured using the innovation and learning perspective.

The college can also look at how it operates its processes both in relation to its staff and its customers. Improvements in these processes could be used to improve the financial results, perhaps, because costs savings can be made.

- (b) The bank could measure the number of new financial products that it has provided to its customers during the year. This measure relates to the innovation and learning perspective. The greater the number of financial products the more choice it has provided to its customers and thus increased its potential customer base.

The bank could measure the time it takes for its staff to answer the telephone at the administration office. This is a measure of the effectiveness of its internal business processes. The longer it takes to answer the call, the more likely is it that potential customers will be lost, because they do not want to wait. If waiting time is significant, the customer may also deter others from making such calls, thus losing the bank even more business.

EXERCISES**15.1 Rate of return, RI and performance measurement**

Mavusa Ltd manufactures and sells transformers. The enterprise expanded to supply farmers with 80 KVA transformers. This additional investment centre will be known as Farmercor.

The enterprise uses the return on investment (ROI) as performance measurement for management bonuses. The desired ROI for all units is 18%. The required return is also 18%. Farmercor's average ROI since 2012 is 21%.

During 2015 the unit refused an investment opportunity with an estimated ROI of 18% because the additional investment would have lowered the unit's average ROI.

The unit's total investment for 2015 is R6 930 000, 5% higher than during 2014. The 2015 Statement of Profit and Loss of Farmercor is as follows:

Statement of Profit and Loss for December 2015

	(R'000)
Income	13 200
Less: Cost of sales	(8 690)
Gross profit	4 510
Less: Administrative costs	(1 177)
Less: Marketing costs	(1 943)
Net profit	1 390

Required

- Calculate Farmercor's ROI for 2015 that is based on average investment.
- Calculate Farmercor's residual income that is based on average investment.
- Would Farmercor have accepted the investment opportunity in 2015 if performance was based on RI? Motivate your answer and show all calculations.

15.2 ROI, RI and decision-making

Rooibush Tea Merchants, the tea harvesting unit of Food Products Ltd made the following budget information for 2016 available:

	R
Sales (100 000 units at R8)	800 000
Variable costs @ R5 per unit	500 000
Marginal income @ R3 per unit	300 000
Fixed overheads	150 000
Net profit	150 000
Total investment	680 000

The required rate of return is 20%.

Required

- Calculate Rooibush's expected return on investment (ROI).
- Calculate Rooibush's expected residual income (RI).
- Rooibush has the opportunity to sell an additional 8 000 units at R7 per unit. Variable costs remain the same, while fixed costs escalate by R15 000 per annum. An additional investment of R40 000 is also required. If Rooibush accepts the special order, how will the RI be affected?

- (d) Rooibush's budgeted volume of sales includes 25 000 units that Bloubos, another tea unit of Food Products Ltd, will purchase. If Rooibush does not supply the products at R6.50 per unit then Bloubos will purchase the tea from an external enterprise. Rooibush can save R40 000 in fixed costs if the production volume of 100 000 units decreases to 75 000 units.
- Calculate Rooibush's profit with the assumption that it will charge Bloubos R6.50 per unit for the 25 000 units.
 - Calculate Rooibush's profit if it loses Bloubos's special order.
 - Calculate the effect on Food Products Ltd's total profit if Rooibush supplies the tea at R6.50 per unit.
 - Calculate the effect on Food Product Ltd's total profit if the tea is purchased from an external enterprise at R6.50 per unit.

15.3 RI, ROI and cost-volume-profit analysis

Area A of Uhleko Ltd manufactures and sells only one product. The following information of Area A is available:

	R
Sales price per unit	20
Variable cost per unit	8
Total fixed cost for the period	400 000
Total investment	1 000 000

Required

- Calculate the number of units that Area A must sell if it requires a ROI of 20%.
- Calculate the ROI if Area A sells 65 000 units.
- Calculate the RI if the required return on investment is 16% and Area A sells 60 000 units.
- Calculate the selling price if the manager requires a ROI of 26% and wishes to sell only 55 000 units.
- Calculate the number of units that must be sold if the required return is 20% and the estimated RI is R100 000.

15.4 The Balance Scorecard

Indiza Airlines is an exclusive airline company that operates both domestically and internationally using a fleet of 10 aircraft. Passengers book flights using the internet or by telephone and pay for their flights at the time of booking using a debit or credit card.

The airline has entered into profit sharing arrangements with hotels and a private luxury car hire specialist companies that allow rooms and cars to be booked by the airline's passengers through the airline's web site.

The airline currently measures its performance using financial ratios. The new Managing Director suggested that other measures are equally important as financial measures and further suggested using the Balanced Scorecard.

Required

- (a) Discuss how the Balanced Scorecard differs from traditional financial performance measurement.
- (b) Explain three non-financial performance measures (one from each of three different perspectives of the Balanced Scorecard) that the airline could use as part of its performance measurement process.

16 Transfer pricing in decentralised enterprises



LEARNING OUTCOMES

<i>How is a transfer policy developed?</i>	• Explain the criteria to be used in the development of transfer prices
<i>What methods are used to calculate a transfer price?</i>	• Apply the three methods to calculate the optimum transfer price
<i>How does transfer pricing apply in an international context?</i>	• Apply the principles of transfer pricing in an international context

CHAPTER OUTLINE

When organisations shift their executive functioning closer to their divisions, it is called decentralisation. The result is a divisional or subsidiary structure where the line managers have more authority and responsibility for making decisions. In effect, the division becomes an autonomous unit with an executive manager who makes decisions for his division instead of a top-heavy organisational structure where all decisions are made at a high level. Companies will find that other structures may better suit their individual needs. Therefore, neither a long chain of command nor a flatter structure is superior. It depends on the context.

Where an organisation consists of numerous divisions, a situation is created where the divisions can trade internally with each other. In this instance, the price at which such divisions trade is called the 'transfer price'. Divisions may be located within the same country or in a different country.

Transfer pricing can lead divisions to make decisions that do not increase the profitability of an organisation. Because of this potentially damaging decision-making, there are specific criteria on which a sound transfer pricing policy should be based. This chapter introduces the methods used to calculate such transfer prices and discusses transfer pricing in an international context with a comprehensive example.

INTRODUCTION

Transfer prices are used when an enterprise decentralises into investment or profit centres, and these units trade with one another. **Transfer prices** are *internal sales prices used to assign values to goods and services exchanged between units*.

Transfer prices create problems for profit and investment centres, and must be calculated to be advantageous to every centre for performance evaluation and decision-making. Business units that act independently must always guard against unnecessarily high transfer prices, since it is sometimes cheaper for a particular division to purchase on the open market instead. The determination of transfer prices must be in the best interests of the various units and the enterprise as a whole.

Products moving from one division to another accumulate costs. When the transfer prices set by the individual divisions are too high, the total cost of the product being made becomes so high that a high selling price eventuates. When the selling price increases, demand decreases, so a situation is created where individually some divisions are performing well, but external sales are lower than they should be, resulting in lost profit. In these instances, transfer pricing policies should be implemented to prevent situations where external sales are negatively impacted.

CRITERIA FOR THE DEVELOPMENT OF TRANSFER PRICES

Transfer prices must meet certain requirements if the enterprise is to achieve its maximum level of efficiency. It is important for transfer pricing methods to arrive at a competitive price. This is the basis for the entire concept of decentralisation. Profit is the yardstick for the measurement of managerial ability. If divisional profits are not competitive, this important method of evaluating management will be lost.

The executive management normally use divisional Statement of Profit and Losses in making policy decisions concerning the profitability of these units.

The main criteria that transfer prices must satisfy are the following:

Goal congruence

Transfer prices must be set at such a level that will encourage managers to make decisions that will optimise profits for the entire enterprise. In decentralised enterprises, ensuring that every manager focuses on the financial success of the whole business is difficult. The success of each division will not necessarily guarantee the optimal success of the entire enterprise.

Performance evaluation

Transfer prices must be reasonable to ensure that fair financial performance of divisional managers can be measured and that a fair indication of the profitability of the different units is revealed. Market prices will ensure that evaluation is fair. Transfer prices must be set at a level where profit can be fairly divided between the units concerned so that performance evaluation is fair.

Autonomy

The transfer price policy must allow divisional managers to manage their units as independent enterprises.

Administrative cost

The transfer pricing system must be user-friendly and inexpensive to operate. Systems with a large and complex volume of internal transactions need a more powerful transfer pricing system and may be more expensive than systems where the transaction volume is insignificant.

COMPANY POLICIES GOVERNING INTER-UNIT TRANSFERS

Internal transfers should only take place if the enterprise's products, services, and prices compare favourably with its competitors. Acceptable delivery services are also necessary, so that the receiving unit does not suffer unnecessary losses. If the quality of products or prices and delivery services is not competitive, the transfer goods policy may include the following actions:

- ☐ Supplies may be purchased from an outside supplier after the enterprise has attempted to bring the internal supplier's unit prices, quality, and delivery services into line with those available outside.
- ☐ The unit is free to purchase outside, but must be prepared to motivate its decision. Where competitive prices are not profitable to the supplier division, the enterprise should implement a cost reduction programme. Transfer policies applying to different products often vary depending on the conditions under which they are marketed and sold.

