Principles of Management Accounting

Study guide one of two for

MAC2601

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CONTENTS

Your separate Study Guide 2 will contain the following:

INTRODUCTION AND OVERVIEW

WELCOME

We would sincerely like to welcome you as a registered student for the module MAC2601.

Nelson Mandela said:

''Education is the most powerful weapon which you can use to change the world.''

We trust you will use this powerful weapon to gain new knowledge, insight and practical skills to advance your future studies and career.

The management accounting environment is changing and so are the skills and competencies required of chartered accountants and management accountants. After successfully completing this module, it is your responsibility to ensure that you keep up-to-date with the latest developments in this field of study.

''Watch, listen, and learn. You can't know it all yourself ... anyone who thinks they do is destined for mediocrity.''
Donald Trump

Before starting your studies, it is important that you take note of what follows below.

GENERAL OBJECTIVES OF THIS MODULE

In this module, the student is introduced to the principles of management accounting.

This module is mainly intended for the student who is interested in registering as a chartered accountant (SAICA) or a chartered management accountant (CIMA). The module will enable students to develop competencies that these two organisations require.

The purpose of this module is:

- to give students a basic knowledge of cost classification, cost behaviour, cost analysis, cost estimation, cost objects and cost management accounting systems;
- to enable students to understand and apply planning, budgeting and control techniques; and
- to enable students to understand how financial and other data are analysed in order to provide information for decision-making.

PREREQUISITES

It is assumed that students possess the following:

- Reading and comprehension skills to enable them to read questions and case studies, comprehend the content of both, and follow a logical thought process. Furthermore, students must be capable of applying the basic principles of the tutorial matter to questions or elementary case studies; they must also be capable of formulating their own opinions, putting forward recommendations, and drawing conclusions based on their mastery of the tutorial matter.

- Knowledge of basic accounting concepts, principles and procedures, as indicated by successful completion of the module that is a prerequisite and that forms part of the admission requirements. (Financial Accounting Principles, Concepts and Procedures – FAC1502.)

STRUCTURE OF THIS STUDY GUIDE AND THE MODULE

This module is structured into four distinct parts, each containing one or more topics. Topics, in turn, are study areas, and each topic is divided into study units. You will find the outcomes, which you are required to achieve for each topic in this guide, at the beginning of each topic. Self-assessment activities are provided at the end of each study unit so that you can assess whether you have mastered the learning outcomes.

The parts of the module are briefly described below:

PART 1 – VALUING INVENTORIES USING BASIC TECHNIQUES

(Topics 1–4)

Part 1 forms the foundation for further studies in cost accounting. It introduces you to the nature and behaviour of costs and to material, labour and overheads in the general ledger. It also explains the difference between the first-in-first-out method (FIFO method) and the weighted average method for acquired inventories. This part concludes with a comparison between the traditional absorption costing method and the variable costing method for the valuation of completed inventories.

PART 2 – VALUING INVENTORIES USING MORE ADVANCED TECHNIQUES

(Topics 5–8)

Part 2 equips you with skills needed to understand the activity-based costing (ABC) system, the job costing system, the process costing system and the joint and by-product costing system.

PART 3 – PLANNING, BUDGETING AND CONTROLLING PERFORMANCE

(Topics 9–10)

Topic 9 concentrates on planning and budgeting, and topic 10 explains a standard costing system and how to apply it.

PART 4 – RELEVANT INFORMATION FOR SHORT-TERM DECISONS

(Topics 11–12)

In part 4, you are introduced to relevant and irrelevant information, special order scenarios, limiting factors and the allocation of resources. Topic 12 concludes with a discussion of sensitivity analysis techniques.

CONTENT MAC2601 (Diagram 1)

Diagram 1 below contains a schematic representation of the content of the MAC2601 module.

MAC2601
Principles of management accounting

Study guide 1

Part 1
Valuing inventories using basic techniques

Topics
1 Nature and behaviour of costs
2 Accounting for material, labour and overheads
3 Methods of inventory valuation
4 Valuing completed inventories: the variable/direct costing method versus the traditional absorption costing method

Part 2
Valuing inventories using more advanced techniques

Topics
5 The activity-based costing (ABC) system
6 The job costing system
7 The process costing system
8 Joint and by-product costing system

Study guide 1

Part 3
Planning, budgeting and controlling performance

Topics
9 Budgeting techniques
10 Standard costing

Part 4
Relevant information for short-term decisions

Topics
11 Relevant costing
12 Sensitivity analysis

STUDY MATERIAL AND RESOURCES

Prescribed study material

The prescribed study material for this module is:

- Study Guide 1 and Study Guide 2 for MAC2601
- Various tutorial letters issued during the semester

***my*Unisa resources**

Please make use of *my*Unisa (https://my.unisa.ac.za), because it contains further resources that will help you to master this module. The following resources are available on *my*Unisa:

- Study Guide 1 and Study Guide 2 for MAC2601
- Various tutorial letters issued during the semester
- Previous examination papers
- Discussion forum
- Announcements
- Other resources

Supplementary literature/Additional reading

You can use the bibliography at the end of certain topics for additional resources if you want to read more about specific topics for the purpose of self-enrichment.

ASSIGNMENTS

Assignments, including the necessary instructions, are set out in Tutorial Letter 101. Please note that your assignment answers **must** be received for marking by the due dates.

It is in your own interest to answer and submit as many assignments as possible for the following reasons:

- Assignments form an integral and major part of your studies.
- There are three compulsory assignments for this module – numbered 01, 02 and 03 – that contribute to your year mark. (Although we call it a year mark, it applies to the semester you are registered for, as MAC2601 is a semester and not a year module).
- You will not be allowed admission to the examination if the first compulsory assignment (number 01) is not received on or before the due date.
- Assignments help you to prepare for the examination.
- As indicated in Tutorial Letter 101, certain assignments are taken into account when calculating your year mark; the higher your year mark, the better chance you have of passing this module.

CRITICAL SUCCESS FACTORS

Our aim in designing the study guide was to give you the best possible opportunity to master the knowledge, skills and values required by the discipline and the demands of professional practice. To discover what other support we offer you, please read Tutorial Letter 101, which you should probably have received by now.

To ensure that you are successful in your studies, we strongly advise you to do the following:

- Start studying as soon as possible. We have found that students who start early have time to reflect on their studies and formulate their own opinions.
- Use your time sensibly.
- Work systematically through the contents of the study guide and tutorial letters.
- Set realistic goals.
- Believe in yourself.

We have designed this module using the guidelines of the South African Qualifications Authority (SAQA) regarding the notional hours you will need to work through the course material successfully. You will need at least 120 hours to read, study the tutorial matter, do the assignments and prepare for the examination. We have prepared a suggested timetable guideline for you on the next page.

Research has shown that students who complete their assignments conscientiously are more likely to pass their examinations than those who do the minimum.

Please note that you will **not** pass this module if you simply try to memorise the study material. We suggest that you allow yourself enough time to read through the study material, use different techniques to summarise the content, spend time reflecting on the issues and principles involved, and practise by doing lots of questions.

USING THE STUDY GUIDE

Before you start studying, we recommend that you prepare a study schedule that allocates time to each study unit, leaving sufficient time for revision closer to the examination (see schedule below).

When studying a new topic, we recommend that you do the following:

- Read the introductory paragraph of the topic in the study guide to familiarise yourself with the aim of the topic.
- Study the topic in detail using the study guide as the primary reference.
- Prepare summaries of key concepts, definitions and important information from your study material.
- Evaluate yourself continuously by working through the self-assessment activities provided in the study guide.

STUDY PROGRAMME GUIDELINE

Part	Topic No	Topic	Hours
1	1	Nature and behaviour of costs	11
	2	Accounting for material, labour and overheads	15
	3	Methods of inventory valuation	3
	4	Valuing completed inventories: The variable/direct costing method versus the traditional absorption costing method	6
2	5	The activity-based costing (ABC) system	5
	6	The job costing system	2
	7	The process costing system	19
	8	Joint and by-product costing system	6
3	9	Budgeting techniques	5
	10	Standard costing	11
4	11	Relevant costing	9
	12	Sensitivity analysis	6
Assignments			20
Examination			2
Total hours			120

TEACHING STRATEGY

The focus of our teaching role is to facilitate your learning experiences, thus enabling you to achieve the specific assessment criteria. Furthermore, these learning experiences are designed to enable you to master the learning content at a predetermined competence level.

Meaning of words

Throughout this module we communicate learning outcomes and self-assessment criteria phrased in terms of what you should be able to do. This process involves the use of action words, which are usually verbs or phrases containing verbs; in other words, in the learning activity, we describe what you are expected to do. It is our objective to ensure that the words we use clearly state what you have to do. For your part, you need to make sure that you clearly understand our instructions and that you are familiar with the range of words that we use in the study material for this module.

We list below (in alphabetical order) examples of some of the action words that you will come across in this module, together with their meanings.

ACTION WORD	DESCRIPTION
Apply	Demonstrate knowledge and understanding by using information in a practical sense; use where relevant or appropriate. Use in a practical way.
Calculate	Ascertain by mathematical procedure/exact reckoning.
Compare	Examine in order to observe resemblances, relationships and differences.
Complete	Finish/add what is required.
Define	State precisely the meaning/scope/total character; make clear (especially the outline); give a concise description of the distinguishing features.
Describe	Give clearly the distinguishing details or essential characteristics of.
Determine	Decide; come to a conclusion/make a decision by means of reasoning.
Discuss	Examine/consider the opposing arguments (for or against a view).
Draft	Prepare a preliminary version of.
Evaluate	Make judgements on the basis of given criteria.
Examine	Investigate carefully/in detail.
Explain	Set out the meaning; clarify the meaning, provide supporting evidence; argue the truth.
Identify	Establish by consideration, select, recognise.
List	Record/document/itemise names or things belonging to a class.
Mention/name/state	Specify by name; cite names, characteristics, items, elements or facts.
Motivate	Cite facts/reasons as support for a viewpoint or argument and draw a conclusion.
Organise	Arrange in an orderly structure/sequence; place into classes/groups according to certain criteria.
Prepare	Make ready/complete; make something ready on the basis of previous study.
Record	Put in writing; set down for reference and retention.
Summarise	Give a condensed version of; state the key aspects of.

IN CONCLUSION

We trust that the remarks we have made in the sections above will help you to approach your MAC2601 studies methodically and with a greater degree of understanding.

MAC2601 is not just one of those modules you pass, tick off as part of your degree requirements, and then continue as you did before – these skills are for life!

Enjoy your studies and remember the words of Vince Lombardi:

''The price of success is hard work, dedication to the job at hand, and the determination that whether we win or lose, we have applied the best of ourselves to the task at hand.''

We trust that you will enjoy the MAC2601 journey with us, and we wish you the best in the weeks and months that lie ahead of you!

Regards,

Your MAC2601 lecturers

VERY IMPORTANT NOTE

After you have passed this module, you should not get rid of your study guides and other study material (like tutorial letters). You may have to refer back to these in your future studies. The principles that are dealt with in this module will not be repeated in subsequent modules! In subsequent modules it is assumed that you completely got the hang of the learning outcomes of prior modules.

PURPOSE OF THE MODULE

This module is mainly intended for the student who is interested in registering as a chartered accountant at the South African Institute of Chartered Accountants (SAICA) or a chartered management accountant at the Chartered Institute of Management Accountants (CIMA). This module will enable students to develop competencies required by both organisations.

The purpose of the module is to provide students with knowledge and skills in the following principles of management accounting:

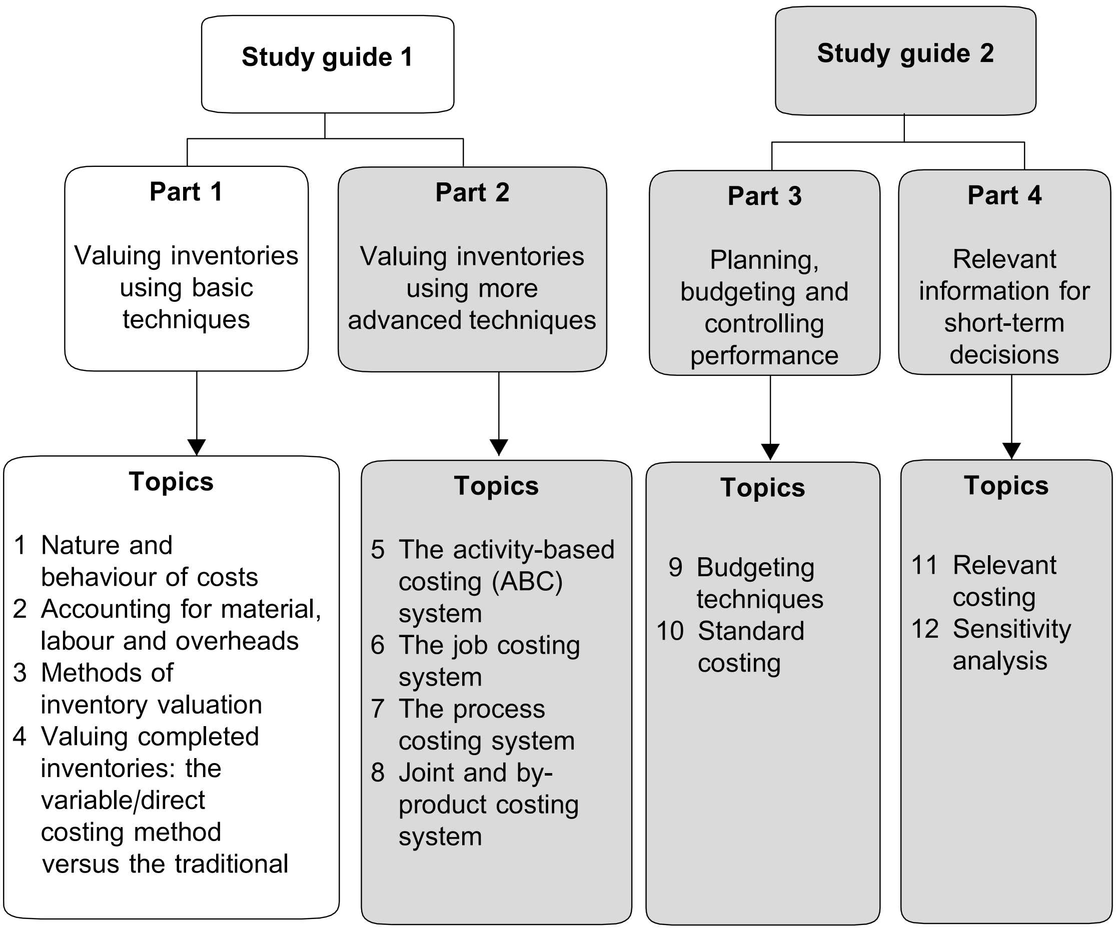
- basic knowledge of cost classification, cost behaviour, cost analysis, cost estimation, cost objects and cost management accounting systems
- planning, budgeting and application of standard costing as a control technique
- analysis of financial and other data to provide information that can be used in decision-making

Valuing inventories using basic techniques

PURPOSE

The purpose of part 1 is to:

- Estimate costs according to their nature and behaviour
- Estimate profits using cost-volume-profit analysis
- Identify and assign material, labour and overheads
- Explain and apply the first-in-first-out (FIFO) method versus the weighted average method in order to value acquired inventories
- Apply the traditional absorption costing method versus the variable/direct costing method in valuing completed inventories