TRANSFER PRICING

The three general methods for determining transfer prices are as follows:

Market-based transfer prices

In a perfectly competitive market, the current market price is the most suitable basis for setting the transfer price. When the market is perfectly competitive, interdependencies of divisions are small. Transfer goods supplied at market prices generally lead to optimal profits for the whole enterprise. By using market prices in perfectly competitive markets, an enterprise can satisfy all the criteria for the development of transfer prices.

The theoretically correct transfer price, where no market, or an imperfect market, exists for transfer goods without capacity constraints, is the variable cost approach at the optimum output level.

The following example illustrates the topic:

Example 16.1										
Manufacturing division				Finishing and Selling division						
Production quantity	Variable cost	Transfer out price	Transfer in price	Variable cost	Total cost	Selling price	Contribution	Sales demand	Total contribution	
Units	R	R	R	R	R	R	R	Units	R	
200	44	44	44	62	106	230	124	200	24 800	
240	44	44	44	62	106	225	119	240	28 560	
280	44	44	44	62	106	210	104	280	29 120	
320	44	44	44	62	106	205	99	320	31 680	
360	44	44	44	62	106	198	92	360	33 120	
400	44	44	44	62	106	185	79	400	31 600	

Example 16.1 shows that using the variable cost approach is theoretically superior in an imperfect market as it eliminates the influence of the transfer price in the decision-making process. It allows for the decision-making to be focused on the production quantity that must be matched to the optimal selling price, where the total contribution of the enterprise is maximised. In this example, it is at 360 units where the highest total contribution of R33 120 can be achieved.

Cost-based transfer prices

Unless a market price is readily available, most transfer prices should be based on production costs. Cost-based transfer prices may, among others, be approached as follows:

(i) Full cost approach

Full costs include all production costs and costs of other business functions (research and development, design, marketing, distribution, and administrative costs). This method is not suitable for enterprises with a decentralised structure, since measuring the profitability of the different units is imperative for these enterprises.

(ii) Variable cost approach

Using variable costs as a basis for the determination of transfer prices does not eliminate all the shortcomings of the full-cost approach, but is an acceptable approach in the short term. The greatest disadvantage of this system is that the management of one unit can generate a profit at the expense of another unit. Normally units are not willing to market their products at variable costs. Therefore, this system is not usually applied, except where a specific profit centre has excess capacity.

(iii) Absorption cost approach

This approach is probably the oldest method of price determination, due to its simplicity and the ease with which it can be implemented.

Absorption cost plus a percentage for profit is a popular choice. The question is always: What percentage must be added? A mark-up percentage may be calculated that will cover operating expenses and provide an acceptable rate of return.

Negotiated price

The use of negotiated transfer prices is often suggested as a compromise between market-based and cost-based transfer prices. Real advantages may exist in allowing two divisional managers to arrive at the transfer price through arm's length bargaining. Negotiated prices are helpful when:

- ☐ cost savings occur from selling and buying internally; and
- ☐ additional internal sales due to unused capacity may arise, allowing the buyer and seller to share the incremental profit.

Dual transfer prices

A dual system allows the selling division to sell at market price and the buying division to purchase at variable cost. This practice encourages the creation of profit as a positive motivation. Both the buying and selling divisions will receive recognition for the same profits. Duplicate profits have to be eliminated before the total enterprise's profit can be determined.

AN ILLUSTRATIVE EXAMPLE OF TRANSFER PRICING

Example 16.2

Neptune has three divisions in Cape Town operating as profit centres:

- ☐ Harvesting: Operates a fleet of 20 trawling vessels.
- ☐ Processing: Processes the raw fish into finished cuts.
- ☐ Marketing: Packages fish in 2 kg packets that they sell to wholesale distributors at R30 each. From 1 000 kg fish caught they are selling 400 packages.

The variable and fixed costs are summarised as follows:

	Harvesting division R	Processing division R	Marketing division R
Variable costs per kg	0.50	2.00	0.75
Fixed costs per kg	1.00	1.50	1.75
Full costs per kg	<u>1.50</u>	<u>3.50</u>	<u>2.50</u>

Variable cost is variable with respect to:

- ☐ Harvesting Division: kilograms raw fish.
- ☐ Processing Division: kilograms raw fish.
- ☐ Marketing Division: kilograms fish marketed.

The fixed costs per unit (kg) are based on the budgeted annual kilograms of fish produced, processed, and marketed. The transfer prices of the processing and marketing divisions are based on raw fish.

- ☐ The harvesting division can sell fish to other parties at R4.50 per kilogram, and the processing division at R10 per kilogram.
- ☐ The processing division *buys* fish from the harvesting division, and then *sells* it to the marketing division. The marketing division can accommodate 1 200 kg of fish per day.
- ☐ The marketing division now operates at 1 000 kg per day.

Required

Calculate the operational and net profit in columnar format for the different divisions, applying the following transfer pricing methods:

- (a) Internal transfers at variable costs.
- (b) Internal transfers at absorption costs.
- (c) Internal transfers at market price.

Solution 16.2

	(a) Variable cost approach R	(b) Absorption cost approach R	(c) Market price approach R
Harvesting Unit			
Revenues:			
(R0.50/R1.50/R4.50 × 1 000 kg)	500	1 500	4 500
Less: Variable costs			
(R0.50 × 1 000 kg)	(500)	(500)	(500)
Operating profit	0	1 000	4 000
Fixed costs (R1 × 1 000 kg)	(1 000)	(1 000)	(1 000)
Net profit	(1 000)	0	3 000
Processing Unit			
Revenue:			
(R2.50/R5.00/R10.00 × 1 000 kg)	2 500	5 000	10 000
Less: Transferred-in costs			
(R0.50/R1.50/R4.50 × 1 000 kg)	(500)	(1 500)	(4 500)
Variable costs			
(R2.00 × 1 000 kg)	(2 000)	(2 000)	(2 000)
Operating income	0	(1 500)	3 500
Fixed costs (R1.50 × 1 000 kg)	(1 500)	(1 500)	(1 500)
Net profit	(1 500)	0	2 000
Marketing Unit			
Revenues:			
(R30 × 400 packages)	12 000	12 000	12 000
Less: Transferred-in costs			
(R2.50/R5.00/R10.00 × 1 000 kg)	(2 500)	(5 000)	(10 000)
Variable costs (R0.75 × 800 kg)	(600)	(600)	(600)
Operational profit	8 900	6 400	1 400
Fixed costs (R1.75 × 800 kg)	(1 400)	(1 400)	(1 400)
Net profit	7 500	5 000	0

The divisional operating income per 1 000 kilograms of fish under each transfer pricing method is as follows:

Unit	Variable costs R	Absorption costs R	Market price R
Harvesting	(1 000)	0	3 000
Processing	(1 500)	0	2 000
Marketing	7 500	5 000	0
Neptune	5 000	5 000	5 000

Although the operating income as well as the net profit of the different divisions changes significantly during the application of the different transfer pricing methods, the total net profit for Neptune remains R5 000 per 1 000 kilograms of fish. The conclusion is that regardless of the choice of transfer price, the total operating income of the enterprise is not affected.

INTERNATIONAL TRANSFERS

International transfers take place *when one or more units of an enterprise are in foreign countries and these units exchange goods and services among themselves*. If tax rates differ significantly between the countries, choosing transfer prices that allow the enterprise to declare profits in the country with the lowest tax rate would be wise.

Example 16.3 illustrates the above as follows:

Example 16.3

The harvesting and processing units are in the RSA where the tax rate is 40%, while the marketing unit is in Zambia where the tax rate is 15%. The operating profit of each unit is stated below.

Unit	Variable costs	Absorption costs	Market price
	R	R	R
Harvesting	(1 000)	0	3 000
Processing	(1 500)	0	2 000
Marketing	7 500	5 000	0
Neptune	<u>5 000</u>	<u>5 000</u>	<u>5 000</u>

Required

Calculate the after tax of the enterprise if the:

- Variable cost approach is applied.
- Absorption cost approach is applied.
- Market price approach is applied.

Solution 16.3

(a) Variable cost approach

	Harvesting Division	Processing Division	Marketing Division	Neptune
	R	R	R	R
Taxable income	(1 000)	(1 500)	7 500	5 000
Tax rate	40%	40%	15%	
Tax	0	0	1 125	<u>1 125</u>
Profit after tax				<u>3 875</u>

continued

(b) Absorption cost approach

	Harvesting Division R	Processing Division R	Marketing Division R	Neptune R
Taxable income	0	0	5 000	5 000
Tax rate	40%	40%	15%	
Tax	0	0	750	750
Profit after tax				<u>4 250</u>

(c) Market price approach

	Harvesting Division R	Processing Division R	Marketing Division R	Neptune R
Taxable income	3 000	2 000	0	5 000
Tax rate	40%	40%	15%	
Tax	1 200	800	0	2 000
Profit after tax				<u>3 000</u>

Example 16.3 indicates that the use of the absorption cost approach to determine the transfer price will be most prudent. With the variable cost approach, the enterprise is taxed on pseudo-profits.

SUMMARY

Transfer prices are used when an enterprise decentralises into profit centres and/or investment centres and these units mutually trade with one another. Criteria that the transfer pricing system must satisfy before its implementation are goal congruence, performance evaluation, autonomy, and administrative cost. Market prices are normally applied in a perfect or near perfect competitive market. When no market exists, or when an incomplete market situation exists, cost-based approaches are popular.

Negotiable transfer prices are normally a compromise between market prices and cost prices and are the result of the negotiations between the respective managers.

When two subsidiaries are trading with each other and one is situated in a tax favourable country, it is possible to shift profits from the subsidiary in the high tax country to the subsidiary in the low tax country. Therefore, transfer pricing provides the opportunity to reduce tax expenditure within a group. When these transfers are made, they must be made within the terms of applicable taxation laws, otherwise the activity becomes illegal.

PERSPECTIVES ON COSTING

Knowledge

You should know the following:

- ☐ the definition and meaning of transfer pricing;
- ☐ transfer prices are used when an enterprise decentralises in large organisational segments and these units trade with one another;
- ☐ the main criteria that transfer prices must satisfy are, among others, goal congruence, performance evaluation, autonomy, and administrative costs;

- ☐ transfer prices often create problems between providing and receiving divisions, as profit is most often the yardstick measurement of managerial ability;
- ☐ transfer prices are normally based on market prices, cost-based prices, negotiated prices or dual transfer prices;
- ☐ international transfers take place when one or more units of an enterprise are situated in foreign countries and these units exchange goods and services among themselves; and
- ☐ international transfers provide an opportunity to make use of more favourable tax rates in foreign companies.

Skills

You should be able to:

- ☐ determine market-based transfer prices, different variations of cost-based transfer prices, negotiated transfer prices and dual transfer prices;
- ☐ determine operational profit applying market-based transfer prices, different variations of cost-based transfer prices, negotiated transfer prices and dual transfer prices; and
- ☐ determine profit after tax, using international transfer prices.

KEY TERMS AND CONCEPTS

International transfers	512	Transfer pricing	506

REVIEW PROBLEMS

Problem 16.1

Dual transfer prices: Fashion (Pty) Ltd manufactures dresses. It operates two divisions, namely Sewing and Marketing. The Marketing Division only buys its products from the Sewing Division. The following information from the Sewing Division for 2015 is available:

Unit costs:	R
Direct materials	8
Direct labour	5
Variable manufacturing overhead	3
Variable selling costs	1
Total	17
Fixed costs for the period:	
Sewing Division	60 000
Marketing Division	40 000

continued

	R
Sales price per unit:	
Sewing Division to Marketing Division	20
Sewing Division to external market	25
Marketing Division to customers	30
Total production was 30 000 dresses	
Sales:	
Marketing Division bought 20 000 dresses from Sewing Division	
The external market bought all 20 000 dresses from the Marketing Division	
The external market bought 10 000 dresses from Sewing Division	
Additional variable unit cost of the Marketing Division (labelling and packaging)	4

Required

- (a) Determine the net income for each division and for the enterprise as a whole.
- (b) Assume that the Marketing Division can purchase dresses of a similar style and quality from an external supplier at R18 per dress. The Sewing Division refuses to give Marketing a similar deal. Assume now that Marketing is allowed to purchase from external suppliers. Determine the net income for each division and the enterprise as a whole.

Solution 16.1**(a) Statement of Profit and Loss**

	Sewing R	Marketing R	Enterprise R
Income	650 000	600 000	850 000
Internal (20 000 × R20)	400 000		
External (10 000 × R25)	250 000		250 000
External (20 000 × R30)		600 000	600 000
Less: Variable costs	(490 000)	(480 000)	(570 000)
Unit cost (20 000 × R16*)	320 000		320 000
Unit cost (10 000 × R17)	170 000		170 000
Transferred in (20 000 units × R20)		400 000	
Additional cost (20 000 × R4)		80 000	80 000
Marginal income	160 000	120 000	260 000
Less: Fixed costs	(60 000)	(40 000)	(100 000)
Net income	100 000	80 000	180 000

*One can reason that transfers do not incur selling costs.

continued

(b) Statement of Profit and Loss

	Sewing R	Marketing R	Enterprise R
Income:	250 000	600 000	850 000
External (10 000 × R25)	250 000		250 000
External (20 000 × R30)		600 000	600 000
Less: Variable costs	(170 000)	(440 000)	(610 000)
Purchases (20 000 units × R18)		360 000	360 000
Unit cost (10 000 × R17)	170 000		
Additional cost (20 000 × R4)		80 000	250 000
Marginal income	80 000	160 000	240 000
Less: Fixed costs	(60 000)	(40 000)	(100 000)
Net income	20 000	120 000	140 000

Problem 16.2

Mabusi Inc. consists of two divisions, Division A and Division B. Division A is operating at 60% capacity, while Division B is operating at full capacity (7 000 hours).

Division B produces two products, Wiki and Tiki. Both products use the same labourers. They are planning to produce 3 000kg Tiki with the remaining capacity applied to Wiki for the coming year.

Direct costs are as follows:

	Wiki Rand per Kg	Tiki Rand per Kg
Material	20	14
Labour	18 (1 hour)	12 (40 minutes)

Overheads amount to R154 000 per annum and are allocated on labour hours. At full capacity, R84 000 of the overheads are variable. Division B determines selling price by adding 50% to total cost. During the coming year, Division A wants to convert 2 500 kg Wiki to obtain a product called Smoots. Smoots sells at R150 per kg.

Conversion costs for Smoots amount to R20 per kg. Division A's fixed costs will remain unchanged, while the variable overhead costs will increase with R1.50 per kg. If Division B transfers products to Division A, packaging costs of R5 will be saved.

Required

- Advise the company if the transfer of 2 500kg Wiki from Division B to A for further conversion should take place.
- Calculate the minimum and maximum acceptable transfer prices from the company's point of view.

Solution 16.2

(a) Determine whether transfer should take place:

Firstly, determine how many units of Wiki Division B can produce

Division B:

$$\begin{aligned} (40\text{min} \times 3\,000\text{kg})/60\text{min} &= 2\,000 \text{ hours used for Tiki} \\ 7\,000 \text{ hours (full capacity)} - 2\,000 \text{ hours} &= 5\,000 \text{ hours available for production of Wiki.} \end{aligned}$$

Wiki requires 1 hour production time.

Thus 5 000kg of Wiki can be produced. Division A had requested 2 500kg

Secondly, calculate the contribution per Wiki unit:

Variable costs:

• Material	20
• Labour	18
• Overheads (84 000 / 7 000 × 1)	12
	R50

Fixed costs:

• Overheads (70 000 / 7 000 × 1)	R10

Total cost:

• Total costs: (50 + 10)	60
• Sales price: (Total cost + 50% of total cost)	R90

Contribution:

• Contribution (R90 – R50)	R40

Thirdly, calculate the contribution per Smoots unit:

Sales price		R150.00
Less: Variable costs		(R66.50)
Existing	50.00	
Saving on packaging	(5.00)	
Conversion	20.00	
Overheads	1.50	
Contribution		R83.50

Lastly, determine which option has a higher contribution:

Transfer of Wiki to Division A should take place to produce Smoots, as the contribution per unit of Smoots is R43.50 higher than per unit of Wiki (R83.50 – R40).

(b) Calculation of minimum and maximum transfer prices from the company's point of view:

$$\begin{aligned} \text{Minimum transfer price} &= \text{Variable costs} \\ &= R50 - R5 \\ &= R45 \end{aligned}$$

$$\begin{aligned} \text{Maximum transfer price} &= \text{Variable costs} + \text{Wiki's opportunity cost} + \text{additional contribution} \\ &= R45 + R40 + R43.50 \text{ (calculation 1)} \\ &= R128.50 \end{aligned}$$

Calculation 1:

Company-wide contribution if only Wiki is produced:

$$5\,000 \text{ units} \times R40 = R200\,000$$

Company-wide contribution if 2 500 Wiki is converted into Smoots:

Wiki: 2 500 units @ R40.00	=	R100 000
Smoots: 2 500 units @ R83.50	=	R208 750
		<u>R308 750</u>

Thus, company-wide contribution will increase by R108 750 if Smoots is produced.