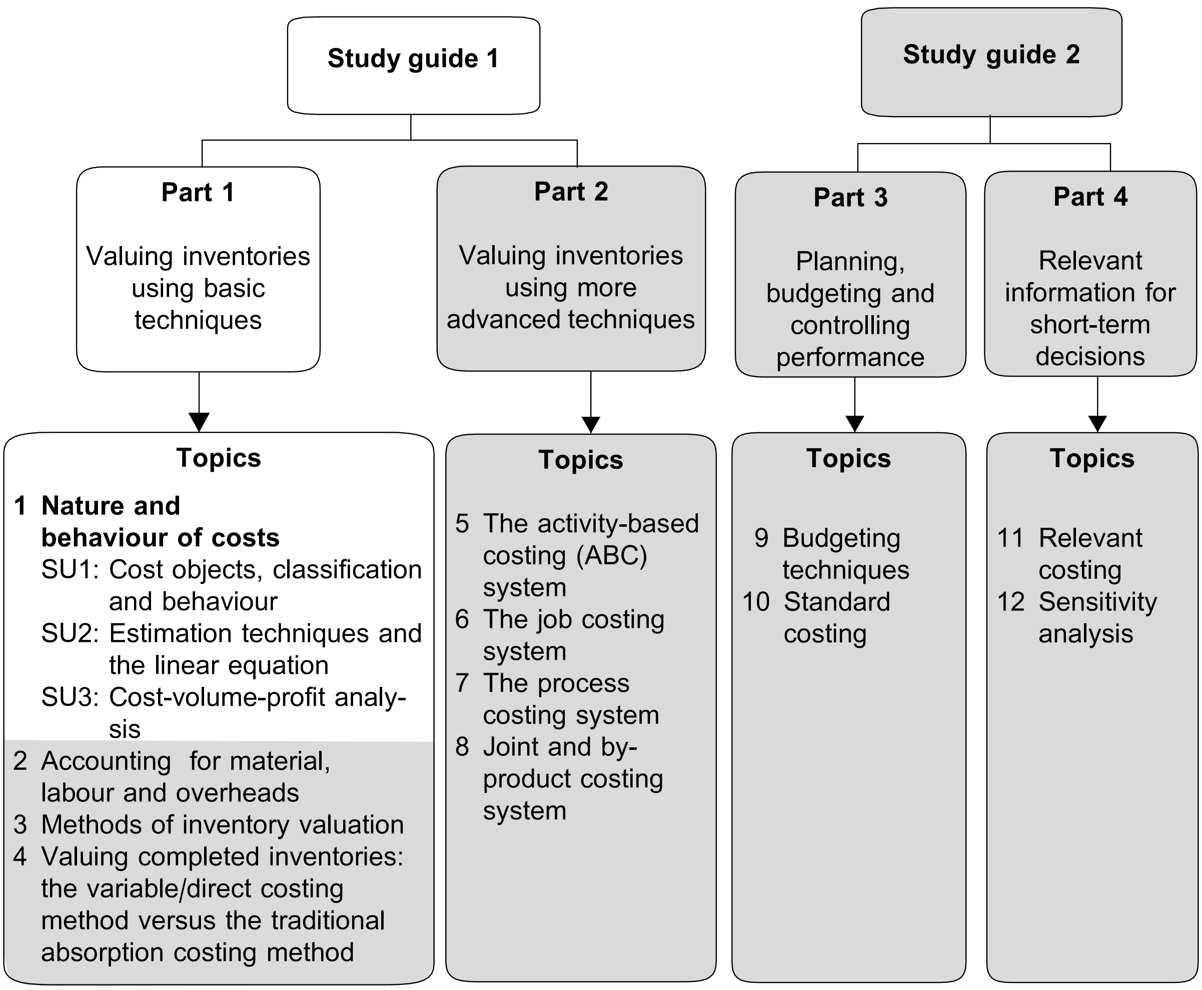
Nature and behaviour of costs

LEARNING OUTCOMES

After studying this topic, you should be able to

- define the different cost objects
- classify costs and explain the behaviour of costs
- estimate costs using different techniques
- use cost-volume-profit analysis to estimate profits

STUDY UNIT	TITLE
Study unit 1	Cost objects, classification and behaviour
Study unit 2	Estimation techniques and the linear equation
Study unit 3	Cost-volume-profit analysis



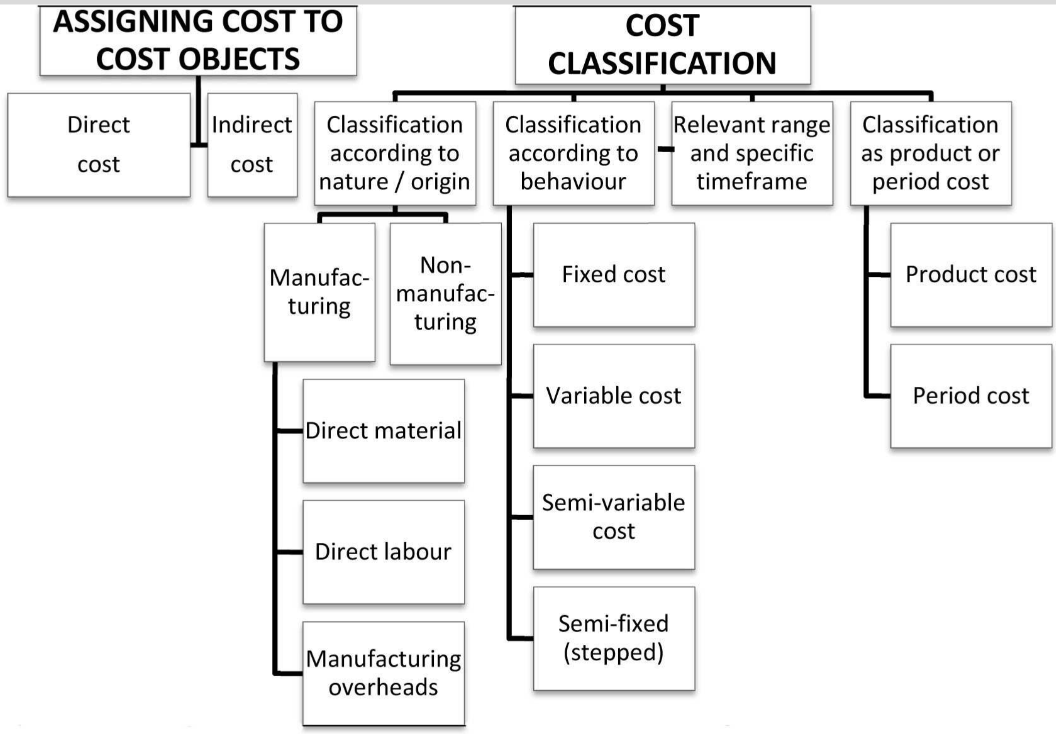
Introduction

Every organisation's business or other activities determine the costing system that is most suitable for that particular entity. Before deciding on the costing system, it is necessary to understand the basic nature and behaviour of cost. This behaviour is modelled on the basis of estimation techniques and is used to forecast the profitability of the enterprise.

STUDY UNIT 1

Cost objects, classification and behaviour

In this study unit



1 Introduction

Different cost systems require different cost classification with different cost terms. To communicate useful information to users (managers), it is necessary to understand the different cost types and terms and how a cost accounting information system calculates cost, depending on the cost object. Study unit 1 will explain these basic concepts to you.

Accountants need to know the cost of certain objects (including products) for the following reasons:

a. to value inventory for reporting purposes
b. to plan and control activities in the organisation
c. to make decisions that will improve the organisation's profitability

2 Cost objects and traceability

The first step in determining the cost of any product or activity is to define the specific cost object.

COST OBJECT

A cost object is any activity, unit or phenomenon for which cost can be accumulated and measured.

The unit or activity may consist of a product unit, a batch of units, a job order, a contract or a project. It can also be a customer, geographical region, etcetera. In manufacturing organisations, the cost object will often be a product or products. To determine whether something is a cost object you need to ask the most fundamental question about cost: **"The cost of what?"** This will provide you with the answer.

When cost is assigned to cost objects, the costs are classified as either direct costs or indirect costs.

Example: A particular type of an item manufactured, say "product A".

NOTE

In IAS2, you can read about the costs that have to be included in/excluded from the cots of inventory for purposes of International Financial Reporting Standards (IFRS). For decision-making purposes, non-manufacturing costs may sometimes have to be include in the costing of SOME cost objects.

DIRECT COST

Direct costs can be traced easily or physically to *a particular cost object*.

Example: The specific material used to manufacture product "A".

Assigning direct costs to a cost object is referred to as *cost tracing.*

INDIRECT COST

Indirect costs *cannot be traced easily* or physically to a particular cost object.

Example: The depreciation cost of the machine used to manufacture product A.

Indirect cost can include low value items as well, such as nails and screws. In the case of these items, the cost of trying to trace costs to objects exceeds the benefit of doing so. These items may be referred to as *general supplies*.

Assigning indirect costs to a cost object is referred to as *cost allocation*.

You will learn more about the different methods used to allocate indirect cost in later topics.

The allocation process, by its very nature, leads to inaccuracies in the costs of objects. It is therefore important to attempt to identify direct costs, which are traceable, as far as possible, taking into account the cost/benefit of doing so.

Activity 1.1

COST ASSIGNMENT

A manufacturer manufactures wooden furniture. Indicate for each of the following items whether it is a cost object, a direct cost, or an indirect cost:

a. A particular type of desk manufactured
b. The wood used to make a desk
c. The wages of the employees assembling desks

d. A particular type of cupboard manufactured
e. The nails used in assembling a cupboard
f. The rent for the factory building
g. The wages of the cleaning staff in the factory

Solution to Activity 1.1

a. Cost object
b. Direct cost
c. Direct cost
d. Cost object
e. Indirect cost (It is not cost effective to trace the cost of small items, such as nails, to each product.)
f. Indirect cost
g. Indirect cost

NOTE

Regarding all *indirect cost* answers:

If the cost object is at a higher level (eg *a specific factory* or *geographical area*), each of these answers will change to *direct cost.*

3 Classification of costs according to their nature or origin

The process of classifying costs may begin by relating costs to different phases in the operation of a business.

In a manufacturing enterprise, total operating cost consists of:

- Manufacturing, factory, or production cost
- Non-manufacturing or commercial cost

MANUFACTURING COST

Manufacturing costs, also called factory costs or production costs, are the total of the costs incurred in the manufacturing or production process: direct material, direct labour, direct expenses and manufacturing overheads.

A more detailed explanation of these cost components will follow later in the topic.

In a service organisation, the manufacturing cost is replaced by service costs, such as salaries and other costs related to the employees and equipment used to render the income-generating services.

NON-MANUFACTURING COST

Non-manufacturing costs fall into two categories:

- ***Marketing costs*** (selling and distribution costs) include all the costs related to the sale and delivery of products.

  These costs start once the manufacturing of the products is completed. Examples of marketing costs are advertising, sales commission, sales salaries and shipping (distribution).

- ***Administrative costs*** are the costs incurred in directing and controlling the organisation.

  Administrative costs include compensation of executives, general accounting costs, secretarial costs and similar costs relating to the general management of an organisation.

Note that products can be produced without incurring these costs.

4 Further classification of manufacturing costs according to its components

As was mentioned in the previous section, manufacturing costs consist of the total costs of the following components:

- direct materials
- direct labour
- other direct manufacturing expenses
- manufacturing overheads

DIRECT MATERIALS

Direct materials are all materials that can be identified as forming part of the individual, finished product and can be included directly in calculating the cost of the product.

As an example, the wood required to manufacture a pencil is a direct material.

DIRECT LABOUR

Direct labour is the work needed to convert direct materials into an individual finished product.

It includes wages paid to employees to assemble products or the manufacturing machine operators (ie where the operator spends time, individually, on each item).

MANUFACTURING OVERHEADS

Manufacturing overheads are the total costs of indirect materials, indirect labour and all other indirect manufacturing costs that cannot be traced directly to specific individual products.

- ***Indirect materials*** are materials that cannot be linked to a specific individual product, because it is used for all products (eg the machine oil), rather than for a specific individual product.

  It may also include smaller items of material where it is not cost-effective to trace the costs to individual products. Examples of these are nails, glue, screws and staples.

- ***Indirect labour*** costs include the wages/salaries of all employees who do not work on the product itself, but who assist in the manufacturing process.

  As an example, the salaries of the factory supervisors or production scheduling staff are indirect labour costs.

- ***Other manufacturing costs*** include costs such as rent for the factory, depreciation of machinery, electricity used in the production process, maintenance and repairs on factory equipment and insurance on the factory building and equipment.

The abovementioned costs can be grouped into **prime** and **conversion** costs.

PRIME AND CONVERSION COST

- ***Prime cost*** (also called primary cost) is the total of all the direct costs. It is the costs for direct materials and direct labour (and other direct manufacturing costs when these exist).
- ***Conversion cost*** is the total cost incurred when converting raw material into finished products. It is the total of the direct labour costs and manufacturing overheads.

The next figure sets out the relationship between the various cost components.

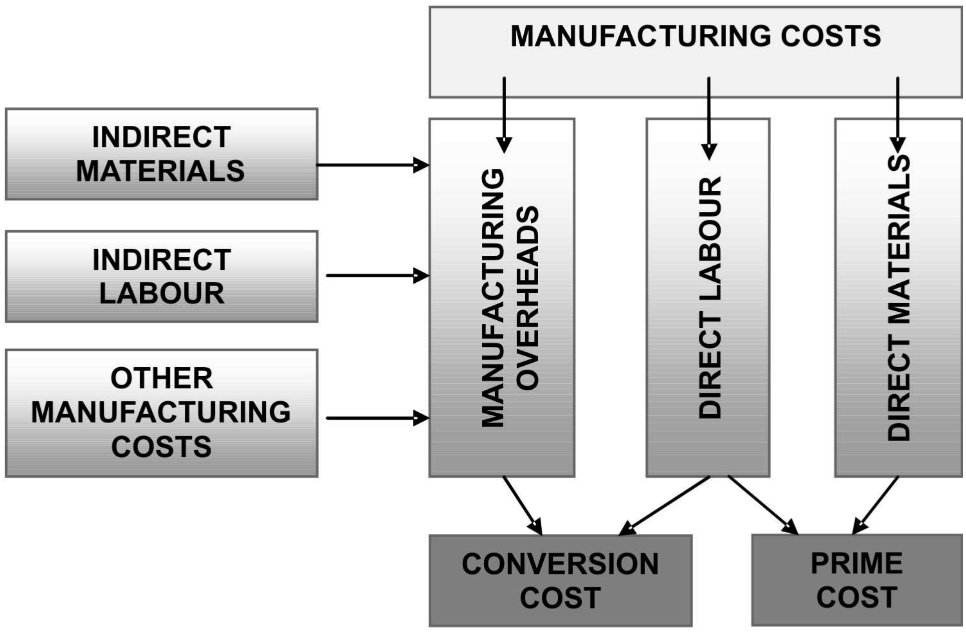


FIGURE 1.1: The relationship between the components of manufacturing cost

NOTE

Did you notice that direct labour falls into both the conversion cost and prime cost groupings?

Activity 1.2

COST CLASSIFICATION BY NATURE

Tebogo Manufacturers incurred the following costs:

	R
Direct materials	250 000
Direct labour	150 000
Manufacturing overheads	400 000

REQUIRED

Calculate the following:

a. Prime costs
b. Conversion costs
c. Total manufacturing costs

Solution to Activity 1.2

a.

	R
Direct materials	250 000
Direct labour	150 000
Prime costs	400 000

d.

	R
Direct labour	150 000
Manufacturing overheads	400 000
Conversion costs	550 000

b.

	R
Direct material	250 000
Direct labour	150 000
Manufacturing overheads	400 000
Total manufacturing costs	800 000

---

5 Classification of costs according to cost behaviour

It is important to know how the total cost of a product "behaves" over a period. Cost reacts or responds to changes in the level of activity. Activity or volume can be measured in different ways, such as kilometres travelled or the number of products produced or sold. Knowledge of cost behaviour is essential for decision-making.

Based on the reaction to changes in activity level, costs fall into one of the following classifications:

- Fixed cost
- Variable cost
- Semi-variable cost
- Semi-fixed, also called stepped fixed cost

Two further factors, namely relevant range and time frame, will always define the changes in activity level. We shall now discuss each of these very important concepts.

5.1 Fixed cost

FIXED COST

Fixed cost is a cost that remains ***constant, in total***, regardless of changes in the level of activity or volume within the relevant range and in a specific time frame.

These costs are incurred to sustain a certain level of production (eg between 8 000 and 10 000 units). This means that the fixed cost *per unit* will decrease when the level of activity increases from, say, 8 000 to 9 000 units; the reverse is also true.