Additional contribution yielded per unit: $R108\,750 / 2\,500$
= R43.50

Transfer price R45:

		WIKI	SMOOTS	COMPANY
SALES				
External	2 500 × 90	225 000		600 000
	2 500 × 150		375 000	
Internal	2 500 × 45	112 500	(112 500)	
				(291 250)
VARIABLE COSTS				
External	2 500 × 50	125 000		
	2 500 × 21.50		53 750	
Internal	2 500 × 45	112 500		
CONTRIBUTION		100 000	208 750	308 750

Transfer price R128.50:

		WIKI	SMOOTS	COMPANY
SALES				
External	2 500 × 90	225 000		600 000
	2 500 × 150		375 000	
Internal	2 500 × 128.50	321 250	(321 250)	
				(291 250)
VARIABLE COSTS				
External	2 500 × 50	125 000		
	2 500 × 21.50		53 750	
Internal	2 500 × 45	112 500		
CONTRIBUTION		308 750	0	308 750

EXERCISES

16.1 Transfer price difference

Rooikat Ltd is a manufacturer of domestic and industrial lawnmowers. Rooikat Ltd is decentralised into two units, namely, Unit A which manufactures and markets domestic lawnmowers, and Unit B which manufactures and markets industrial lawnmowers. The units are operated as profit centres. Unit A normally purchased lawnmower engines at R355 per unit from Unit B. After Unit B increased the transfer price to R445 per unit, Unit A decided to purchase the engines at R400 per unit from an external supplier.

The increase in price was because of the installation of new equipment and the high depreciation charge on it. It was impossible for Unit B to realise an adequate rate of return unless the transfer price was increased. Unit B referred the matter to the executive management of Rooikat Ltd and supplied them with the following information to support their case:

Unit A's annual purchase:	1 000 units
Variable cost per lawnmower engine:	R360
Fixed cost per lawnmower engine:	R60

Required

- Determine whether the enterprise as a whole will benefit if Unit A purchases the lawnmower engines at R400 per unit from an external supplier. No alternative use for the idle facilities of Unit B exists.
- Unit B's facilities can be rented out at R60 000 per annum if they do not manufacture the 1 000 lawnmower engines. Should Unit A purchase the 1 000 lawnmower engines from an external supplier?
- Assume there is an alternative use for the internal facility and the external sales price decreases by R50 per unit. Should Unit A purchase the 1 000 units from an external supplier?
- Assume that Unit A can sell the 1 000 units to another client at R465 per unit. The additional variable marketing cost is R15 per unit. Determine if Rooikat Ltd will benefit if Unit A can purchase 1 000 units at R400 each from an external supplier.

16.2 Transfer pricing and goal congruence

Delta Ltd has two profit centres, namely, Unit Alpha and Unit Beta, that together manufacture hunting rifles. Unit Alpha manufactures the rifle barrels and Unit Beta assembles the rifles into final products. A market for both rifles and rifle barrels exists. The transfer price is based on current market prices.

The following information is available:

	R
Sales price per rifle	3 800
Sales price per rifle barrel	2 000
Cost price of rifle barrel	900
Parts and assembling costs of rifles	1 250

Required

- (a) If Unit Alpha has no excess capacity, should there be transfer of goods to Unit Beta? Is market price the correct transfer price?
- (b) If Unit Alpha's capacity is 1 000 units per month and the sales of rifle barrels are 800 units per month, should 200 rifle barrels be transferred to Unit Beta? What should the transfer price be?
- (c) If Unit Alpha determines a transfer price of R1 600 per unit for the 200 units, what will the marginal income for Delta Ltd be as a whole if the transfers take place? Should Unit Beta purchase the rifle barrels at R1 600 per unit?

16.3 Transfer prices and goal congruence

Triad Electronics manufactures various domestic electronic appliances. Triad Electronics is decentralised into different units.

Unit TV manufactures and markets 51cm television (TV) sets. Unit TV's budgeted Statement of Profit and Loss for 2016 is as follows:

Budgeted Statement of Profit and Loss for 2016

	Per unit R	Total (R'000)
Sales	1 500	30 000
Variable manufacturing costs	750	15 000
Colour tube	400	8 000
Other	350	7 000
Fixed manufacturing costs	200	4 000
Gross income	550	11 000
Marketing costs	175	3 500
Variable	75	1 500
Fixed	100	2 000
Net profit before tax	375	7 500

The estimated sales of Unit TV amount to 20 000 units. Unit TV imports all colour tubes from Phillips (USA). Unit Screen is operating now at a capacity of 30 000 units and the external selling price is R600 per unit. Unit Screen has a capacity to manufacture 45 000 colour screens per annum. The variable manufacturing costs are R250 per colour tube and the variable marketing costs are R20 per colour tube. The fixed manufacturing overheads amount to R2 100 000 for the period.

Unit TV approaches Unit Screen concerning a proposal to purchase tubes from them. Unit Screen will not have any variable marketing costs if it supplies Unit TV with colour tubes.

Required

- (a) The manager of Unit TV suggests purchasing 20 000 colour tubes from Unit Screen at R360 per unit. Should Unit Screen accept this offer?
- (b) Assume that Unit TV is willing to purchase some colour tubes from an external supplier and others from Unit Screen. How many colour tubes must be purchased from Unit Screen, and how many externally, to optimise the profit of Triad Electronics?
- (c) What range of transfer prices will be beneficial to Unit Screen?
- (d) What range of transfer prices will the manager of Unit TV be willing to pay before he will buy from external suppliers?

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LEARNING OUTCOMES

What operational systems exist for management accounting?

- Compare and contrast the differences between MRP-I, MRP-II and ERP
- Explain the roles that MRP-I, MRP-II and ERP play in the modern business environment

How does focusing on quality improve profitability?

- Understand and explain the concept of Total Quality Management (TQM)
- Describe how focusing on quality improves customer satisfaction and profitability
- Define Lean Management and describe how waste elimination can be achieved
- Define Just-in-Time (JIT) and describe the philosophy of achieving a continuous flow in production
- Define Kaizen and the concept of small, continuous improvements

How does life-cycle costing assist management in cost management and decision making?

- Explain life-cycle costing (LCC) and its holistic view on cost management

How can target costing assist in cost management?

- Describe the target costing approach to cost management

How can the theory of constraints and throughput accounting improve efficiency?

- Discuss the theory of constraints (TOC) and throughput accounting (TA) in the context of improving efficiency

What role does Six Sigma play in the process of operational improvement?

- Explain the concept of Six Sigma
- Compare and contrast Six Sigma to other modern operational philosophies

What concept is used when drastic operational change is required?

- Explain what Business Process Re-engineering (BPR) is
- Discuss the core elements of BPR

What impact does the Fourth Industrial Revolution have on costing?

- Explain what the Fourth Industrial Revolution is, along with 'Big Data', Robotic Process Automation (RPA) and Block Chain Technology
- Discuss the role these developments play in costing

CHAPTER OUTLINE

This chapter serves as an introduction to more advanced concepts and philosophies that are being used in the modern business environment. Topics covered in this chapter describe how certain advances were made in meeting customer needs and the steps that can be taken to meet those needs more cost-effectively.

INTRODUCTION

Within the broader field of finance, there are two major divisions, the first being financial management, and the second being management accounting. Finance is concerned with three decisions, namely, the investment decision, the financing decision, and the dividend decision. The second division, management accounting, focuses on costing and is the subject of this textbook.

Costing, in the broadest sense of the word, is the process of assigning costs to cost objects. Any costs incurred by a business would, through judgement and elimination, be allocated to a specific cost object. This is done for various reasons, the most critical being for accounting purposes and business decision-making. Costing provides essential information used in the accounting records of a company, and to this end several methods and techniques such as standard costing, activity-based costing and process costing, to name a few, have been discussed throughout this textbook. The other function of costing is to support decision-making and provide information that is relevant to this function. There are several types and ways of making financial decisions, but they all rely in part on financial input.

This chapter introduces the next level in the costing theme, which is using costing information to inform strategic decision-making in a business. Strategic decision-making does not necessarily form part of the traditional finance function but instead finds its home in management. Understanding how cost information supports this function is the focus of this chapter. It is important to note that this chapter is merely an introduction to this higher level and as such, you will need to confirm whether it forms part of your syllabus.

MATERIAL REQUIREMENTS PLANNING

Material Requirements Planning (MRP-I) was developed in the 1970s to aid manufacturing companies in improving the procurement processes that support manufacturing operations. The purpose of MRP-I is to calculate the quantity of materials required per product/batch or production run, and determine when such materials will be required. The quantity and timing of such requirements are based on the forecasted demand for goods and services. MRP-I thus allows management to have a clear plan of when to order materials by considering the ordering lead time from when they will need a particular material for production.

MANUFACTURING RESOURCE PLANNING

Manufacturing Resource Planning (MRP-II) expands on MRP-I by integrating a much more extensive scope of organisational departments and functions into the planning process. MRP-II takes on a more strategic, long-term vision than MRP-I, incorporating the financial planning aspect into production planning. Concepts such as cost reduction, quality control, standard costing, and economic order quantity (EOQ) now play a significant role in the resources planning process, allowing for optimisation to occur in the production process.

ENTERPRISE RESOURCE PLANNING

Enterprise Resource Planning (ERP) is a third-generation system expanding from MRP-II. It extends its linkage to all business departments, not just focusing on the departments involved in manufacturing and purchasing functions. ERP comes in the form of a business process management software package that attempts to integrate all departments and functions of an organisation into a single system of applications. One of the benefits is that management processes and back-office functions are automated and integrated.

As ERP automates a substantial portion of an organisation's non-core or non-critical functions, benefits such as improved efficiencies and freeing up of resources are realised. These additional resources can be directed towards core value-adding activities instead, resulting in greater efficiencies and, ultimately, a higher level of profitability.

TOTAL QUALITY MANAGEMENT

Total Quality Management (TQM) is a comprehensive and structured approach to organisational management. TQM's objective is to improve the quality of goods and services by refining the production and service delivery processes, specifically in response to client and workforce feedback.

The implementation of TQM involves creating a culture throughout the organisation that continuously strives for quality improvement. TQM relies on a few central pillars, including Just-in-Time, Lean Management and Kaizen. TQM was very popular in the mid-1990s and has seen significant advancement in the form of the ISO 9000 standards that certify continuous production quality.

The idea behind managing quality is that if the client's needs can be met more precisely and with higher quality, a competitive advantage would be generated through superior customer satisfaction and lower costs. Both would eventually lead to greater profitability.

Just-in-Time

Just-in-Time (JIT) is a management philosophy rather than a costing system. It is often referred to as an inventory strategy, but JIT applies in various contexts. The Japanese Toyota Corporation developed the philosophy in the 1960s and 1970s in response to constantly changing customer demands.

The philosophy requires that functions produce goods and services delivered to meet customers' demands in quantity and quality precisely on time. The philosophy finds its

application in all aspects of a business, but most notably within inventory and production processes.

Recently, the concept has been described as a 'waste-reducing' strategy. Waste or wastage can occur in all functions and aspects of a process, including:

- ☐ Waste from overproduction
- ☐ Waste from waiting time
- ☐ Waste from transportation time
- ☐ Processing waste
- ☐ Inventory waste
- ☐ Waste of excessive motion
- ☐ Waste from product defects

The intention of eliminating waste is founded on cost-saving and improved efficiency, resulting in customer demands being met more competitively. Specifically, regarding inventory, it can be seen that increasing the efficiency of material-handling times and reducing the need to keep stock on hand will significantly impact costs. If inventory levels are low, there would be a reduced need for stock on hand, warehousing space, and warehousing management systems – this reduction would lead to cost savings.

Implementing this concept will require a more accurate demand-forecasting level. Because of the increased reliance on suppliers, steps such as increasing the number of suppliers may need to be taken.

Lean Management

Lean management is the concept of systematically eliminating waste from a business. It is rooted in the manufacturing industry, so the focus is typically on business processes and systems.

Lean management tries to make obvious what adds value by eliminating non-value-added activities and cutting out wasteful steps in the business process. The steps can be described as follows:

- ☐ Identify what the client perceives as value
- ☐ Identify steps in the process and specify which ones add value and are wasteful
- ☐ Eliminate wasteful steps
- ☐ Streamline the value-creation sequence

Two ideas that support lean management are Kaizen, and the smooth flow of the automation process.

Kaizen

Kaizen is a Japanese concept that promotes 'continuous improvement' within the business environment. It is more of a management philosophy than a specific costing system and finds its application within a wide variety of contexts in a company. Kaizen forms part of Lean Management, because it requires *continuous* improvement and not merely focusing on waste elimination.

When applied within a business, the philosophy entails minor incremental improvements involving the entire workforce, from assembly-line workers to the Chief Executive Officer (CEO). It specifically applies to purchasing, manufacturing, supply chain activities, and logistics. The concept has been so effective that it is used in border contexts such as governments, hospitals, banking, life-coaching and other industries.

When continuous improvements are made, no matter how small, it results in waste elimination. This eventually results in a permanent competitive advantage, which would be tough for competitors to match, as it is built up over time.

Kaizen is a daily process that is ultimately about more than just improving the productivity of a company or workforce. It also humanises a workplace, by striving to eliminate overly hard work. Another benefit is that it frees up resources through greater efficiency and reliance on computers and machinery.

Implementation requires that different levels of the workforce are facilitated in sessions where suggestions are received, and experiments are set up to test the suggestions, with successful ones implemented.

This approach is in contrast to Business Process Re-engineering (BPR) in that it focuses on small continuous improvements instead of large sweeping changes made on an *ad-hoc* basis.

LIFE-CYCLE COSTING

Life-cycle costing (LCC) is a method of estimating and accumulating the costs of a product over its entire life cycle, from inception to decline and, ultimately, abandonment. It can be applied to products, services, customers, market segments, projects, and assets. Traditionally, management accounting's cost and control methods emphasised the manufacturing stage of a product's life cycle, and ignored the pre- and post-manufacturing stages. In the case of an asset, for example, only an asset's acquisition and disposal costs are considered. Because the pre- and post-costs are not considered, they do not come under the same scrutiny (management and control) as production costs. The true profitability of the product is therefore unknown. The purpose of LCC is to incorporate all the costs over the product's life cycle, so that they can be considered, managed, and controlled to maximise the total return over the product's life. For example, considering total costs, LCC can determine whether the profits earned during the manufacturing phase will cover the cost of the pre- and post-manufacturing phases. LCC will also consider the product's environmental cost consequences and encourage management to reduce or eliminate these costs.

Three focus areas should be optimised to maximise a product's profitability over its entire life:

Design implications on cost

Effective cost management begins at the design stage of a product's life. A product's design will determine its costs in material and labour consumption, as well as the manufacturing process required. LCC is most relevant for products with high planning, research and development costs, or high post-production costs as most of the total life cycle costs (between 70% and 90%) are locked in during the design phase of the product (see Diagram 17.2). These locked-in costs or committed costs arise from how the product was designed and the features that have been included. Design implications on cost is grounded in value engineering, where there are two ways to increase value: (1) increase functionality without increasing costs, and (2) decrease costs without compromising functionality.

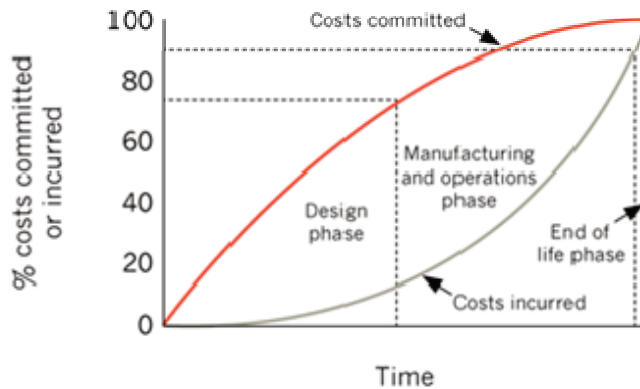


Diagram 17.1: A typical pattern of committed cost and costs incurred in a product's life cycle

Source: ACCA (2022)

Minimising time to market

The growth phase of the product life cycle provides an opportunity to charge a price premium and entrench the product in the consumer's buying habits. Attention must be given to the competitive market for the new products to maximise the first mover advantage.

Maximising the product life cycle (cash flows)

The longer a product can generate revenue, the greater its total net profit will be, all other things being equal (*ceteris paribus*). Consider a discounted cash flow scenario, where the net present value is increased if the time to generate revenue is extended. The same is valid for products, and management must therefore consider this and provide creative ways to maximise total net profit. Examples include:

- ☐ The automotive industry introduced its vehicle face-lifts a year to three years after the initial launch. At the vehicle's core, little has changed, except for limited visual aspects of the design. This lengthens the time of the product on the market.
- ☐ Products that are outdated in one market may be introduced to a new market, similar to staggering product launches in different markets.
- ☐ Design a product with only minor changes that can satisfy several different markets.

TARGET COSTING

Target costing is a method of reverse engineering the product cost to determine the desired cost of a product. It answers the question: *What may a product cost?* Furthermore, it involves setting a target cost by subtracting the desired profit margin from a competitive market price.

This is used mainly for new product development, where a company needs to know what the maximum cost of a new product must be so that it will be profitable. This situation is typical of companies that are price takers (rather than price makers), or if they are following a cost leadership strategy. Target costing is also a risk management technique for profit control of existing products. Target costing ensures that products are produced at a 'targeted cost', given the required functionality and quality, to achieve a pre-determined (or *targeted*) profit.

The following steps briefly explain the process of target costing:

Step 1: Market research is conducted to determine the market-based selling price, given the required functionality and quality of the product.

Step 2: The desired profit margin is determined and subtracted from the selling price (determined in step 1), leaving the product's target cost (termed '*allowable cost*').

Step 3: Estimate the current cost of the product.

Step 4: If the product's current cost exceeds the target cost (allowable cost), the parties involved in producing and delivering the product must determine ways to produce and deliver the product to the market at the targeted cost, while maintaining the required functionality and quality of the product.