The allocation of fixed cost to products is based on managerial decisions or by making use of cost allocation methods (see topics later on in this study guide). The control of fixed costs is the responsibility of higher-level management rather than the operating supervisors.

Examples of fixed costs are supervisor salaries, rent, insurance, depreciation. The annual insurance premium of an organisation will, for instance, be negotiated by the administrative or financial manager.

NOTE

Fixed costs can be incurred for manufacturing and non-manufacturing purposes. For example, in the case of insurance, all the assets of the business are insured, whether it is the manufacturing machines or the computers used by the administrative staff.

Activity 1.3

FIXED COST

The total fixed cost of Tebogo Manufacturers amounts to R15 000 per month.

REQUIRED

Calculate the fixed cost per unit if Tebogo Manufacturers produces 100, 200, or 300 units per month.

Solution to Activity 1.3

R15 000/100 units = R150 per unit

R15 000/200 units = R75 per unit

R15 000/300 units = R50 per unit

NOTE

Can you see that it becomes more beneficial (*cheaper)* for Tebogo to increase its production output? Optimal capacity utilisation is very important when it comes to fixed cost, *BUT this is always subject to market demand.*

5.2 Variable cost

> **Key term: VARIABLE COST**
>
> Variable cost is a cost that *varies, in total*, in direct proportion to changes in the level of activity or volume. The variable cost ***per unit is constant*** within a relevant range.

This means that, if the volume doubles, the *total* variable cost will double. The tracing of variable costs to products can be done with reasonable ease and accuracy.

A variable cost consists of two variables: one for the quantity used and another for the price/ cost per unit of supply, for example rand per unit, rand per kg, rand per hour. The quantity used is controlled by a specific operating level supervisor (eg the cubic metres of wood requisitioned from the stores to manufacture a batch of pencils).

Employees outside the production environment/department (eg the purchasing staff) usually control or determine the price per unit of a variable source for example, the cost of the wood per cubic metre or kilogramme.

Direct materials and direct labour are examples of variable cost.

NOTE

① Labour costs associated with employees permanently employed in the manufacturing environment will only be considered as a variable cost if management is able to adjust the supply (ie retrench workers) in the short term (within the budget period, usually one year). For this module, you may assume that direct labour cost is variable, unless specifically stated otherwise.

② Cost controllability (who controls which aspect of a cost) is an important issue in cost management. You will learn more about this issue in later topics.

Activity 1.4

VARIABLE COST

For Tebogo Manufacturers, the variable cost per unit is R200.

REQUIRED

Calculate the total variable cost if Tebogo Manufacturers produces 100, 200, or 300 units per month.

Solution to Activity 1.4

R200 x 100 units = R20 000 per month

R200 x 200 units = R40 000 per month

R200 x 300 units = R60 000 per month

Figure 1.2 is a graphical representation of variable and fixed cost behaviour.

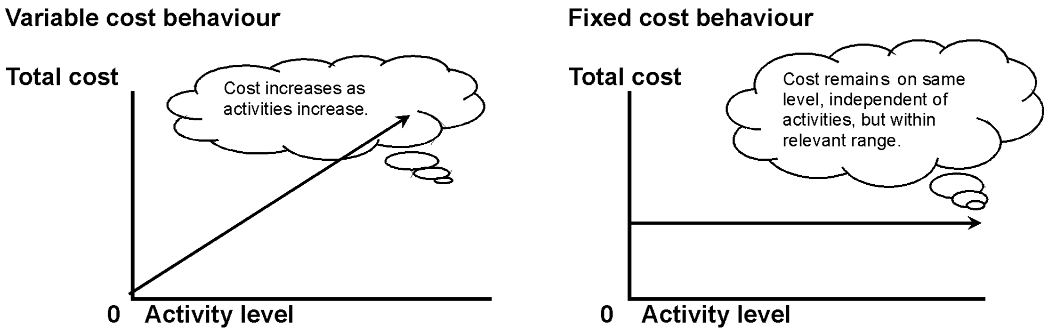


FIGURE 1.2: Variable and fixed cost behaviour

NOTE

Fixed cost remains constant in total and variable cost remains constant per unit.

5.3 Semi-variable cost

SEMI-VARIABLE COST

Semi-variable or mixed cost contains both fixed and variable cost. The mixture of cost includes a fixed amount within a relevant range of output and an amount that varies proportionately with output changes.

Telephone cost, for example, is usually semi-variable because the line rental is fixed, while call charges vary, depending on the number of calls made. Another example is equipment maintenance costs. In any given period the total maintenance expense can consist of routine, preventative maintenance that takes place irrespective of units manufactured, and maintenance that occurs after, say, every 1 000 hours of production or units produced. The latter is dependent on the volume manufactured and varies with hours worked/units produced.

Activity 1.5

FIXED, VARIABLE AND SEMI-VARIABLE COST

Classify each of the following costs as fixed **(F)**,variable **(V)**, or semi-variable **(SV)**, according to the number of units produced during the month:

a. A factory supervisor's salary
b. The paper used in textbook production
c. Factory insurance
d. The screws used in furniture production
e. The rent on a factory building
f. The piecemeal wages paid to workers assembling a product
g. The routine, monthly maintenance of machinery and three call-outs for breakdowns
h. The wood used in furniture production

Solution to Activity 1.5

a. F
b. V
c. F
d. V
e. F
f. V
g. SV
h. V

5.4 Semi-fixed (stepped) cost

SEMI-FIXED (STEPPED) COST

Certain kinds of fixed costs increase or decrease only in fixed increments or in steps.

For example, a manufacturer's current production capacity (at a cost of R15 000 per month) is 10 000 units of a product and the forecast demand is 12 000 units. The organisation needs to increase its production capacity by 2 000 units by buying an additional machine. However, the new machine's capacity is 5 000 units (but only 2 000 extra units are required!). The monthly operating cost of the new machine is R3 000. The cost to produce the first 10 000 units is therefore R15 000 per month, and units 10 001 to 15 000 will be produced at a cost of R3 000, irrespective whether 50, 2 000 or 5 000 are produced. (Producing anywhere between 10 001 and 15 000 units per month will cost R18 000 in total.) The cost, therefore, jumps up a *step*, and does not increase gradually.

Semi-fixed cost is intertwined with the concepts ''relevant range'' and ''time frame''.

Figure 1.3 is a graphical representation of semi-variable and semi-fixed cost behaviour.

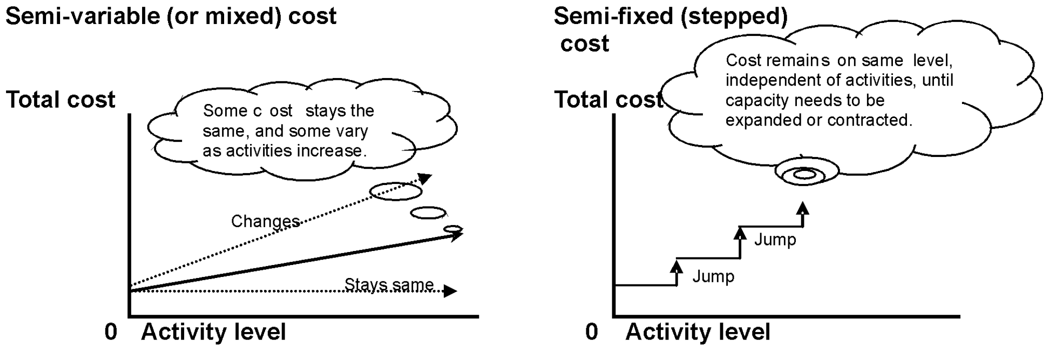


FIGURE 1.3: Semi-variable and semi-fixed costs

6 A closer look at relevant range and specific time frame

6.1 Relevant range

> **RELEVANT RANGE**
>
> The relevant range is normally defined by the *production capacity* (number of units) within which the organisation *normally operates*.

For example, normal production lies between 8 000 and 10 000 units per month. Within this range, cost estimation models (discussed in study unit 2) will be reasonably accurate.

6.2 Specific time frame

Time has a significant impact on the behaviour of cost, especially fixed cost.

- In the very short term (eg in the next month), almost all cost (excluding direct material) is fixed, because its supply has already been contracted and committed.
- In the short term (eg the next year), most of the fixed cost will remain fixed in monetary terms, because the price or amount was already negotiated.
- In the medium term (two to three years), significant changes in the level of fixed cost can be implemented. For example, some machines can be taken out of production if a decline in demand for the product is forecast.
- In the long term, *all cost becomes variable*, because management can adjust the level of support and infrastructure provided to meet the demand level for the product required at that specific stage. This results in changes, even to fixed costs. For example, if forecast market demand for one of the products indicates a decline in three years' time (due to the launch of newer models), management can plan to eventually close that part of the manufacturing process, resulting in savings in infrastructure and support costs (usually fixed) for that product.

NOTE

The time frame is very important in all decisions regarding cost behaviour in the future.

7 Classification of cost as product or period cost

7.1 Product cost

PRODUCT (MANUFACTURING) COST

Product cost is the cost incurred in the manufacturing of a product.

NOTE

You will see in Topic 4 that there could be a variation in this definition, based on the costing method.

Costs incurred in the manufacturing of inventory that remain unsold at the end of the period are called the *unexpired costs*. These costs are shown as an asset in the *inventory account* in the *statement of financial position.* When the completed goods/ products are sold, the costs are called ***expired costs***. They are then transferred to the *cost of goods sold account* in the *statement of comprehensive income*. Product costs are therefore treated as expenses only when the product is sold.

7.2 Period costs

PERIOD COSTS (EXPENSES)

Period costs are costs that are not included in product costs.

These costs are treated as expenses in the *statement of comprehensive income* in the period in which they are incurred. For example, rent for an office building, marketing costs and administrative costs are not included as part of the cost of a manufactured product, but will appear on the *statement of comprehensive income in* the period they are incurred. (NOTE: the rent of a factory building will be part of manufacturing costs.)

NOTE

Cost relating to inefficient use of production resources will also be treated as period cost and not *as part of the cost of* inventory. You will learn more about this in the topic on standard costing.

Activity 1.6

Classify the following items as product costs or period costs:

a. Material
b. Marketing cost
c. Salary of the secretary of the Human Resources Department
d. Salary of the machine operator

Solution to Activity 1.6

a. Product costs
b. Period costs
c. Period costs
d. Product costs

8 Summary

In this study unit, you have learnt the basis of classifying cost, which is as follows:

- The types of **cost objects**.
- ***The nature of costs*** – total operating cost consists of manufacturing and non-manufacturing costs. Non-manufacturing costs fall into two categories: marketing costs and administrative costs.
- ***The elements of manufacturing costs*** – direct material, direct labour and manufacturing overheads. The total cost of direct material and direct labour are known as the prime costs and the total cost for direct labour, and manufacturing overheads is the conversion cost.
- ***Cost behaviour*** – cost can be fixed, variable, semi-variable or semi-fixed.
- ***Product or period costs*** – costs linked to the efficient manufacturing process are product costs. All other costs are period costs.

In the next study unit, we will discuss techniques used to separate fixed and variable costs and to project or forecast cost at different levels of activity.

Self-assessment Activity

Answer the following questions.

QUESTION 1

a. Are the wages paid to the operator of a manufacturing machine an example of *period cost* or *direct labour* or *both*?
b. Is the salary paid to the factory supervisor an example of *product cost* or *manufacturing overhead cost* or *both*?
c. Are property taxes on a **manufacturing** plant an *component of conversion cost* or *period cost* or *both?*
d. When the volume or level of activity increases, will variable costs *increase* or *decrease* in total?
e. The following costs were incurred in April:

	R
Direct materials	15 000
Direct labour	20 000
Manufacturing overheads	30 000
Administration costs	10 000
Selling costs	12 000

i What is the total amount for conversion costs?
ii What is the total amount for prime costs?

f. Mangora Ltd's manufacturing overheads are 40% of its total conversion costs of R60 000. Calculate the direct labour and manufacturing overheads.

QUESTION 2

Listed below are a number of costs incurred by organisations.

1. the piecemeal wages of the workers assembling computers
2. magazine subscriptions for the factory canteen
3. the boxes used to ship the detergent produced by a company to its customers
4. the factory supervisor's salary
5. executive directors' life insurance

REQUIRED

a. Which of the abovementioned costs are variable to production levels and which are fixed to production levels?

b. Which of the abovementioned costs are direct, indirect manufacturing, or non-manufacturing costs?

QUESTION 3

Ntombeni Limited has a financial year starts on 1 March and ends on 28 February. The management accountant of the company has just prepared the budget for the forthcoming year, based on the following cost structure:

– Number of units to be produced	7 000
– Direct material	R 49 per unit
– Direct labour	R 21 per unit
– Indirect labour (all variable)	R28 000
– Other manufacturing overheads (60% variable)	R21 000
– Selling and administrative expenses (all fixed)	R28 000

REQUIRED

Calculate the following:

a. Prime costs per unit

b. Total conversion costs

c. Total manufacturing costs

d. Total period costs

e. Total variable manufacturing costs

f. If the company produces fewer than 7 000 units in the forthcoming year, would you expect the total variable costs to increase, decrease or remain constant? *(Explain only – no calculations necessary.)*

Solution to Self-assessment Activity

QUESTION 1

a. Direct labour; not a period cost, but a product cost.

b. It is both.

c. Element of conversion cost, not a period cost, but a product cost.

d. Increases in total.

e. Variable manufacturing cost:

i R50 000 for conversion costs (R20 000 + R30 000)
ii R35 000 for prime costs (R15 000 + R20 000)

f. Direct labour: 60% x R60 000 = R36 000
   Manufacturing overheads: 40% x R60 000 = R24 000

QUESTION 2

a. The wages of the workers assembling computers variable & direct
b. Magazine subscriptions for the factory canteen fixed and indirect
c. The boxes used for shipping the detergent variable and selling cost (non-manufacturing)
d. The factory supervisor's salary fixed and indirect
e. Executive directors' life insurance fixed, but admin cost (non-manufacturing)

QUESTION 3

a.

	R
Direct material costs per unit	49
Direct labour costs per unit	21
Prime cost per unit	70

b.

	R
Direct labour costs (R21 x 7 000)	147 000
Indirect labour costs	28 000
Other manufacturing overheads	21 000
Total conversion costs	196 000

c.

	R
Prime costs (R70 x 7 000)	490 000
Indirect labour costs	28 000
Other manufacturing overheads	21 000
Total manufacturing costs	539 000

d.

	R
Selling and admin expenses	28 000

e.

	R
Prime costs	490 000
Indirect labour costs (R28 000 x 30%)	28 000
Other manufacturing overheads (R21 000 x 60%**)**	12 600
Total variable manufacturing costs	530 600

f. Variable costs vary, in total, in direct proportion to changes in the level of activity. The total variable costs would therefore decrease.

STUDY UNIT 2

Estimation techniques and the linear equation

In this study unit

- The linear equation
- The high-low method
- The scatter diagram
- Simple regression analysis (LSM)

1 Introduction

In the previous study unit, we introduced you to the various cost terms and explained how different costs behave under different circumstances. One of the more difficult costs to calculate and forecast is semi-variable costs, because these are a combination of fixed and variable costs. In this study unit, we will explore the methods that can be used to identify the components of a semi-variable cost. We will use the components in the linear cost equation to forecast or project costs at different levels.