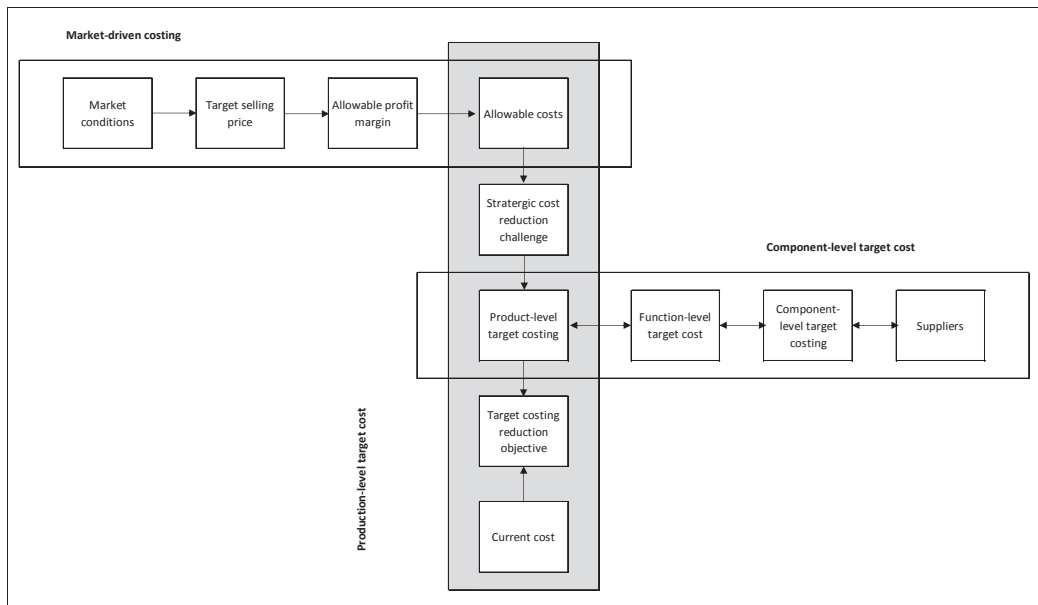


Diagram 17.2: Target costing conceptualised

Source: Cooper and Slagmulder (1999:32)

Establishing a selling price and determining the desired profit margin

The objective of market-driven costing is to establish the allowable costs. Market research (on elements such as demand, brand image and perception, market share, target market, etc.) is conducted to show the market's willing buying price (or *target selling price*, from the perspective of the company). A required margin is deducted from the selling price, yielding the allowable cost (or '*target cost*') of that product. Typically, the desired profit from a product will be influenced by the return on investment that management or shareholders require, which will in turn depend on the cost of capital.

Product-level target cost

The allowable costs, as the product of market-driven costing, serves as the starting point of the product-level target cost. The allowable cost is the ideal standard of cost or theoretical cost, as opposed to the current or actual cost. The challenge is to achieve a product-level target equal to or as close as possible to the allowable cost.

Component-level target cost

The product-level target cost is broken down into the component-level target cost. The buyers' target costs of purchasing the components of a product (either internally through transfer pricing or externally through a supply chain) are the suppliers' selling price. This is communicated to all parties involved in the design, production, and supply chain, and facilitates the transmission of competitive cost pressure across the entire organisation and supply chain.

As the various internal and external suppliers set out to achieve their targeted component costs, they may institute target costing for their components. This results in chained target-costing systems being formed. Chained target costing plays a vital role in the distribution of the competitive pressures faced by the firm at the end of a supply chain to other firms in the upstream supply chain.

THE THEORY OF CONSTRAINTS AND THROUGHPUT ACCOUNTING

The concept of the **Theory of Constraints** (TOC) was introduced by Goldratt and Cox (1984) in their book, *The Goal: A Process of Ongoing Improvement*. The concept was built on the foundations of Optimised Production Technology (OPT), which was developed in the 1970s to assist organisations in achieving greater profitability with less waste. It is based on identifying and removing bottlenecks, which is seen as the origin of wasteful (Japanese: '*mudas*') aspects of the production line. OPT aims to put a maximum just-in-time flow through the whole manufacturing chain without creating additional, redundant stock.

Based on OPT, the TOC assumes that every system (not only in production) must have at least one constraint (or bottleneck). A constraint "*is anything that limits a system from achieving higher performance versus its goal*" (Goldratt, 1988: 453). Any profit organisation will theoretically make an unlimited profit if this assumption does not hold.

Constraints can be internal and external. Internal constraints result from an organisation's internal operations, for example, outdated accounting software or production machinery. External constraints arise from the environment (or ecosystem) within which the organisation operates, and on which the company relies to achieve its objectives. These are typically upstream and downstream supply chain factors, such as delayed or limited supply inputs (upstream) or a lack of customer demand (downstream).

The constraints are not viewed negatively, and the existence of constraints represents opportunities for improvement. As each constraint is addressed, there is a gradual elevation in throughput. As throughput improves, investment in inventory and conversion costs must be optimised. This process highlights three essential terms: throughput contribution, investment in inventory, and conversion costs.

Throughput contribution is defined as *sales less direct materials*. It indicates the rate at which the system generates profit (that is, money paid to suppliers from customers). Note that this differs from contribution or marginal income as covered in chapter 4, where variable labour costs and overheads are deducted from the selling price. TOC assumes that direct material is the only variable cost.

Investment in inventory is the sum of all inventories, including raw material, work-in-progress, finished goods, research and development costs, costs of equipment and buildings, etc.

Conversion costs are all operating expenses other than direct materials, such as labour and overheads, including rent, utilities, and relevant depreciation incurred to earn the throughput contribution. These costs are assumed to be fixed.

TOC aims to increase the throughput contribution while decreasing investment in inventory and conversion costs. Throughput contribution must be prioritised, followed by inventory, and lastly, conversion costs (operating expenses). This change in priority from traditional management accounting theory steps away from management's obsessive need to reduce operating expenses (investment in inventory and conversion costs), which can sometimes result in a downward spiral of cost-cutting exercises that lead to brand hollowing.

TOC presents a series of steps that are designed to maximise throughput:

Step 1 Identify the system's constraints

The first step involves identifying the constraints that restrict the output or goal. This is essentially done by comparing what is required or demanded by the system to what is available. There may be several constraints, both internal and external. Therefore, it may also require prioritising the constraints according to their impact on the goal.

Step 2 Decide how to exploit the system's constraints

Once the constraints have been identified and prioritised, the next step is to ensure that the system is used to its maximum capacity, that is, the maximum throughput gained per unit of constraint. This step essentially addresses any possible sub-optimal performance in the constrained activity by focusing on maximising productivity and utilisation. Production setups should, for example, take place before employees go on breaks, so the machines are always left running. Another example is that an inspection may be required before a machine or assembly activity to ensure that no time is wasted in manufacturing defective units.

Step 3 Subordinate everything else to the decision in Step 2

The constrained resource should determine the production levels for the organisation. It does not make sense that non-constrained activities produce more units than the constrained activity can produce. Therefore, all the activities that are not constrained should be aligned with the activity that is constrained. Producing more out of the non-constrained activities in the system than the constrained activity is inefficient and costly, as it results in excess or wastage throughout the system, for example, work in progress, lead times and new bottlenecks.

Step 4 Elevate the constraints of the system

Only once the constraint has been fully exploited (see Step 2) can the constraint of the system be elevated. This long-term decision may require capital investment to either elevate or transform the constraint into a non-constraint.

Step 5 If in the previous steps a constraint has been broken, go back to Step 1.

It is natural that as one constraint has been elevated, a new constraint will present itself. The TOC process is then repeated. The TOC process is one of continuous improvement. Typically, internal constraints will be the initial focus areas. Eventually, the final constraint on the system will most likely be consumer demand (external).

When implementing the TOC via the throughput contribution, it appears to be similar to that of the contribution per limiting factor covered in chapter 5 (The influence of limiting factors). Consider Example 17.1:

Example 17.1

TA (Pty) Ltd produces three products using three different machines.

	A	Products B	C	Total
Selling price per unit	R25	R24	R20	
Estimated sales demand	150	200	250	
Direct materials cost per unit	R10	R12	R10	
Machine hours required per unit:				
- Machine 1	8	3	2	
- Machine 2	12	4	1	
- Machine 3	6	2	1	
Required machine hours:				
- Machine 1	1 200	600	500	2 300
- Machine 2	1 800	800	250	2 850
- Machine 3	900	400	250	1 550

Machine capacity is limited to 2 000 hours per machine.

Required

- Calculate the throughput contribution per unit for each product.
- Calculate the throughput contribution return per hour of constrained resource.
- Rank the products in order of the priority in which they should be produced, starting with the product that generates the highest return per hour.
- Calculate the optimal production plan allocating the constrained resource to each one in order.

Solution 17.1a

	Products		
	A	B	C
a) Throughput contribution per unit	R15	R12	R10
b) Throughput contribution return per hour of constrained resource			
Machine 2 is identified as the highest constraining (or bottleneck) activity (2 850>2 000)			
<i>Therefore:</i>			
Machine 2 hours required:	12	4	1
Throughput contribution return per hour of constrained resource	R1.25	R3	R10
c) Ranking	3	2	1
d) Optimal production plan			
	Machine hours used		Balance of hours
250 units of C	250		2 250
200 units of B	800		1 450
120 units of A	1 440		10

As guided by the five TOC steps, action should be taken to exploit or elevate the constraints caused by Machine 2. Perhaps this may mean purchasing a new Machine 2 to allow for more production hours (capacity). Once Machine 2's bottleneck is elevated, the process can be repeated, and the next bottleneck can be identified (Machine 1 as 2 300> 2 000) and addressed.