The three most common methods are:

1. the high-low method
2. the scatter diagram
3. simple regression analysis

2 The linear equation

Estimation techniques or models can be used to project cost at different levels of operation by employing the following linear equation:

$$y = a + bx$$

Key formula: COST EQUATION BASED ON LINEAR EQUATION

The cost equation $y = a + bx$ represents a straight line, where:

y = total cost; the dependent variable
a = total fixed costs; the intercept on the y-axis
b = variable cost per unit of activity; the slope of the straight line
x = activity level (eg volume of unit manufactured, machine hours, inspection hours, etc); the independent variable

The linear equation can also be represented on a graph such as the following:

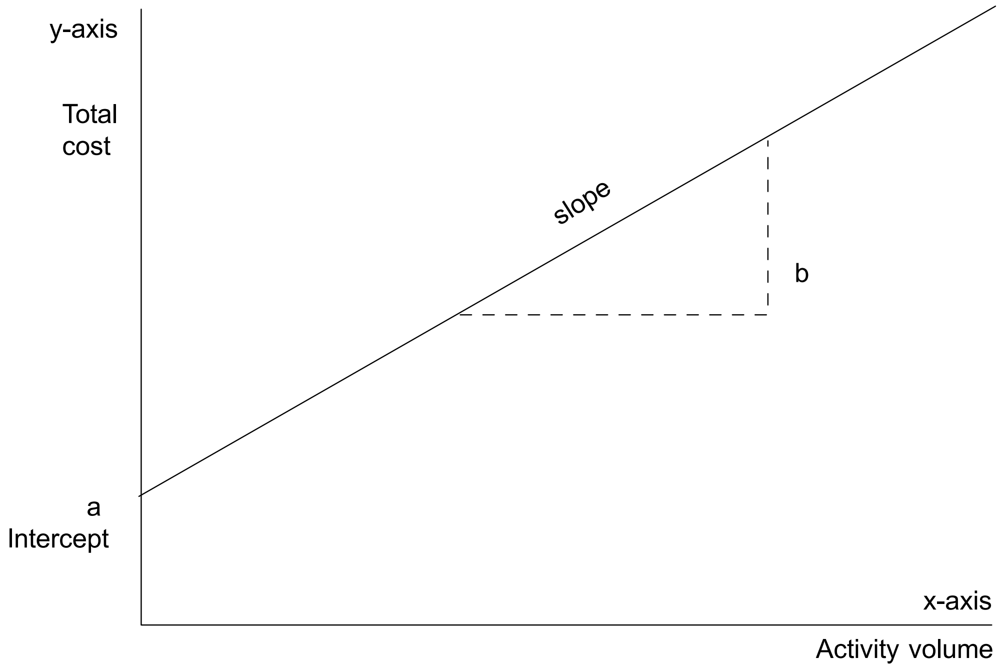


Figure 2.1: Total cost graph

3 The high-low method

This method involves comparing the change in costs between two activity levels. Here we apply a simple technique that identifies the highest and lowest activity levels and their respective costs from a set of data. The difference between the two total costs is then divided by the difference between the two activity levels. The result is the **variable cost per unit** of activity, on the assumption that the fixed cost, by definition, is the same at both activity levels, that is, high and low.

Key formula: VARIABLE COST PER UNIT (HIGH-LOW METHOD)

$$= \frac{\text{the difference between costs at the highest and lowest activity}}{\text{the difference between highest and lowest activity}}$$

The fixed costs are then determined as follows:

fixed costs = total mixed costs for related activity level – (variable cost per unit x related activity level)

NOTE

Use either the cost and unit information at the highest activity level, or the cost and unit information at the lowest activity level, to substitute into the equation.

A linear equation is then formulated to represent the cost function. Note that this is a rough model. Each historical data point (cost) might not be perfectly explained by the linear equation. A more accurate model can be developed by simple regression analysis, which we will cover later.

Activity 2.1

Doublet Limited incurred the costs as indicate below. During the six months ended 30 June, these costs changed, but not in direct relation to the volume.

MONTH	NUMBER OF UNITS PRODUCED	HISTORICAL COST (R)
January	98	1 980
February	100	2 000
March	105	2 050
April	95	1 950
May	104	2 040
June	106	2 060

REQUIRED

a. Use the high-low method to determine the variable cost per unit and the total fixed costs.
b. Formulate a linear equation that explains and predicts cost behaviour.
c. Forecast the total costs if an estimated 110 units are to be manufactured in July.

Solution to Activity 2.1

a. **Variable cost per unit** $= \dfrac{\text{R2 060} - \text{R1 950}}{106 - 95 \text{ units}}$
$= \underline{\underline{\text{R10 per unit}}}$

Total fixed costs (@ highest observation) = R2 060 – (106 x R10)
$= \underline{\underline{\text{R1 000}}}$

OR

Total fixed costs (@ lowest observation) = R1 950 – (95 x R10)
$= \underline{\underline{\text{R1 000}}}$

b. **y = R1 000 + R10x**

c. **Forecast for 110 units**

y = R1 000 + (R10 x *X* units) = R1 000 + (R10 x 110 units)
= R2 100

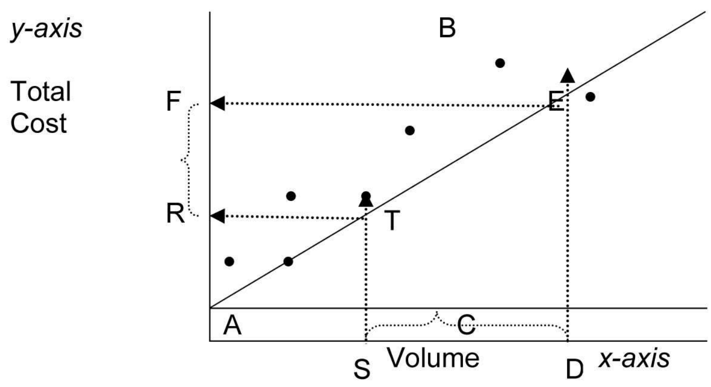
NOTE

- It is important to note that the identification of the high and low points is based on ACTIVITY level and not on cost.
- This applies only if ALL activity levels fall inside the RELEVANT RANGE.

4 The scatter diagram

This method involves graphically plotting the total cost on the y-axis for each activity level on the upper axis. A straight line is then drawn simply by sight between the observation points so that the distances between the points above the line are approximately equal to the distances of the points below the line. Unlike the high-low method, the scatter diagram can include more than two activity levels. However, this method does not claim to be accurate, because each person will draw the line slightly differently.

The scatter diagram on the next page shows past volume and cost data, with individual observations represented by dots. The diagram enables one to identify representative high and low volumes. It is also useful in determining whether costs can be reasonably approximated by means of a straight line.



To plot the straight line:

1. Draw a straight line (AB) through the various points of the total semi-variable overheads for the period and connect this line to the y-axis (A). Line AB is a straight line that best fits all the different points (by sight).
2. Draw a horizontal line through point A to C. (Line AC represents the fixed portion of the semi-variable overheads.)

Do the following to find the total mixed (semi-variable) overheads for any production volume within the relevant range:

1. The budgeted semi-variable costs for any volume on the x-axis is obtained by drawing a vertical line ST from point S *(the volume for which the cost is needed)* on the x-axis until it intersects with line AB.
2. A horizontal line is then drawn to the left, which cuts the y-axis at point R.
3. Read off the costs from the y-axis, which seem to be approximately R206 in semi-variable overheads.

If you use graph paper, you should be able to get a more accurate reading.

Once the straight line is drawn, the components of the mixed costs in the cost equation $y = a + b\,x$ can be found as follows:

1. The fixed cost (**a**) is equal to the intercept on the y-axis.
2. The variable cost (**b)** is computed by taking two points, **F** and **R,** on the y-axis and **S** and **D** on the x-axis and calculating the difference per unit of activity in the same way as the high-low method.

5 Simple regression analysis (least squares method)

The linear equation $y = a + b\,x$ can once again be used to determine the fixed and variable portions of manufacturing overheads. Simple regression analysis (also referred to as the least squares method) can be used to determine the relationship between the dependent (total cost) and independent variable (number of units manufactured).

NOTE

It is important to note that, in order to use the results of the simple regression analysis, the correlation between the dependant and independent variables needs to be strong. In later MAC modules, you will learn more about linear regression correlation statistics (r^2). For the purposes of MAC2601, you can assume that the correlation is good enough to predict behaviour.

Key formula: FIXED AND VARIABLE OVERHEAD PORTION (SIMPLE REGRESSION ANALYSIS OR LEAST SQUARES METHOD)

The values for **a** and **b** can be found by simultaneously solving the following equations:

xy = a x + b x..................①
y = an + b x....................②

is the Greek capital letter sigma meaning the "sum of" (ie xy means the sum of the result of x multiplied with y).

nis the number of observations (data points).

x^2 is "x" to the power of two, meaning "x" multiplied by itself.

NOTE

① The formulae for the simple regression analysis method (or least squares method), was statistically determined. For this course, you do not need to know how it was derived. Note that, in the examination paper, the formulae will be given to you.

② Statisticians determined that *reliable* linear modelling using a simple regression analysis needs at least 100 observation points for y and x EACH. (An observation point can be the total number of pencils manufactured per day on the x-axis and the total cost for those pencils on the y-axis.) In this module, it is not practical to supply you with data sets of 100 or more, and so we will use less than 100 observation points (or data items per unit) to teach you the techniques. **However, in the workplace**, you should use the correct minimum observation points, which should be more than 100.

Activity 2.2

OBSERVATION (data point)	VOLUME (units, etc)	TOTAL OVERHEAD COSTS (R)
1	4 000	23 000
2	3 000	18 000
3	2 400	16 000
4	4 400	24 000
5	2 000	11 000
6	3 600	23 000
7	2 200	15 000

REQUIRED

Use the simple regression analysis method to determine the variable overhead cost per unit and the total fixed overhead costs and define a linear equation for the cost behaviour.

Use the following equations:

a. xy = a x + b x.................①
b. y = an + b x...................②

Solution to Activity 2.2

The required calculations are shown below.

OBSERVATION n	VOLUME X (Independent)	TOTAL COSTS Y (Dependent)	XY	X^2
1	4 000	23 000	92 000 000	16 000 000
2	3 000	18 000	54 000 000	9 000 000
3	2 400	16 000	38 400 000	5 760 000
4	4 400	24 000	105 600 000	19 360 000
5	2 000	11 000	22 000 000	4 000 000
6	3 600	23 000	82 800 000	12 960 000
7	2 200	15 000	33 000 000	4 840 000
	21 600	130 000	427 800 000	71 920 000

Substituting these values into the normal equation, we obtain:

427 800 000 = a 21 600 + b 71 920 000..........................③
130 000 = a 7 + b 21 600..④

We solve **b** by eliminating **a**. To do this, we need to have the same coefficient for **a** in each equation. This is done by multiplying equation ③ by 7 and equation ④ by 21 600. By obtaining the difference between the two new equations, **a**is eliminated, and **b** can be solved.

We then obtain the following:

2 994 600 000 = 151 200 a + 503 440 000 b.............⑤ (③x 7)
2 808 000 000 = 151 200 a + 466 560 000 b.............⑥ (④x 21 600)
186 600 000 = 36 880 000 b.............⑦(⑤ – ⑥)

NB: Equation ⑦ is the difference between equations ⑤ and ⑥.

Solving equation for **b**, we obtain

$$b = \frac{186\ 600\ 000}{36\ 880\ 000}$$

$$= 5{,}06$$

We can solve **a** by substituting the value of **b** in any of the equations containing **a**. In doing this in equation, we obtain

$$7a = 130\ 000 - 21\ 600\ (5{,}06)$$
$$7a = 20\ 704$$
$$a = \frac{20\ 704}{7}$$
$$= 2\ 958$$

The resulting cost estimation equation is: total costs (y) = R2 958 + R5,06 *x*

Activity 2.3

The quarterly production and cost data as recorded in five expense accounts of Valkop Ltd. are provided below.

QUARTERS	**1**	**2**	**3**	**4**
	UNITS PRODUCED			
	8 000	10 000	11 000	9 000
	Total cost per expense item			
ACCOUNTS	R'000	R'000	R'000	R'000
Maintenance	46	54	58	50
Indirect labour	24	30	33	27
Direct labour	80	100	110	90
Production plant insurance	36	36	36	36
Utilities	18	22	24	20

REQUIRED

a. Indicate whether each cost is fixed (f), variable (v), or mixed (m).
b. Write down the cost equation for the following accounts only, by using the high-low method (if applicable):
   i. Maintenance
   ii. Indirect labour

Solution to Activity 2.3

a. Behaviour of cost

A total cost that varies as the volume changes obviously consists of variable or mixed costs. We therefore calculate the cost per unit to identify the variable cost items. Variable cost per unit would remain constant across all the production volumes.

The fixed cost remains constant in total across all production levels.

QUARTERS	1	2	3	4
	UNITS PRODUCED			
	8 000	10 000	11 000	9 000
ACCOUNTS	R per unit	R per unit	R per unit	R per unit
Maintenance	5,75	5,40	5,27	5,56
Indirect labour	3 00	3 00	3 00	3 00
Direct labour	10 00	10 00	10 00	10 00
Utilities	2,25	2,20	2,18	2,22

Maintenance = Mixed
Indirect labour = Variable
Direct labour = Variable
Plant depreciation = Fixed
Utilities = Mixed

b. Cost equations

i. Maintenance:

b (variable cost per unit) $= \dfrac{R58\ 000 - R46\ 000}{11\ 000 - 8\ 000}$

$= R4{,}00$

a (fixed cost) = R58 000 – R4 (11 000) = R14 000

Cost equation y = R14 000 + R4 x

where, in each quarter, **y** represents the total costs and $x$represents volume.

ii. Indirect labour:

For example

Quarter 1 = R24 000 8 000 units = R3 variable cost
This is variable cost, therefore fixed cost = 0 (nil)
Therefore y = 3x + 0

---

6 Summary

In this study unit, we looked at three methods that cost accountants can apply in order to forecast or predict semi-variable cost behaviour. All three are based on the basic linear equation for the cost function.

In the next study unit, we are going to explore the concept of cost-volume-profit analysis for predicting profits in various scenarios.

Self-assessment Activity

QUESTION 1

The following information was obtained from the books of Plastic Manufacturers Ltd. for the year:

Month	Number of bags manufactured	Semi-variable manufacturing overheads R
March	120	2 000
April	130	2 100
May	125	2 020
June	115	1 900
July	132	2 100
August	124	2 040
September	130	2 060
October	140	2 150
November	135	2 120
December	134	2 110
January	130	2 100
February	126	2 080

REQUIRED

a. Use the high-low method to calculate the budgeted semi-variable manufacturing overheads if 120 bags are manufactured.

b. Use the least squares method to calculate the budgeted semi-variable manufacturing overheads if 120 bags are manufactured. Use the following formulae:

$$xy = a\ x + b\ x^2 \ldots\ldots\ldots\ldots\ldots\ldots ①$$

$$y = an + b\ x \ldots\ldots\ldots\ldots\ldots\ldots\ldots ②$$

QUESTION 2

The following information was obtained from the books of Dolls Unlimited Manufacturers Ltd. for the year:

Month	Number of bags manufactured	Semi-variable manufacturing overheads R
March	360	200
April	390	210
May	375	202
June	345	190
July	396	210
August	372	204
September	390	206
October	420	215
November	405	212
December	402	211
January	390	210
February	378	208

REQUIRED

Use the scatter diagram to calculate the budgeted semi-variable manufacturing overheads if 385 dolls are manufactured.

Solution to Self-assessment Activity

QUESTION 1

a. High-low method

	Volume		*Semi-variable overheads*
			R
Highest (October)	140	for	2 150
Lowest (June)	115	for	1 900
Difference	25		250

Variable overheads = $\frac{R250}{25\text{ bags}}$ = R10 per bag

Fixed overheads = R2 150 – (140 bags x R10) = R750 per month

Total budgeted semi-variable manufacturing overheads for 120 bags per month:

	R
Variable portion of semi-variable overheads (120 bags x R10)	1 200
Fixed portion of semi-variable overheads	750
Total budgeted semi-variable overheads	1 950

b. Least squares method

Month	Volumes x	Overheads y	xy	x^2
March	120	2 000	240 000	14 400
April	130	2 100	273 000	16 900
May	125	2 020	252 500	15 625
June	115	1 900	218 500	13 225
July	132	2 100	277 200	17 424
August	124	2 040	252 960	15 376
September	130	2 060	267 800	16 900
October	140	2 150	301 000	19 600
November	135	2 120	286 200	18 225
December	134	2 110	282 740	17 956
January	130	2 100	273 000	16 900
February	126	2 080	262 080	15 876
	x = 1 541	y = 24 780	xy = 3 186 980	b x = 198 407

Equations:

xy = a x + b x^2.................①

y = an + b x....................②

where x = number of bags

y = semi-variable manufacturing overheads for the particular volume

n = number of observations

a = fixed overheads for the period

b = variable overheads per unit

Substitute the values for x and y into equations ① and ②:

R3 186 980 = 1 541a + 198 407b..............①

R 24 780 = 12a + 1 541b ....①

① x 12 : R38 243 760 = 18 492a + 2 380 884b............................③

② x 1 541 : R38 185 980 = 18 492a + 2 374 681b............................④

③ – ④ 57 780 = 6 203b

∴b = R9,3148

Then: Replace b with R9,3148 in equation ②

R24 780 = 12a + (1 541 x R9,3148)

R24 780 = 12a + 14 354,11

R10 425,89 = 12a

∴ a = R868,824

∴ Variable portion : R 9,3148 per bag

Fixed portion : 868,824 per month

Total budgeted semi-variable manufacturing overheads for 120 bags per month:

	R
Variable portion of semi-variable overheads	
(120 x R9,3148)	1 117,78
Fixed portion of semi-variable overheads	868,82
Total budgeted semi-variable overheads	1 986,60

(Note: Allow up to R1,00 difference owing to rounding off.)

Summary:

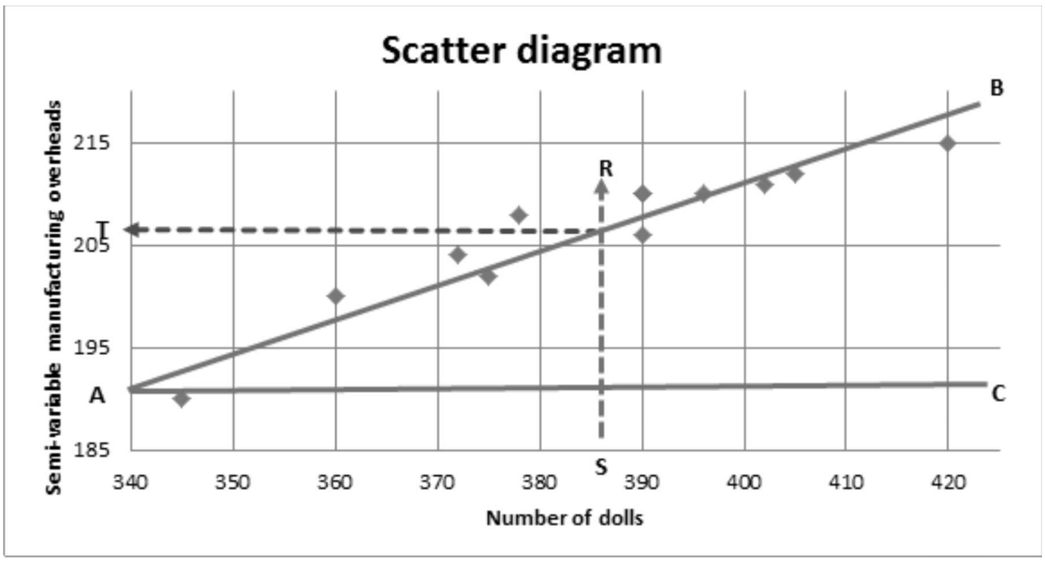
High-low	R1 950
Regression least squares method	R1 987

NOTE

We used two methods, each of which has a different level of accuracy. This resulted in different answers which, nevertheless, are fairly close to each other!

QUESTION 2

Scatter diagram method



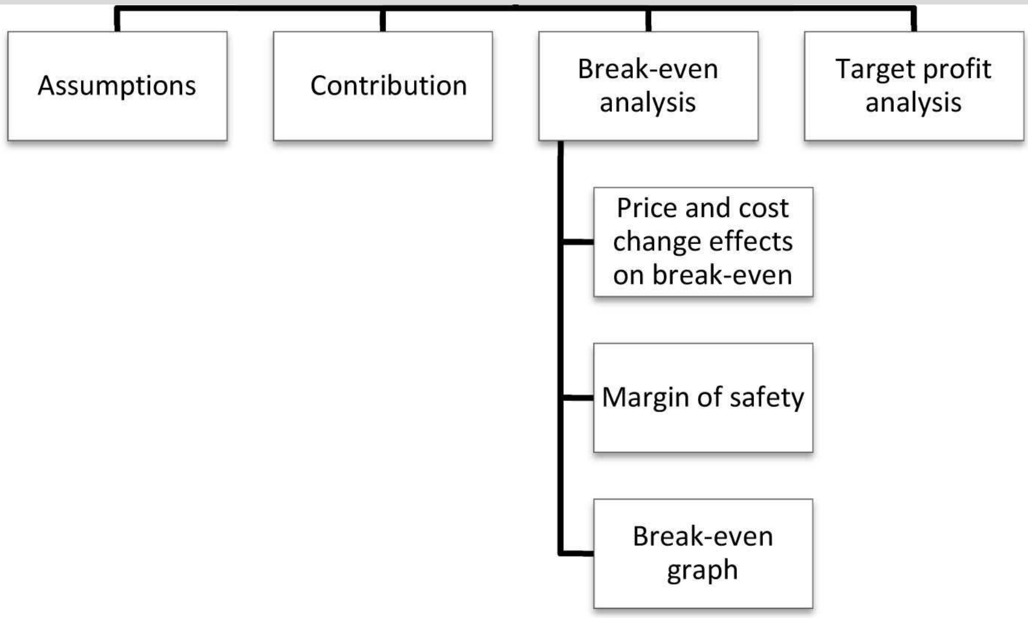
The total semi-variable overheads are obtained as follows:

1. Draw a straight line (AB) through the various points of total semi-variable overheads for the year and connect it to the y-axis (A).
2. Draw a horizontal line through point A to C. (Line AC represents the fixed portion of the semi-variable overheads.)
3. The budgeted semi-variable costs for 385 dolls is obtained by drawing a vertical line SR from point S on the x-axis until it intersects with line AB.
4. Then draw a horizontal line to the left, which cuts the y-axis at point T.
5. Read off the costs from the y-axis, which seems to be *approximately R206* semi-variable overheads.
6. *If you use graph paper, you should be able to get a more accurate reading.*

STUDY UNIT 3

Cost-volume-profit analysis

In this study unit



1 Introduction

In the previous study unit, we explored three techniques for predicting or modelling cost behaviour using a linear equation. In this study unit, we incorporate revenue into the equation to predict the impact of management decisions on the organisation's profitability.

2 What is the cost-volume-profit analysis?

COST-VOLUME-PROFIT ANALYSIS

The cost-volume-profit analysis investigates the change in profit that results from changes in

- activity levels (units produced and sold);
- per unit selling prices;
- per unit variable costs; and
- total fixed costs.

The CVP analysis is a powerful tool that management uses for short-term decision-making and planning to investigate the impact of decisions on profit.

The primary goal of a business is to make a sustainable profit.

PROFIT

Profit is the amount left after all costs are covered.

The amount of profit made will largely be the result of decisions made by management at all levels of the organisation. Profit is based on the relationship between cost, volume of production, selling price and expected profit.

Cost-volume-profit analysis is applicable to service, merchandising and manufacturing activities, as well as to profit and non-profit organisations. In non-profit organisations, the emphasis is on planning for service levels, fund-raising activities and determining funding requirements.

3 Assumptions of the cost-volume-profit analysis

The cost-volume-profit analysis is based on a number of underlying assumptions:

- The selling price per unit is constant, irrespective of the sales volume.
- All costs are linear and can be accurately divided into variable and fixed elements.
- Variable costs are constant per unit, whereas fixed costs are constant in total over the relevant range.
- The sales mix is constant in multiproduct organisations.
- Inventory levels do not change – the number of units produced equals the number of units sold.
- Cost-volume-profit analysis applies to the relevant range only. *(This is crucial!) Outside the upper and lower level of the relevant range for activity (volume), costs and revenue WILL behave differently.*

RELEVANT RANGE

The relevant range is the upper and lower levels of production (= sales) activity levels within which the organisation normally operates and for which cost and revenue behaviour are known and can be predicted.

Despite these limitations of the cost-volume-profit analysis, the technique is a valuable tool for management when it comes to short-term decision-making and profit forecasting.

4 Contribution

In the previous study unit, we emphasised the need to separate the fixed and variable elements of cost. This distinction between fixed and variable costs is also important in the application of cost-volume-profit analysis. One of the key elements in the cost-volume-profit analysis is the concept of contribution.

CONTRIBUTION

Contribution is the amount remaining after the deduction of all variable cost from sales. This amount *contributes* towards covering the organisation's fixed cost.

Key formula: CONTRIBUTION

Contribution = sales – total variable costs

Contribution indicates the excess of sales over all variable costs (ie variable production costs AS WELL AS variable selling and distribution costs).

> **CONTRIBUTION RATIO**
>
> The ratio of the contribution to total sales is known as the contribution ratio (this can expressed as a precentage and also referred to as the profit-volume ratio or contribution margin ratio).

Key formula: CONTRIBUTION RATIO

$$\textbf{Contribution ratio} = \frac{\textbf{contribution}}{\textbf{sales}} \times \textbf{100\%}$$

The contribution ratio indicates the percentage of sales available to cover fixed costs. Once ALL fixed costs are covered, each additional unit sold increases net profit by the amount of the contribution per unit.

In today's complex manufacturing environment, an organisation's fixed cost constitutes a major proportion of all costs, making it crucial that the organisation cover its fixed cost.

The use of contribution is specific to management accounting and differs from the concepts "gross profit" and "net profit". We can also compile profit statements on the contribution basis, which differs from that prescribed by **financial accounting** and IFRS (International Financial Reporting Standards). In the format of the *statement of comprehensive income* used by financial accounting, no distinction is made between fixed and variable costs.

NOTE

You will see that, in MAC2601, we sometimes refer to the statement of profit or loss and other comprehensive income as one of the following:

- statement of profit and loss and other comprehensive income
- income statement
- profit statement
- statement of comprehensive income (SCI)

All of the above terms refer to the same statement for purposes of MAC2601, as this statement is used for **internal** reporting purposes in Management Accounting, and does not have to meet the requirements of IFRS (International Financial Reporting Standards), which relates to external reporting.

For the same reason, the format of the "income statement" for purposes of MAC2601, as well as the terminology used therein, may differ from the formats and terms used in financial accounting.

The following is an example of a financial accountingstatement of comprehensive *income* for a period (simplified for illustrative purposes and easier comparison):

	R
Sales	10 000
Less: Expenses	8 000
Net profit for the period	2 000

Management, however, prefer a *contribution statement of comprehensive income*, in which a distinction is made between fixed and variable costs. The *contribution statement of comprehensive income* is far more useful to management, because it provides cost information that can help in planning, control and decision-making. It provides vital information on the effect of changes in selling price, cost and volume on profit.

An example of a *contribution statement of comprehensive income* for a period (for the same results as above) is as follows:

	R
Sales	10 000
Less: Variable expenses	5 000
Contribution	5 000
Less: Fixed expenses	3 000
Net profit for the period	2 000

Activity 3.1

Last month's *contribution statement of comprehensive income* for Bonsero Ltd. is as follows:

	Total	Per unit	Percent
	R	R	%
Sales (1 500 units)	75 000	50	100
Less: Variable costs	45 000	30	60
Contribution	30 000	20	40
Less: Fixed costs	20 000		
Net profit	10 000		

REQUIRED

a. Calculate the number of units sold.
b. Calculate the contribution ratio.

Solution to Activity 3.1

a. **Number of units sold**

Contribution per unit	=	Total contribution ÷ number of units sold
Number of units sold	=	R30 000 ÷ R20 per unit
	=	500 units
		(Also: R75 000 ÷ R50 per unit = R500 units)

The contribution per unit remains constant as long as the selling price and variable cost per unit do not change.

b. **Contribution ratio** = $\frac{\text{contribution}}{\text{sales}} \times 100$

= $\frac{R30\ 000}{R75\ 000} \times 100$

= 40%

(Also: R20/R50 = 40%)

The contribution ratio of 40% indicates that R0,40 of every R1 of sales is available to cover fixed costs. Once all fixed costs are covered, R0,40 of every R1 of sales will contribute to net profit.

Activity 3.2

The following information is available for product Q:

Units sold	5 000
	R
Sales	150 000
Variable costs	75 000
Fixed costs	30 000

REQUIRED

Calculate the following:

a. Contribution in total and per unit
b. Contribution ratio

Solution to Activity 3.2

a. **Contribution in total**

	R
Sales	150 000
Less: Variable costs	75 000
Contribution	75 000

Contribution per unit:

	R
Selling price per unit (R150 000 ÷ 5 000)	30
Less: Variable costs per unit (75 000 ÷ 5 000)	15
Contribution per unit	15

OR

Contribution in total ÷ units sold = R75 000 ÷ 5 000
= R15 per unit

b. **Contribution ratio** = $\frac{R75\ 000}{R150\ 000} \times 100$

= 50%

OR

R15/R30 x 100 = 50%

---

5 Breakeven analysis

It is essential for management to know the point of operation at which business revenues (sales) and costs are exactly equal. A part of the value of each sales transaction is used to cover the variable costs incurred in production and selling, and the remainder (the contribution) is applied towards the recovery of fixed costs.

> **BREAKEVEN POINT**
>
> The breakeven point is the point where the total contribution is equal to total fixed costs (*the point where profit is zero)*.

When operating performance goes beyond the breakeven point, the contribution earned over and above fixed costs represents the profit.

The profit can be calculated by means of the following linear equation:

y = bx – a

Where:

y = net profit
b = contribution per unit
x = number of units sold
a = total fixed cost

Mathematically, the breakeven point in units can be expressed as:

$$0 \text{ (nil)} = b\,x - a$$
$$a = b\,x$$
$$x = \frac{a}{b}$$

This translates into the formula provided below.

Key formula: BREAKEVEN POINT IN UNITS

$$\textbf{Breakeven point in units} = \frac{\textbf{total fixed cost}}{\textbf{contribution per unit}}$$

This is the minimum number of units that has to be sold to ensure that the fixed costs are covered and that a loss is not suffered. It is also known as the breakeven quantity or volume.

> **BREAKEVEN VALUE**
>
> The breakeven value is the sales value of the breakeven units or quantity.

Key formula: BREAKEVEN VALUE

Breakeven value = breakeven units x selling price per unit

OR

$$\textbf{Breakeven value} = \frac{\textbf{total fixed costs}}{\textbf{contribution ratio}}$$

Activity 3.3

BREAKEVEN ANALYSIS

Using the data provided in **Activity 3.1**, calculate the breakeven point in units and value.

Solution to Activity 3.3

Breakeven units $= \dfrac{\text{total fixed cost}}{\text{contribution per unit}}$

$= \dfrac{R20\ 000}{R20}$

$= 1\ 000$ units

This means that when 1 000 units are produced and sold, sales and total costs (ie fixed and variable costs) are equal.

Proof

Sales	=	1 000 units x R50
	=	**R50 000**
Variable costs	=	1 000 units x R30
	=	R30 000
+ fixed costs	=	R20 000
	=	**R50 000**

OR

Total contribution	=	1 000 units x R20
	=	R20 000

The fixed cost of R20 000 can therefore be paid from the R20 000 contribution, which means that there is neither an excess nor a shortage.

Breakeven value $= \dfrac{\text{total fixed costs}}{\text{contribution ratio}}$

$= \dfrac{R20\ 000}{40\%}$

$=$ R50 000

OR

Breakeven value	=	breakeven units x selling price per unit
	=	1 000 units x R50
	=	R50 000

NOTE

The following layout will demonstrate that the total profit derived from 1 500 units was earned by the 500 units sold in excess of the breakeven units:

	Total	Breakeven	Excess
Volume	1 500	1 000	500
Sales	75 000	50 000	25 000
Less: Variable costs	45 000	30 000	15 000
Contribution	30 000	20 000	10 000
Less: Fixed costs	20 000	20 000	–
Net profit	**10 000**	**–**	**10 000**

6 The effects of price and cost changes on the breakeven point

The usefulness of the cost-volume-profit analysis (also called a sensitivity analysis) comes to the fore when an organisation's management wants to predict the effect on profitability of certain changes in selling price, variable costs or fixed costs. We will now demonstrate how the cost-volume-profit analysis is applied in various scenarios.