Throughput accounting (TA) was developed by Galloway and Waldron (1988) as an accounting-based technique based on the TOC. It ranks the optimum use of the constrained resource according to the throughput, a TA ratio. The throughput accounting ratio is defined as:

TA ratio	=	$\frac{\text{Return per factory hour}}{\text{Cost per factory hour}}$
<i>Where:</i>		
Return per factory hour	=	$\frac{\text{Sales price} - \text{material cost}^1}{\text{Time on key resource}}$
Cost per factory hour	=	$\frac{\text{Total factory cost}^2}{\text{Total time available on key resource}}$
¹ Sales less direct material cost is equal to TOC's throughput contribution		
² Total factory cost is equal to TOC's conversion costs		

Let us now apply the TA ratio to Example 17.1, by assuming that the total factory cost for the period is R150 000.

Solution 17.1b

	A	Products B	C
Throughput contribution return per hour of R1.25 constrained resource		R3	R10
Cost per factory hour (R150 000/2 000h)	R75	R75	R75
TA ratio	0.016	0.04	0.13
Ranking	3	2	1

The TA ratio rankings are identical to the throughput contribution per hour of constrained resource calculated in Solution 17.1a. Suppose you consider that the return per factory hour is equivalent to the throughput contribution return per hour of constrained resource as the numerator. In that case, the TA ratio only represents a re-statement of the contribution per limiting factor.

Finally, it is essential to note that TOC and TA assume that all costs, except direct materials, are fixed. Thus, to work on the objective of maximising contribution (where contribution equals sales price minus variable costs) will be flawed as it will consider costs that cannot be controlled in the short term. TOC and TA can be viewed as an extreme version of marginal costing as they treat only direct material as variable costs and all labour and overhead costs as fixed.

SIX SIGMA

Six Sigma is a management philosophy developed by Motorola in 1985 that assists organisations in focusing on developing and delivering near-perfect products or services.

The word 'sigma' is a statistical term that measures how far a given process deviates (the variation) from perfection (the standard). This process of statistical measurement of defects permits the identification of the cause of defects. Once the cause is known, an appropriate solution can be found to address it. As this process continues, organisations are empowered to get as close to zero defects as possible.

To achieve the goal of Six Sigma, an organisation should strive to produce no more than 3.4 defects per million opportunities (in units). This translates into 99.99% accuracy.

Key principles of Six Sigma include:

- ☐ Focusing on the customer
- ☐ Identifying and understanding how the work gets done (the *value chain*)
- ☐ Managing, improving, and smoothing the process flow
- ☐ Removing non-value-adding steps and waste
- ☐ Managing by fact and reducing variation
- ☐ Involving and equipping the people in the process
- ☐ Undertaking improvement activity in a systematic way

Thus, the minimisation of defects leading to higher customer satisfaction should improve an organisation's profitability.

Advantages of Six Sigma include:

- ☐ Up to 50% process cost reduction
- ☐ Production time improvements
- ☐ Increased customer satisfaction
- ☐ More reliable products and/or services

Disadvantages of Six Sigma include:

- ☐ Can be costly to implement
- ☐ It requires extremely specialised individuals to conduct it

It can take several years before an organisation sees bottom-line results.

BUSINESS PROCESS RE-ENGINEERING

In today's volatile, uncertain, complex, and ambiguous (VUCA) environment, organisations must continuously change how they perform their core processes. Such change creates improvements and adaptations to the changing environment, ultimately resulting in competitive advantages that are created or maintained. **Business Process Re-engineering** is a much more drastic change than that proposed by Total Quality Management, the idea being that small changes may not be sufficient to achieve the desired outcome.

One of the tools used by management and management consultants to execute significant change initiatives in business processes is the philosophy of Business Process Re-engineering (BPR). Cases such as **Ford** realising a 75% decrease in the workforce in the accounts payable department, or **Taco Bell** going from a \$500 million company to a \$3 billion company in a decade, and **Hallmark** reducing its new product introduction cycle from three years to less than one year, have all been attributable to BPR.

Business Process Re-engineering is defined as the “fundamental *rethinking and radical redesign of business processes to achieve dramatic improvements in critical, contemporary measures of performance such as cost, quality, service and speed*” (Hammer & Champy: Reengineering the corporation (1993)).

The four critical elements of BPR are as follows:

- ☐ **Fundamental:** BPR focuses on the organisation's core functions, posing the question, “Why are those functions currently performed in that manner?”.
- ☐ **Radical:** BPR is a complete turnaround approach towards what is currently being done.
- ☐ **Processes:** BPR is orientated around the business process, that is, the value-creating process for the customer.
- ☐ **Dramatic:** BPR leads to ‘quantum leaps in performance’ as compared to Kaizen or TQM (for example) which are both incremental in their performance improvements.

Where to apply BPR?

BPR is explicitly applied to the core processes of value creation in an organisation. A process is defined as a series of activities that receive one or more inputs and create an output through a series of activities.

How to implement Business Process Re-engineering:

Fitzgerald and Murphy (1996) propose a methodology to implement BPR by following a series of phases which are as follows:

1. *Select process to be re-engineered:* This addresses the fundamental question "Where are we going to start?"
2. *Establish a process team:* Addresses the question, "Who is going to do it?"
3. *Understand the current process:* Addresses the question, "Where do our stakeholders see us now?" Also, in this phase, the current physical state relating to the current logical mapping of the process models is established.
4. *Develop a vision of the improved process:* Addresses the question, "Where do our stakeholders want us to be?" In this phase, the new logical model of the process is defined.
5. *Identify the actions needed to move to the new process:* Addresses the question, "What do we need to achieve?" Here, the new physical process model is established.
6. *Negotiate/execute a plan to accomplish these actions:* Addresses the question, "How will we achieve it?"

Practical application limitations

Due to the drastic changes that BPR creates, the risk of failure is significantly higher than the possibility of success. Such failure is due to the lack of proper training in BPR, an insufficient understanding of business processes, and a lack of adequate change management procedures.

THE FOURTH INDUSTRIAL REVOLUTION

The First Industrial Revolution occurred with the emergence of mechanisation. It began in Britain in about 1760, and continued until the mid-1800s, when water and steam power were used to create mechanical production facilities, particularly in the textile industry, which was previously entirely hand made. Clothing and fabrics were no longer imported, as raw cotton was mechanically converted into cloth. With the invention of the spinning machine, a slow shift occurred from hand-held tools and processes to machines, factories and mass production of products. This industrial revolution brought about a tremendous increase in products and variety, but also resulted in depressing working conditions and sometimes poor living standards. It also marked the start of urbanisation, with families now living in cities instead of farmlands.

The Second Industrial Revolution, known as the Technological Revolution, occurred between the mid-19th century and the beginning of the 20th century, just before the start of World War I. Several developments characterised this revolution. The first was the growth of pre-existing industries, while the second was expansion into new industries, such as steel production, petroleum (oil), automobiles, production lines and electricity. The primary outcome of this revolution, which changed the world, was a marked increase in public transport and communication technology. Electrical power, telephones and water supply set the stage for further revolutions to occur in technology.

The Third Industrial Revolution was the Digital Revolution that took off in the 1970s and showcased the rise of electronics, with the development of the transistor, microprocessor, telecommunications, computers and, of course, the internet. For the first time,

digital technology brought a new rise of technology that allowed for great communication and computing power advancements. Machines (computers) could now be used in business to increase the production scale to new levels.

The Fourth Industrial Revolution is currently unfolding around us. Aspects such as virtual reality and artificial intelligence are all products of it. It is an emerging out of the Third Industrial Revolution, but is considered a new era rather than a continuation. This is because of the explosiveness of its development and the disruptiveness of its technologies across all industries worldwide. It is characterised by the integration of digital, physical, and biological systems. Artificial Intelligence will eventually allow for the complete replacement of certain historical jobs such as lawyers, accountants and even doctors.

Challenges and opportunities

The Fourth Industrial Revolution, like its predecessors, brings significant changes to the way value is created in business and the overall economy. Jobs that are standardised will slowly but surely become irrelevant, while highly skilled, highly specialised tasks that focus on value creation become a standard prerequisite in a digitised, integrated economy.

As South Africa has become less dependent on commodities, the country will have to take the next step in cultivating its digital skills by transforming its population from low-skilled, low-paying jobs to high-skilled, high-paying jobs.

Impact on Cost Accounting

Costing is traditionally a finance function, where in smaller organisations, the accountant would take care of the necessary, and in a big organisation there would be teams of finance professionals working on costing production. It is precisely these types of jobs and processes that are being targeted by artificial intelligence software and programs. Software that can learn and create will replace these traditional jobs.

Big Data

Following on from recent technological advances, it became clear that it is possible to glean some insights into business, customer behaviour and trends by analysing large data repositories accumulated by business. Thus, the term '**big data**' refers to the use of advanced data analytics methods, such as predictive analytics and user behaviour analytics that extract value from large data sets. 'Big data' is therefore not exclusively a reference to big data sets.