Activity 3.4

BREAKEVEN POINT – PRICE AND COST CHANGES

The following information relates to a manufacturer of cement blocks:

	R	R	R
Sales (40 000 units @ R20)			800 000
Less: Cost of sales	**Fixed**	**Variable**	560 000
Cost of direct materials	–	120 000	
Cost of direct labour	–	160 000	
Manufacturing overheads	200 000	80 000	
Gross profit			240 000
Less: Selling and administrative costs	60 000	40 000	100 000
Net profit			140 000

REQUIRED

Determine the following:

a. The breakeven point (in units and value)
b. The effect on the breakeven units if there is an
   i. increase of 10% in the selling price per unit
   ii. increase of 10% in the sales volume
   iii. increase of 10% in the variable costs per unit
   iv. increase of 10% in fixed costs

Scenarios i.–iv. should be considered independently from each other.

Solution to Activity 3.4

a. The breakeven point (in units and value):

	Total R	Per unit R
Sales (40 000 units x R20)	800 000	20
Less: Variable costs (120 000 + 160 000 + 80 000 + 40 000)	400 000	10*
Contribution	400 000	10

* R400 000 ÷ 40 000 units

Breakeven units $= \dfrac{\text{total fixed costs}}{\text{contribution per unit}}$

$= \dfrac{R260\ 000}{R10}$

$=$ 26 000 units

Breakeven value = 26 000 units x R20
= R520 000

NOTE

1 Can you see that variable costs include **ALL** variable costs, not only production costs?

2 Can you see that fixed costs include **ALL** fixed costs, including selling and administrative costs?

b. Effect on breakeven units

i. The selling price per unit increases by 10% (R20 x 1,10) = R22

	Total R	Per unit R
Sales (40 000 units x R22)	880 000	22
Less: Variable costs	400 000	10
Contribution	480 000	12

OR

Increase in selling price per unit = R2 + previous contribution per unit R10
= R12 per unit

Breakeven units $= \dfrac{R260\ 000}{R12}$
= 21 667 units

➡ **There is a decrease from 26 000 to 21 667 in the breakeven units.**

ii. Sales volume increases by 10% (40 000 x 1,10) = 44 000 units.

	Total	Per unit
	R	**R**
Sales (44 000 units x R20)	880 000	20
Less: Variable costs (44 000 units x R10)	440 000	10
Contribution	440 000	10

Breakeven units $= \frac{R260\ 000}{R10}$

$= 26\ 000$ units

OR

Fixed cost remained unchanged.
Contribution per unit remained unchanged.
Therefore: Breakeven units remained unchanged.

➡ **There is no effect on the breakeven units.**

iii. Variable costs increase by 10% per unit (R10 x 1,10) = R11.

	Total	Per unit
	R	**R**
Sales (40 000 units x R20)	800 000	20
Less: Variable costs (40 000 x R11)	440 000	11
Contribution	360 000	9

OR

Previous contribution per unit	R10
Less: Increase in variable cost per unit of	R 1
Total	R 9

Breakeven units $= \frac{R260\ 000}{R9}$

$= 28\ 889$ units (Remember to round up!)

➡ **There is an increase from 26 000 to 28 889 in the breakeven units.**

iv. Fixed costs increase by 10%

Fixed costs increase by 10% (R260 000 x 1,10) = R286 000

Breakeven units $= \frac{R286\ 000}{R10}$

$= 28\ 600$ units

➡ **There is an increase from 26 000 to 28 600 in the breakeven units.**

NOTE

The breakeven units move in the same direction as changes in the variable costs and fixed costs, whereas any change in the selling price has an effect in the opposite direction. The following table summarises the impact of these changes:

Price factor	Direction of change	Number of breakeven units
Fixed costs	Increase Decrease	Increase Decrease
Variable costs	Increase Decrease	Increase Decrease
Selling price	Increase Decrease	Decrease Increase

IMPORTANT:

Breakeven units are one of the most critical performance indicators in any business.

7 Margin of safety

Another feature in the cost-volume-profit analysis is the **margin of safety**.

> **MARGIN OF SAFETY**
>
> The margin of safety is the excess of budgeted (or actual) sales over the breakeven sales, that is, *the amount or percentage by which sales revenue may decline before losses commence.*

Key formula: MARGIN OF SAFETY (IN UNITS OR VALUE)

Margin of safety in units = total sales (units) – breakeven sales (units)

Margin of safety in value = total sales – breakeven sales

> **MARGIN OF SAFETY RATIO**
>
> The margin of safety can also be expressed as a *percentage of the total sales* value or sales units, which is known as the margin of safety ratio.

Key formula: MARGIN OF SAFETY RATIO (IN UNITS OR VALUE)

Margin of safety ratio (units) %

$$= \frac{\text{total sales (units)} - \text{breakeven sales (units)}}{\text{total sales (units)}} \times 100\%$$

Margin of safety ratio (value) %

$$= \frac{\text{margin of safety in value}}{\text{total sales (value)}} \times 100\%$$

Mathematically, both the formulae above will give the same answer (because the selling price per unit is constant).

NOTE

The margin of safety ratio is useful to management because it indicates to *what extent (by what percentage)* the value of sales can decline before the business starts to show a loss.

Activity 3.5

Refer back to **Activities 3.1, 3.3 and 3.4a**. What is the margin of safety in each case?

Solution to Activity 3.5

Activity 3.1 and 3.3

Margin of safety in units	=	1 500 units – 1 000 units
	=	500 units
Margin of safety in value	=	R75 000 – R50 000
	=	R25 000
Margin of safety % (value)	=	R25 000 ÷ R75 000 x 100%
	=	33,33%
Margin of safety % (units)	=	500 ÷ 1500
	=	33,33%

Sales can decline by 33,33 percent before the business will start to show a loss.

Activity 4a.

Margin of safety in units	=	40 000 units – 26 000 units
	=	14 000 units
Margin of safety in value	=	R800 000 – R520 000
	=	R280 000
Margin of safety % (value)	=	R280 000 ÷ R800 000
	=	35%
Margin of safety % (units)	=	14 000 ÷ 40 000 = 35%

Sales may decline by 35% before the business will start to show a loss.

8 Target profit analysis

With the aid of cost-volume-profit analysis, it is also possible to determine the sales value that will produce a certain net profit.

Key formula: TARGET SALES (IN UNITS OR VALUE)

$$\textbf{Sales units} = \frac{\textbf{fixed costs + expected profit}}{\textbf{contribution per unit}}$$

$$\textbf{Sales value} = \frac{\textbf{fixed costs + expected profit}}{\textbf{contribution ratio}}$$

NOTE

When determining the required sales in units to achieve a certain profit, you must always determine whether that level of production is within the PRODUCTION CAPACITY of the plant.

Activity 3.6

Refer back to **Activity 3.1.** Assume that the target profit is R15 000 per month. How many **units** must it sell each month to reach this target?

Solution to Activity 3.6

Unit sales required to make a required profit

$$= \frac{\text{total fixed costs} + \text{target profit}}{\text{contribution per unit}}$$

$$= \frac{\text{R20 000} + \text{R15 000}}{\text{R20}}$$

$$= \text{1 750 units}$$

OR

The units to be sold to make the required profit can also be calculated by using an equation:

Let *x*	=	units sold
Sales	=	variable expenses + fixed costs + profits
R50*x*	=	R30x + R20 000 + R15 000
R20*x*	=	R35 000
x	=	1 750 units

Activity 3.7

Refer back to Activity 3.2. Assume that the expected profit on product Q is R22 500. How many units of product Q must be sold to reach the target profit?

Solution to Activity 3.7

Unit sales to make required profit

$$= \frac{\text{total fixed costs} + \text{target profit}}{\text{contribution per unit}}$$

$$= \frac{\text{R30 000} + \text{R22 500}}{\text{R15}}$$

$$= \text{3 500 units}$$

NOTE

Later on in this module, you will learn how to apply these principles when working with an after-tax profit target. In your later MAC modules, you will also be introduced to further cost-volume-profit functions, such as the operating leverage and the change-over point.

9 Breakeven graph

The relationship between sales, costs, volume and profit can be expressed graphically by preparing a **breakeven graph**, also known as a cost-volume-profit graph. This is a very useful tool for illustrating the concepts "breakeven" and "margin of safety" to non-financial managers.

The breakeven graph below is based on the following data:

		Per unit		
		R		
Selling price		100		
Less: Variable costs		60		
Contribution		40		
Fixed costs for period		R300 000		
Breakeven units	=	R300 000 ÷ R40	=	7 500 units
Breakeven value	=	7 500 units x R100	=	R750 000

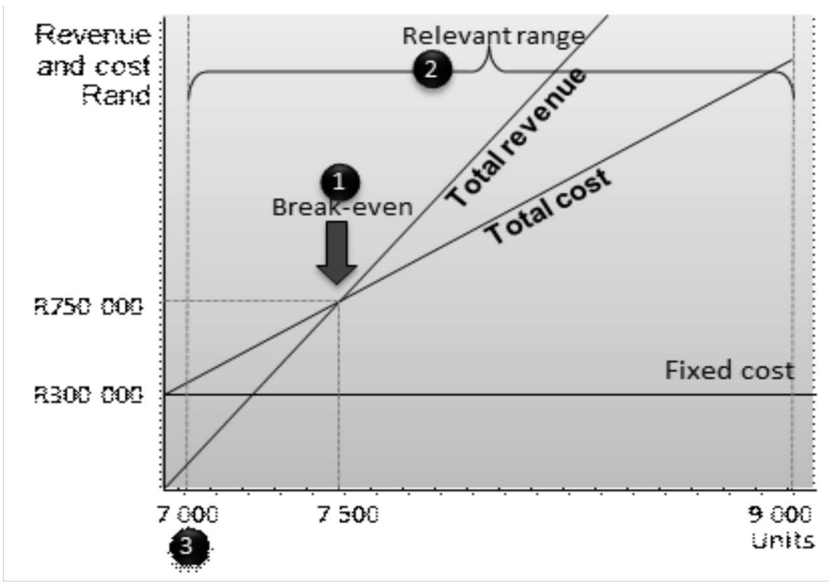


FIGURE 3.1: Breakeven graph

NOTE

① Can you see that the breakeven point is reached where the total revenue line intersects with the total cost line?
② The organisation determined that, historically, its normal operating level is between 7 000 and 9 000 units. It has obtained cost and revenue data for these production and sales levels (relevant range). A cost-volume-profit analysis can be used with reasonable accuracy as long as the volume remains between 7 000 and 9 000 units.

③ The lower limit of the relevant range is 7 000 units. That is below the breakeven point, which means the organisation will be making a loss. The organisation will endeavour to limit the periods spent below the breakeven point, even though these periods are part of the relevant range.

10 Summary

In this study unit, you have learnt the principles of cost-volume-profit analysis, and attention was given to the following:

- The assumptions of cost-volume-profit analysis
- Contribution
- Breakeven analysis
- The effects of price and cost changes on the breakeven point
- Margin of safety
- Target profit analysis
- Graphic representation

Self-assessment Activity

QUESTION 1

Boka Ltd. produces and sells a single product. The following information is obtained from the budget for the month ending 30 October:

	R
Sales (20 000 units)	1 000 000
Direct materials	200 000
Direct labour	150 000
Manufacturing overhead costs:	
Variable	70 000
Fixed	80 000
Selling and administrative costs:	
Variable	100 000
Fixed	30 000

REQUIRED

Calculate the following:

a. The contribution per unit
b. The contribution ratio
c. The breakeven units and breakeven value
d. The margin of safety ratio (also interpret your answer)
e. The number of units that must be sold to earn a profit of R500 000
f. The breakeven units and breakeven value if the variable production costs per unit increase by 15% and the fixed selling and administrative costs increase by 10%
g. The change in net profit if the sales volume increases by 20% with no change in fixed costs

QUESTION 2

Lebogang Ltd. provides you with the following *statement of comprehensive income*, which was compiled by using the contribution approach:

	R	R
Sales		987 750
Less: Variable costs		600 000
Direct materials	225 000	
Direct labour	150 000	
Overheads	150 000	
Selling costs	75 000	
Contribution		387 750
Less: Fixed costs		305 000
Production overhead costs	110 000	
Selling costs	45 000	
Administrative costs	150 000	
Net profit for the period		82 750

The projected *statement of comprehensive income* was based on sales of 75 000 units. Lebogang has the capacity to produce 120 000 units during the year.

REQUIRED

(Round all calculations to three decimal places.)

a. Calculate the margin of safety ratio.

b. The sales manager believes the company could increase sales by 15 000 units if advertising expenditures are increased by R50 000. The supplier of the direct material will give a discount of 2,5% on all purchases because of the higher volumes. One additional supervisor must be appointed to cope with the larger production volumes. The supervisor will receive a salary of R30 000 for the period under consideration. Determine the effect on income by compiling a *contribution statement of comprehensive income*. Show all the manufacturing costs in your statement.

c. Calculate the breakeven point in units for the information in b.

d. Refer to the information in b. What is the maximum amount the company could pay for advertising if the advertising were to increase sales by 15 000 units?

e. Calculate the number of units that must be sold in order to generate a net profit of R225 000. Use the information in b.

f. The general manager requests you to calculate the sales price and variable cost per unit if the contribution ratio is 35% (which represents R4,75 per unit).

QUESTION 3

Zimbani Ltd. manufactures and sells a single product. The budgeted monthly information for the next year is as follows:

Sales per month	70 000 units
Selling price per unit	R5
Variable costs per unit	R2
Fixed costs per month (annual ÷ 12)	R150 000
Initial investment	R2 000 000

REQUIRED

a. Calculate the budgeted profit for the year by using cost-volume-profit principles. You do not need to compile the *statement of comprehensive income*.

b. How many units must be sold per year if the company wishes to earn 10% net profit per year on the initial investment?
c. What is the breakeven point in units and in value?
d. Using the figures for the year, assume that there is an increase of 10% in fixed costs and an increase to R2,50 per unit in variable costs. Calculate the following:
   i The breakeven point in value and in units
   ii The margin of safety value and the margin of safety ratio

QUESTION 4

Yambara Ltd. manufactures and sells a skin-care product. The budget for the year, according to which the company will work at 80% of its capacity, is as follows:

	R
Sales (10 000 units)	1 100 000
Variable costs	345 000
Fixed costs	655 000
Net profit	100 000

The company's management are dissatisfied with the budgeted net profit and requests the sales manager to increase turnover. The sales manager proposes the following independent alternatives:

- Decrease the selling price by 5% and increase the fixed costs by R30 000. This will result in a 10% increase in sales volume.
- Decrease the selling price by 10% and increase the fixed costs by R50 000. This will mean that the company will operate at 100% capacity.
- Increase the quality of the products. This will increase the sales volume by 15%. The improvement in quality will increase the variable cost per unit by 10% and the fixed costs by R40 000.

REQUIRED

a. Determine the following for the budget year (exclude the alternatives):
   i The contribution ratio
   ii The breakeven sales in value and in units
   iii The margin of safety ratio
b. Calculate the net profit for the three alternatives.
c. Calculate the margin of safety ratio for each alternative.
d. Which alternative should the sales manager choose? Give a reason for your answer.

QUESTION 5

Lesenyeho Ltd. manufactures and sells calculators. The company's management accountant prepared the following cost and revenue data for the forthcoming year:

	Total R	Per calculator R
Sales	520 000	65
Variable costs	?	?
Fixed costs	109 200	

Lesenyeho Ltd. must sell 2 600 calculators in order to break even. It is expected that there will be no closing inventory at the end of the year. There was no opening inventory.

REQUIRED

a. Calculate the following:

   i The number of calculators produced and sold
   ii The contribution per calculator
   iii The variable cost per calculator
   iv The breakeven value
   v The number of calculators that must be sold to earn a profit of R75 600

b. Draw a breakeven graph that shows costs and sales from zero level of activity up to budgeted sales volume. (Indicate the breakeven point clearly.)

Solution to Self-assessment Activity

QUESTION 1

a. Contribution per unit

		Per unit R	**Total R**
Selling price	(R1 000 000 ÷ 20 000)	50,00	1 000 000
Less: Variable cost		26,00	520 000
Direct material	(R200 000 ÷ 20 000)	10,00	200 000
Direct labour	(R150 000 ÷ 20 000)	7,50	150 000
Variable overheads	(R70 000 ÷ 20 000)	3,50	70 000
Variable selling and admin cost	(R100 000 ÷ 20 000)	5,00	100 000
Total contribution for 20 000 units			480 000
Divided by 20 000 units			20 000
Contribution per unit		24,00	24,00

NOTE

Examination technique: it saves time to rather work with the total amounts and only divide by the number of units right at the end. However, some questions may ask you for amounts per unit – in that case, you should calculate per unit amounts for every cost. It is important to read the wording of REQUIRED very carefully.

b. Contribution ratio

$$= \frac{\text{contribution per unit}}{\text{selling price}} \times 100\%$$

$$= \frac{R24}{R50} \times 100 \quad \textbf{OR} \quad \frac{R480\ 000}{R1\ 000\ 000}$$

$$= \mathbf{48\%}$$

c. Breakeven units and breakeven value

First, calculate total fixed cost:

Fixed manufacturing overheads	R 80 000
Fixed selling and admin cost	R 30 000
Total fixed costs	**R110 000**

Breakeven units $= \dfrac{\text{fixed cost}}{\text{contribution per unit}}$

$= \dfrac{R110\ 000}{R24}$

$= 4\ 583{,}333$

$\approx$ **4 584 units (rounded up!)**

Breakeven value $= \dfrac{\text{fixed cost}}{\text{contribution ratio}}$

$= \dfrac{R110\ 000}{0{,}48}$

= **R229 167**

OR

Breakeven value = 4 583,333* units x R50 **OR** 4 584 units x R50

= **R229 167** **= R229 200**

* The decimals are retained for the sake of accuracy.

d. Margin of safety = sales – breakeven sales

= R1 000 000 – R229 167 **OR** 20 000 – 4 584

= **R770 833** **= 15 416 units**

Margin of safety ratio $= \dfrac{\text{margin of safety}}{\text{sales}} \times 100\%$

$= \dfrac{R770\ 833}{R1\ 000\ 000} \times 100\%$ **OR** $\dfrac{15\ 416}{20\ 000} \times 100\%$

= **77,08%**

Sales can decline by 77,08% before the business will begin to show a loss. This is a very satisfactory margin of safety. Something dramatic has to happen before the organisation will be in jeopardy.

e. Units sold $= \dfrac{\text{fixed costs} + \text{target profit}}{\text{contribution per unit}}$

$= \dfrac{R110\ 000 + R500\ 000}{R24}$

= **25 417 units**

f. Change in breakeven units and value

New variable production cost per unit:	**R**	**Total**
Direct materials	10,00	200 000
Direct labour	7,50	150 000
Variable manufacturing overheads	3,50	70 000
Variable production costs	21,00	420 000
		÷ 20 000 = R21
15% increase	3,15	
New variable production costs	24,15	
Current fixed selling and admin costs	30 000	
10% increase	3 000	
Total new fixed selling and admin costs	**33 000**	

	R	OR
Contribution per unit:		Prev. 24,00
Sales	50,00	
Less: Variable costs:	29,15	
Production costs	24,15	Incr. 3,15
Selling and admin costs	5,00	
Contribution per unit	20,85	20,85
Fixed manufacturing overheads	80 000	Prev. 110 000
Fixed selling and admin costs	33 000	Incr. 3 000
Total fixed costs	**113 000**	**113 000**

NOTE

Examination technique: It is possible to arrive at the same answers by working with the changes and applying that to the previous figures. This is called the *incremental* approach.

Breakeven point $= \dfrac{\text{fixed costs}}{\text{contribution per unit}}$

$= \dfrac{\text{R113 000}}{\text{R20,85}}$

= 5 419,664

≈ **5 420 units (rounded)**

Breakeven value = 5 419,664 x R50

= **R270 983**

g. Change in net profit with 20% volume increase

		Current	Expected
Sales (in units)	(*20 000 x 120%)	20 000	24 000*
		R	R
Sales (in rand)	(R50 x units)	1 000 000	1 200 000
Less: Variable costs	(R26 x units)	520 000	624 000
Contribution	(R24 x units)	480 000	576 000
Less: Fixed costs		110 000	110 000
Net profit		**370 000**	**466 000**

Net profit will increase by R96 000 (R466 000 – R370 000)

OR (saving time)

Increase in units	(20 000 x 0,2)	4 000 units
x contribution per unit		x R24
Increase in net profit		
= increase in contribution (as no change in fixed cost)		**R96 000**

QUESTION 2

(All calculations rounded to three decimal places.)

a. Margin of safety ratio

		Per unit R	Total
Sales	(R987 750 ÷ 75 000 units)	13,17	987 750
Less: Variable cost		8,00	600 000
Direct material	(R225 000 ÷ 75 000)	3,00	225 000
Direct labour	(R150 000 ÷ 75 000)	2,00	150 000
Overheads	(R150 000 ÷ 75 000)	2,00	150 000
Selling costs	(R 75 000 ÷ 75 000)	1,00	75 000
Contribution	**(R387 750 ÷ 75 000)**	**5,17**	**387 750**

$$\text{Breakeven units} = \frac{\text{fixed cost}}{\text{contribution per unit}}$$

$$= \frac{R305\ 000}{R5{,}17}$$

$$= 58\ 995 \text{ units}$$

$$\text{Margin of safety ratio} = \frac{75\ 000 - 58\ 994}{75\ 000}$$

$$= \mathbf{21{,}3\%}$$

b. Contribution statement of comprehensive income

Sales volume = 75 000 + 15 000 = 90 000 units

	Per unit R	Total R
Sales (90 000 units)	13,170	1 185 300
Less: Variable cost	7,925	713 250
Direct material (R3 – 2,5%)	2,925	263 250
Direct labour	2,000	180 000
Overheads	2,000	180 000
Selling costs	1,000	90 000
Contribution	5,245	472 050
Less: Fixed costs		385 000
Overheads (R110 000 + R30 000)		140 000
Selling costs (R45 000 + R50 000)		95 000
Administrative cost normal		150 000
Net profit		**87 050**

Net profit increases by R4 300 (R87 050 – R82 750).

Proof:

15 000 x R5,17	=	77 550	(additional units @ "old" contribution per unit)
90 000 x R0,075	=	6 750	(additional contribution on ALL units: 5,245 – 5,17 @ "old" contribution per unit)
Incremental income		84 300	
Advertising increases by		(50 000)	
Production overheads increase by		(30 000)	
Incremental profit		4 300	

c. Breakeven point

$$\text{Breakeven units} = \frac{\text{fixed cost}}{\text{contribution per unit}}$$

$$= \frac{R385\ 000}{R5{,}245}$$

$$= \mathbf{73\ 404\ units}$$

d. Maximum advertisement spend

METHOD 1

Increase in net profit available to spend on advertising

75 000 x R0,075	=	R5 625	(additional contribution on 'old' units)
15 000 x R5,245	=	78 675	(new contribution on 'new' units)
Additional supervisor		(30 000)	
		54 300	

METHOD 2

The additional contribution must cover the additional fixed costs. If we assume the same information as b, the profit only increased by R4 300 after spending R50 000 on advertising. We therefore add it back:

Maximum = R50 000 + R4 300 = R54 300

NOTE

NB! The idea is to find out how much MORE you can spend on an expense item before you are back in the *previous profit position*. This is an important point.

e. Units sold for R225 000 profit

$$\text{Units sold} = \frac{\text{fixed cost + target profit}}{\text{contribution per unit}}$$

$$= \frac{R385\ 000 + R225\ 000}{R5{,}45}$$

$$= \mathbf{116\ 302\ units}$$

NOTE

This is still within the capacity (< 120 000 units)!

f. Sales price and variable cost

Contribution ratio

$= \frac{\text{contribution}}{\text{sales}}$

$= \frac{35}{100}$

Therefore:

	%	Per unit R
Sales (R4,75 ÷ 0,35)	100	13,571
Less: Variable cost (R13,571 – R4,75)	65	8,821
Contribution	**35**	**4,750**

QUESTION 3

a. Budgeted profit per year

The budgeted profit for the year:

		R
Contribution	(R5 – R2) x 70 000	210 000
Less: Fixed costs		150 000
Net profit		60 000
X 12		**720 000**

b. Number of units to be sold to earn a 10% net profit return on investment

Net profit = R2 000 000 x 10% = R200 000

Number of units $= \frac{\text{fixed cost + net profit}}{\text{contribution per unit}}$

$= \frac{(\text{R150 000 x 12}) + \text{R200 000}}{\text{R5 – R2}}$

$= \frac{\text{R2 000 000}}{\text{R3}}$

= **666 667 units per year (55 556 units per month)**

c. Breakeven points

Breakeven units $= \frac{\text{fixed cost}}{\text{contribution per unit}}$

$= \frac{\text{R1 800 000}}{\text{R3}}$

= 600 000 units per year (50 000 units per month)

Breakeven value = 600 000 units x R5

= **R3 000 000 per year (R250 000 per month)**

OR = **R1 800 000 ÷ 60% = R3 000 000**

d. Breakeven points, margins of safety, profit

Increase in fixed cost = R150 000 x 12 x 110%

= R1 980 000

Increase in variable costs to R2,50 per unit

Contribution per unit = R5 – R2,50

= R2,50 per unit

e. Breakeven units $= \dfrac{\text{fixed cost}}{\text{contribution per unit}}$

$= \dfrac{\text{R1 980 000}}{\text{R2,50}}$

= 792 000 units per year (66 000 per month)

Breakeven value = 792 000 units x R5
= R3 960 000

f. Margin of safety

Margin of safety value = sales – breakeven value
= (R70 000 x 12 x R5) – R3 960 000
= R240 000

Margin of safety ratio $= \dfrac{\text{sales – breakeven value}}{\text{sales}}$
$= \dfrac{\text{R240 000}}{\text{R4 200 000}}$
= 5,7%

QUESTION 4

a. Budgeted figures

i. **Contribution per unit** = selling price – variable costs
= R110 – R34,50
= R75,50

Contribution ratio $= \dfrac{\text{contribution per unit}}{\text{selling price}}$

$= \dfrac{\text{R75,50}}{\text{R110}}$

= 68,64%

OR $= \dfrac{\text{Total contribution}}{\text{total sales}}$

$= \dfrac{\text{R1 100 000 – R345 000}}{\text{R1 100 000}}$

= 68,64%

ii. **Breakeven value** $= \dfrac{\text{fixed costs}}{\text{contribution ratio}}$

$= \dfrac{\text{R655 000}}{\text{0,6864}}$
= R954 254

Units = 954 254 / R110 = 8 675

iii. **Margin of safety** = sales value – breakeven value
= R1 100 000 – R954 254
= R145 746

Margin of safety ratio $= \dfrac{\text{sales value – breakeven value}}{\text{sales value}}$

$= \dfrac{\text{R145 746}}{\text{R1 100 000}}$
= 13,25%

OR $= \dfrac{\text{unit sales – breakeven sales}}{\text{unit sales}}$

$= \dfrac{10\ 000 - 8\ 675}{10\ 000}$

$= 13{,}25\%$

b. and c. Net profit and margin of safety ratio

Alternative 1

Units sold (10 000 x 110%)	11 000 units
	R
Sales (R110 x 95% x 11 000 units)	1 149 500
Less: Variable costs (R34,50 X 11 000 units)	379 500
Contribution **(R70 per unit)**	770 000
Less: Fixed costs (R655 000 + R30 000)	685 000
Net profit	85 000

Breakeven point = 9 768 units Margin of safety % = 11,2%

Alternative 2

Units sold (10 000 ÷ 80% x 100%)	12 500 units
	R
Sales (R110 x 90% x 12 500 units)	1 237 500
Less: Variable costs (R34,50 x 12 500 units)	431 250
Contribution **(R64,50 per unit)**	R806 250
Less: Fixed costs (R655 000 + R50 000)	705 000
Net profit	101 250

Breakeven point = 10 931 units Margin of safety % = 12,6%

Alternative 3

Units sold (10 000 x 115%)	11 500 units
	R
Sales (R110 x 11 500 units)	1 265 000
Less: Variable costs (R34,50 x 110% x 11 500)	436 425
Contribution **(R72,05 per unit)**	828 575
Less: Fixed costs (R655 000 + R40 000)	695 000
Net profit	133 575

Breakeven point = 9 647 units Margin of safety % = 16,1%

d. Alternative 3 would be the best option because it earns the highest net profit. Furthermore, it carries the least risk, because the breakeven units required are the lowest and its margin of safety percentage is the highest.

QUESTION 5

a.

i **Calculators produced and sold** $= \frac{R520\ 000}{R65}$

$= 8\ 000$ calculators

ii **Contribution per calculator** $= \frac{\text{fixed cost}}{\text{breakeven units}}$

$= \frac{R109\ 200}{2\ 600}$

$= R42$

iii **Variable cost per calculator** = sales – contribution

= R65 – R42

= R23

iv **Breakeven value** = R65 x 2 600

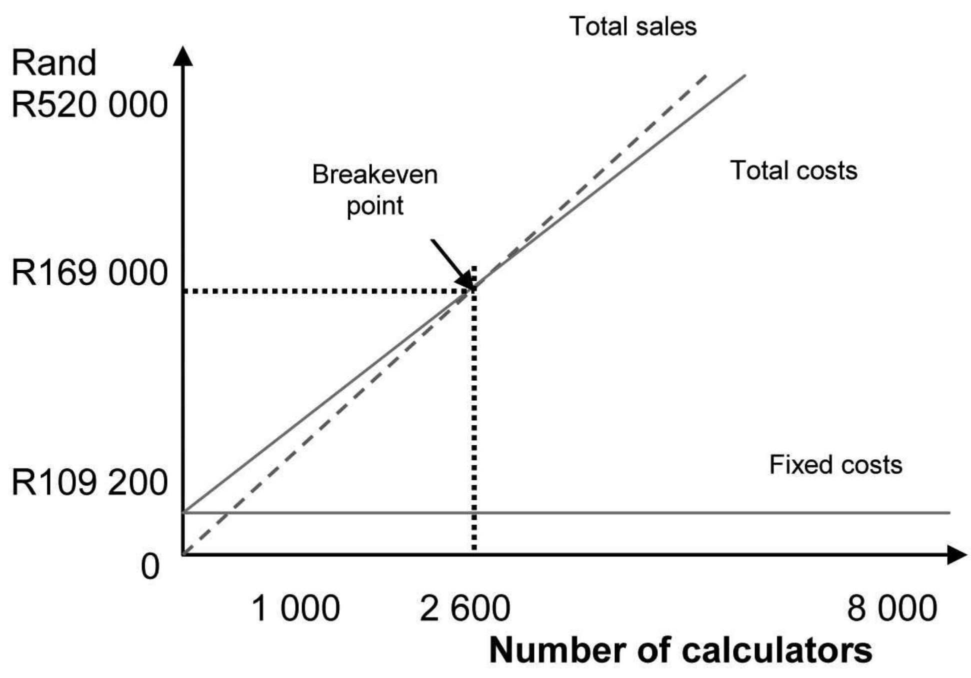
= R169 000

v **Number of units to be sold** $= \frac{\text{fixed cost + expected profit}}{\text{contribution per unit}}$