In certain instances, these trends and behaviours have led to great cost savings and insights into new solutions for problems. For example, medical data sets are often investigated to identify the most appropriate procedures for patients, given their genetics, age, gender, and other relevant variables. Businesses can also establish customer buying patterns and habits to further assist their marketing campaigns.

Big data therefore supplies business with an opportunity to obtain a strategic advantage over their competitors.

Robotic Process Automation (RPA)

Robotic Process Automation does not imply the use of physical robots; instead, it refers to software robots or artificial intelligence. It usually takes the form of a software

application replicating repetitive actions previously performed by human beings, using a computer system. In other words, high-volume, low-value-added tasks that are done repetitively can be standardised and executed by software applications.

Such applications will replace the reliance on human resources, which can lead to cost savings. Several challenges faced when dealing with staff are eliminated, such as, performance reviews, salary increases, employee turnover and poor performance. At face value, this change may seem like a major threat to jobs and has been met with some resistance. However, RPA may provide competitive advantages to businesses by addressing the following challenges:

- ☐ Improved cost efficiency: the replacement of a non-value-adding human workforce in high-frequency tasks, at the same time as significantly reducing the processing time and errors, leading to major cost savings.
- ☐ Greater control of the manufacturing process.
- ☐ Turning the focus of the human workforce to value-adding activities only.

Blockchain technology

In 2008, the concept of a 'blockchain' originated. Using this concept, Bitcoin was developed as the world's first cryptocurrency in 2009. The concept of a blockchain is, however, revolutionary in its implications.

A **blockchain** is a series of digital 'blocks', each containing information. Sequentially linked to the previous block, each block can contain a set number of transactions and is secured using a cryptographic security hash algorithm. Bitcoin is secured using the SHA-256 algorithm, which stands for Security Hash Algorithm number 256. The United States National Security Agency designed the algorithm.

Blockchains are typically public, meaning that anybody can view their content and see the transactions. Because the blockchain must comply with the requirements of the security algorithm, it is effectively possible to record information in a highly secure fashion, while at the same time acting as an authoritative public ledger of transactions. Therefore, once a transaction has been recorded in a block, it cannot be changed.

It seems that the recording of transactions in the future is heading towards an open public ledger format using blockchain technology.

PERSPECTIVES ON COSTING

Knowledge

You should know:

- ☐ the differences, similarities and evolution of MRP-I, MRP-II and ERP;
- ☐ the goal of Total Quality Management (TQM), that is, focusing on improving the quality of goods and services by following a number of strategies;
- ☐ the concept of Just-in-Time, namely, that customers' needs are met in terms of quantity and quality at the exact time they need it;
- ☐ that lean management and Kaizen costing are both pillars that support TQM. Lean management focuses on eliminating waste, while Kaizen focuses on small, continuous improvements;
- ☐ that life-cycle costing provides a holistic view of cost management;
- ☐ how target costing assists in cost management;

- ☐ how the theory of constraints and throughput accounting assists in improving efficiencies;
- ☐ the principles of Six Sigma;
- ☐ the principles of Business Process Reengineering; and
- ☐ the new developments linked to the Fourth Industrial Revolution, specifically with regard to big data, robotic process automation, and blockchain technology.

Skills

You should be able to:

- ☐ discuss the benefits and considerations of strategic cost and management concepts.

SUMMARY

This chapter introduced more advanced, strategic methods that are used to manage quality and reduce costs. It explained the fundamental idea of focusing on quality, breaking it down into the need to eliminate waste, improve on production processes, and implement continuous improvements.

KEY TERMS AND CONCEPTS

Blockchain	538	Life-cycle costing	527
Big Data	537	Material requirements planning	524
Business process re-engineering	535	Manufacturing resource planning	525
Conversion costs	531	Robotic Process Automation	537
Enterprise resource planning	525	Six Sigma	534
Fourth Industrial Revolution	536	Target costing	528
Investment in inventory	530	Total quality management	525
Just In Time	525	Theory of Constraints	530
Kaizen	526	Throughput accounting	533
Lean Management	526	Throughput contribution	530

REVIEW PROBLEMS

Problem 17.1

A company would like to make a target profit of 28% on the selling price of a product. The current market price for the product is R220, and the current cost to manufacture the product is R165.

Required

By what percentage should the company cut the manufacturing cost to meet the target cost?

Solution 17.1

The company should cut the manufacturing cost by 4% to meet the target cost. This is calculated as follows:

$$(165 - (220 \times (1 - 0.28))) / 165 = 0.04 \text{ or } 4\%$$

Problem 17.2

MICRO manufactures and sells a limited range of flat-pack furniture. Due to the standardisation of its products, MICRO uses a standard costing system to monitor its performance. At the start of each financial year, the company directors agree a set of standard costs for each of the company's products. Monthly variance reports are discussed at each monthly board meeting.

A few months ago, the Production Director attended a conference on World Class Manufacturing and was interested in a presentation on Kaizen Costing. The presenter illustrated how the use of Kaizen Costing had enabled her company to reduce its unit manufacturing costs by 20%.

Required

- (a) Explain the principles of Kaizen Costing.
- (b) Discuss how Kaizen Costing conflicts with MICRO's current performance reporting procedures.

Solution 17.2

- (a) Kaizen Costing is a system of cost reduction based upon the concept of continuous review of systems and procedures to identify and implement small incremental cost savings. It is used in the production phase of a product, and employees are both encouraged and empowered to recommend changes that they believe will reduce costs without affecting the quality of the products or otherwise adversely affecting the customer's perception of the products.
- (b) Standard costing and variance analysis is a means of monitoring performance by comparing actual costs with the standard costs that have been set. MICRO currently sets its standards at the start of the financial year and then uses these standards as the basis of its comparisons. This implies that these standards are the targets to be achieved for the year. This system does not allow for improvements during the year. Kaizen Costing is based on continuous improvements being made throughout the year. Consequently, the Kaizen cost is a moving target that changes each month. This conflicts with the concept of having a clear and fixed target against which performance is to be measured. If a changing standard were to be set based on the revised Kaizen cost and used as the basis of performance management, managers may become confused, and the measurement of variance trends over time would be affected.

Problem 17.3

COMFY is a manufacturer and distributor of household products. It has well-established relations with its suppliers of various raw materials. It is not a dominant player in the market in which it operates, and as a result is forced to accept the market price for each of its products. The company is keen to ensure that it continues to compete and earn satisfactory profit at each stage through a product lifecycle.

Required:

Explain how COMFY could use target and Kaizen costings to improve its performance.

Solution 17.3

Target costing is a system that is used when a company is unable to dictate the selling price of its products and is forced to accept the market price of the item it is planning to market. Once the specification of the product has been completed, the company determines the price that the market is prepared to pay for its product. This may be discovered by market research or by considering the prices of similar items that are already available. The company then subtracts its profit target from this price to determine its cost targets. If the expected product costs already meet the target cost of the life cycle of the product, taking account of any cost reductions that may occur, for example, due to the benefits of the learning and experience curves, then production commences. However, it is more likely that at this initial stage, the expected product costs exceed the target costs, and as a result major product process changes are made to achieve the target cost. If it is not possible to achieve the target cost by making these changes, the product is abandoned.

'Kaizen' means improvement. Kaizen costing is a system that is used once production has commenced, unlike target costing, which is typically applied during the design stages. The system is applied by continually striving to improve. Kaizen does not look for large, significant improvements; instead, it is based on making small improvements continuously. It is a group effort in which everyone is involved. It should become part of every employee's daily routine to consistently look for ways to improve the workflow within the organization. Kaizen is based on a continuous cycle of 'plan, do, check, act'. 'Plan' refers to the need to set a target for improvement, as without a benchmark, success cannot be measured. 'Do' refers to the implementation of the plan. 'Check' is the determination of whether the plan has improved the process. 'Act' means standardise the improved procedures so that they can be repeated.

One of the differences between target costing and Kaizen costing is that target costing applies before production commences, whereas Kaizen costing applies once production has commenced. Another difference is that although both systems involve making changes to improve the results, target costing looks at making significant changes to reduce the expected cost until it reaches the target cost necessary to achieve the target profit from the given set price. Kaizen costing deals with making several further small improvements by involving everyone in the process.

Problem 17.4

Company B would like to calculate a target cost for Product C. Company B paid R25 000 for market research aimed at obtaining information regarding selling prices and expected sales volumes. It was determined that the market would be willing to pay R580 per unit, at an expected sales volume of 12 000 units. The cost to manufacture Product C amounts to R480 per unit. Company B has a weighted average cost of capital of 12%, and would like to make a target profit of 20% when selling Product B.

Required

What is the target cost per unit of product B?

Solution 17.4

The target cost per unit of product B is R464, arrived at as follows:

$$580 \times (1 - 0.2) = \text{R}464$$

All other costs that are not related to the products manufacturing, such as market research and cost of capital, are irrelevant to the target cost calculation.

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