$= \frac{R109\ 200 + R75\ 600}{R42}$

= 4 400 units

b. **Breakeven graph**



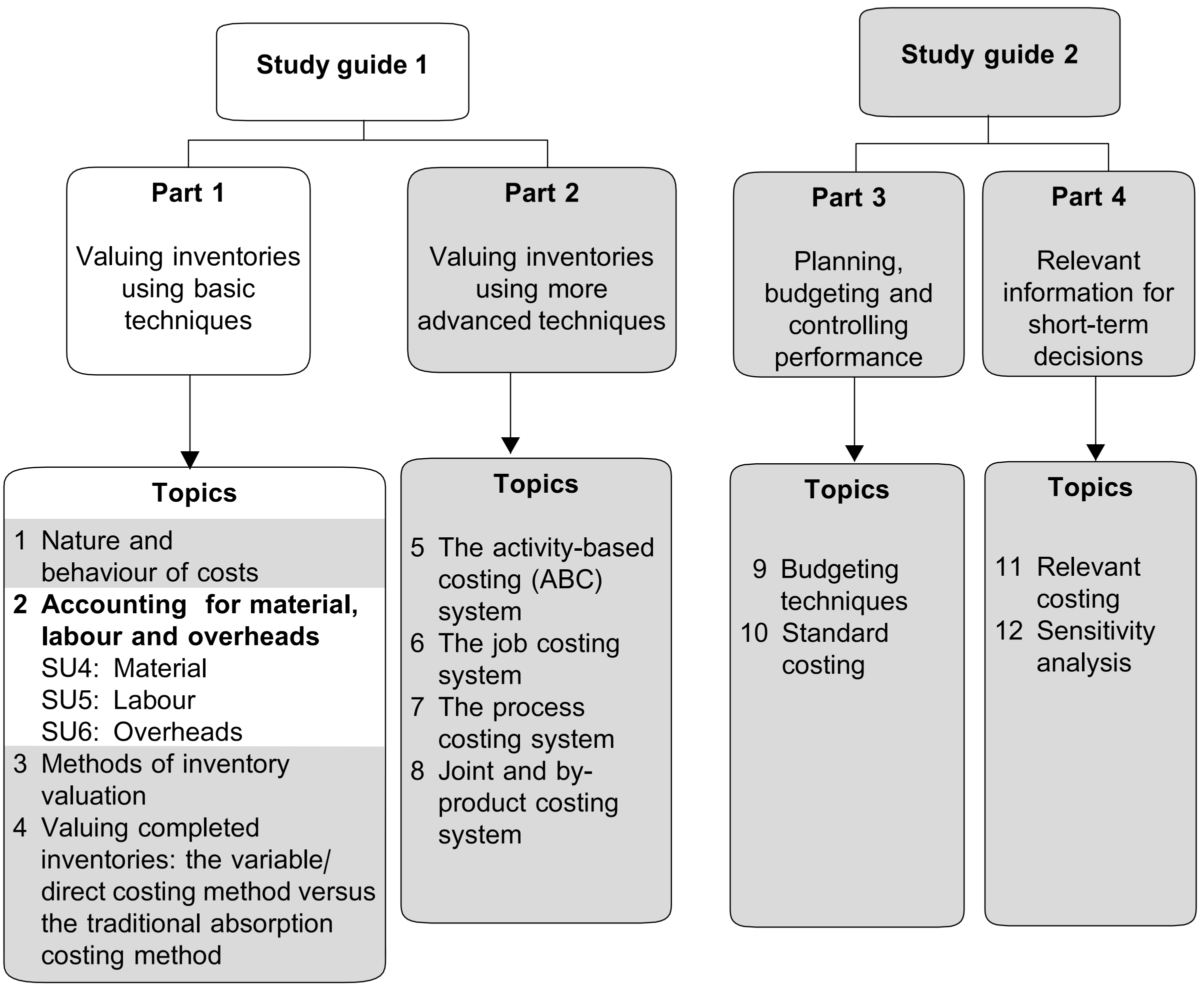
Accounting for material, labour and overheads

LEARNING OUTCOMES

After studying this topic, you should be able to:

– account for the acquisition of material, labour and overheads
– consider the appropriate allocation of these costs to cost objects
– calculate the economic order quantity (EOQ)
– calculate labour and overhead allocation rates

STUDY UNIT	**TITLE**
Study unit 4	Material
Study unit 5	Labour
Study unit 6	Overheads



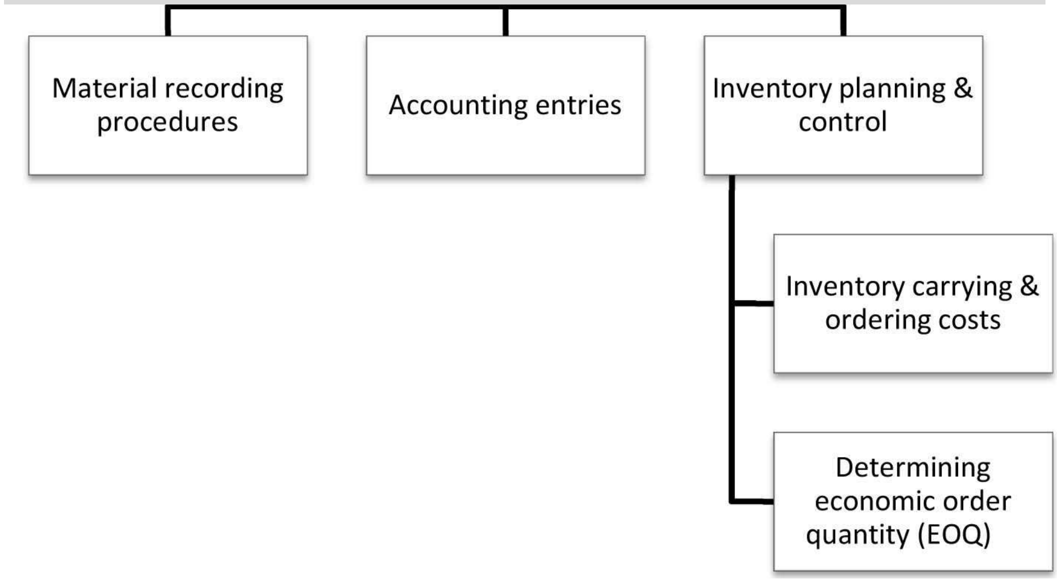
Introduction

As explained in the previous topic, all resources and their associated costs can be classified as material, labour, or overheads (manufacturing or non-manufacturing). In this topic, we will investigate how to account for the **acquisition** of each of these resources and how to account for the **use** of them.

STUDY UNIT 4

Material

In this study unit



1 Introduction

In this study unit, we will discuss the accounting treatment and management of material inventory. As mentioned in the previous topic, materials are one of the key inputs into the manufacturing process.

> **MATERIAL**
>
> Material refers to the group of costs that includes all the physical materials converted into products during the manufacturing process, indirect material, and other consumables used by the organisation.

In practice, there is usually a time interval between the acquisition and use of materials. During this period, materials are held as inventory.

Part of the cost and management accounting functions in an organisation is to determine the value of the inventory on hand at any given time, as well as to provide information for the control and management of the inventory.

The planning and control of material inventory, including the valuation and recording of material inventory, are of considerable strategic significance to the management of an organisation. Effective material and inventory control is essential in order to minimise cost and maximise profit, produce at maximum efficiency, manage inventories at predetermined levels and control investment in inventories. We will introduce you to some basic techniques for managing inventory. The valuation of material inventory will be covered in the next topic.

2 Material recording procedures

The organisation's purchasing department orders raw material and other supplies required in the manufacturing process and elsewhere in the organisation. The warehouse or storeroom is responsible for taking delivery of the material purchased, which are then checked against the purchase order. The clerk signs the goods received note (GRN). You will learn more about the internal control surrounding purchases in your Auditing modules.

From the warehouse, the issuing of raw material takes place on receipt of an authorised material requisition form.

The **material requisition form** identifies the raw materials to be issued by the materials clerk to be used in production and indicates the department, job, or project charged with the materials used. The form serves as a record of the movement of materials, from the warehouse to the production plant or other department, and copies are sent to the cost accounting department. This process may be entirely automated and paperless.

The quantity (from the GRN) and value (from the purchase order) of each individual item of material are recorded in the **materials inventory ledger or system.** In addition to showing quantities and prices **for each type** of materials received, issued and on hand, the records normally detail the account number, description or type of material, locations, unit measurement and maximum and minimum quantities to carry. These records may be in the form of hard copies or computer records.

The accounting entries are recorded in an inventory control account, because the number of inventory types are usually too many (can be thousands) to be accounted for separately in the general ledger.

A **perpetual inventory** accounting system is used to record the movement in the materials inventory. The perpetual method of inventory recording enters each increase and reduction of inventory in order to maintain up-to-date materials ledger records. Under this system, a continuous record is kept of the movement of inventory. The inventory record is adjusted every time items are received or issued. The inventory record reflects the actual inventory on hand at all times.

A **physical inventory count** must be done from time to time, usually at the end of the financial period, to determine the correct value and quantity of each inventory item separately, and of the inventory in total. Inventory ledger records should be compared with the physical inventory count and any differences investigated.

A guiding principle in accounting for the **cost of acquiring material** is that all costs incurred in getting a unit of material into its current place and condition must be included. Acquisition costs, such as the supplier's invoice price and transportation costs, are the most visible costs of the purchased materials. When materials are imported, you would also add customs duty and shipping costs (including insurance whilst in transit) to the purchase price. Please refer to IAS2 (International Accounting Standards) for more detail on the accounting treatment of material.

NOTE

Remember that the organisation's own warehousing cost is treated as an overhead cost and is not treated as part of the cost of materials.

3 Accounting entries

Accounting entries for recording purchases and issues of materials are similar to those used in financial accounting for a perpetual inventory system and are based on the double-entry principle. This principle requires that there should be a corresponding credit entry for each debit entry.

A control account for all inventory types is usually maintained in the general ledger. A separate computerised inventory system is usually kept that contains the detail for each inventory type (by inventory code). As mentioned before, the physical inventory is counted and compared at least once annually with the computerised inventory system. However, the total balance (value) of all inventories in the inventory system is reconciled monthly to the inventory control account in the general ledger.

The material inventory control account is debited as materials are received, and the accounts payable account or bank account (whichever is applicable) are credited. Both direct and indirect material, as well as other consumables, may be recorded in the material inventory control account.

	Debit	**Credit**
Material inventory control account	xxx	
Accounts payable/bank		xxx

When raw material is **issued** to production, direct material is recorded as work-in-process (WIP) and indirect material as manufacturing overheads, that is, consumables used for maintenance of the factory. Consumables, like stationary issued to the sales department, will be allocated to non-manufacturing overheads.

Material and supplies (indirect material) requisitions are summarised and recorded as follows:

		Debit	**Credit**
WIP	[*direct material*]	xxx	
Manufacturing overheads	[*indirect material*]	xxx	
Non-manufacturing overheads	[*other consumables*]	xxx	
Material inventory control			xxx

All **returns** from production or other departments to stores result in credits in the WIP account and/or the manufacturing overheads account and/or the administration overheads accounts (non-production overheads) and in debits to the material inventory control account.

Material returns are recorded as follows:

		Debit	**Credit**
Material inventory control		xxx	
WIP	[*direct material*]		xxx
Manufacturing overheads	[*indirect material*]		xxx
Non-manufacturing overheads	[*other consumables*]		xxx

NOTE

You will learn more about the cost of material issued from stores to production, etc in the next topic.

Activity 4.1

To illustrate this, the following balances were taken from the books of Indaka Ltd. for March:

Balances on 01 March:

		R
Material inventory control	(Dt)	4 000
WIP	(Dt)	16 000
Accounts payable	(Ct)	30 000

Transactions for March:

		R
Material purchased on credit		38 500
Material issued:	Direct material	27 500
	Indirect material	2 000

The company uses a perpetual inventory system to record its inventory.

REQUIRED

Prepare the journal entries and the T-accounts for the month.

Solution to Activity 4.1

The journal entries for the above-mentioned transactions are:

	Debit	Credit
	R	R
1 Material inventory control	38 500	
Accounts payable		38 500
2 WIP	27 500	
Manufacturing overheads	2 000	
Material inventory control		29 500

The ledger accounts for the above-mentioned transactions are:

Material inventory control

	R		R
Balance	4 000	WIP	27 500
Accounts payable	38 500	Manufacturing overheads	2 000
		Balance	13 000
	42 500		42 500
Balance	13 000		

WIP

	R		
Balance	16 000		
Raw material	27 500		

Accounts payable

			R
		Balance	30 000
		Raw materials inventory	38 500

Manufacturing overheads

	R		
Material (indirect)	2 000		

4 Inventory planning and control

In addition to determining the value of the material inventory on hand, the management accountant needs to ensure that the proper balance of material on hand is maintained. In large organisations, this is the role of the material management department (as part of supply chain management) by individuals who are specifically trained to do this, using advanced computer programs. The management accountant would then only act in an advisory role.

An inventory of sufficient size and diversity must be maintained for efficient operations, but the size should not be excessive in relation to the scheduled production needs. If too much inventory is purchased, capital is unnecessarily invested in inventory (the money could have earned interest in the bank account) and storage space is wasted. If insufficient inventory is purchased, losses may result due to production stoppages.

REASONS FOR HOLDING INVENTORY

There are usually three reasons for holding inventory:

a. **Transaction** motive – this refers to holding inventory for day-to-day use in the production process or for sales, where the supplier might not be able to supply at short notice.
b. **Precautionary** motive – this refers to holding extra inventory when future demand is uncertain and/or the supply is unreliable.
c. **Speculative** motive – this refers to holding more or less inventory than usual, because a change in the supplier's price is anticipated.

Inventory planning and control deal with the question "*How much* of *what* is required *when*"? The two fundamental factors that must be determined here are: the quantity and the time to purchase. The quantity and timing of the order are determined by various techniques. We will introduce you to one of the techniques – the economic order quantity (EOQ) – in this study unit. You will learn about the timing of the order in the module: Application of management accounting techniques (MAC3701).

We will now discuss in more detail a number of important underlying concepts relating to the EOQ technique.

4.1 Inventory carrying and ordering costs

INVENTORY CARRYING OR HOLDING COSTS

Inventory carrying or holding costs are the relevant costs of keeping inventory on the organisation's premises until it is used and includes costs such as handling costs, warehouse or storage costs, insurance and obsolescence costs. The relevant costs are only those costs that change with a change in inventory levels. The interest incurred or forfeited as a result of the unit's purchase is usually expressed as a percentage of the unit purchase price.

If an organisation buys in large quantities, the cost of carrying the inventory will be extremely high, because of the sizeable investment. The carrying cost of inventory is dependent on the size of the average inventory on hand. This is a function of the size of the order, and assumes that the inventory is used or issued at a constant daily rate.

The average inventory would therefore be:

= ½ x order size

Activity 4.2

X Ltd. orders inventory in quantities of 100 every 10 days. Usage occurs evenly (same quantity per day).

REQUIRED

Calculate the average inventory on hand.

Solution to Activity 4.2

Average usage per day

$$= \frac{\text{order size}}{\text{order interval}}$$

$$= \frac{100}{10}$$

= **10 units per day**

Average of day	**Units**	
1	95	(100 + 90) / 2
2	85	(90 + 80) / 2
3	75	etc
4	65	
5	55	
6	45	
7	35	
8	25	
9	15	
10	5	
	500	

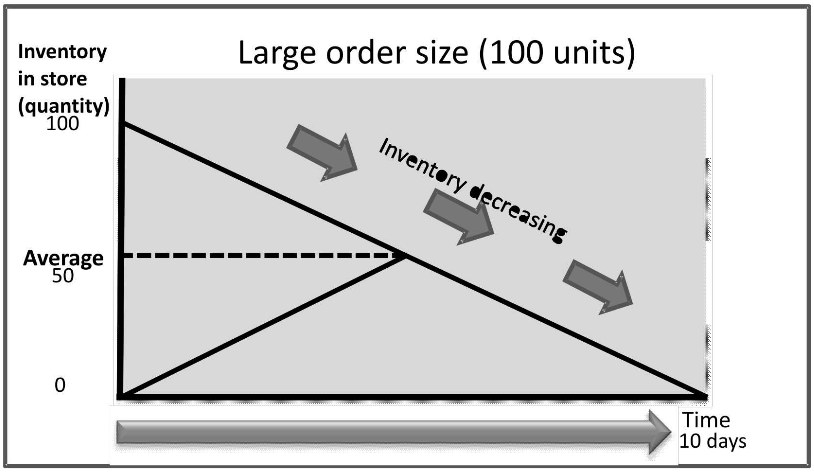
Average for 10 days = 50

OR

½ x order size = ½ x 100

= 50

The effect of order size on average inventory can be depicted as follows (assuming equal constant usage per day):



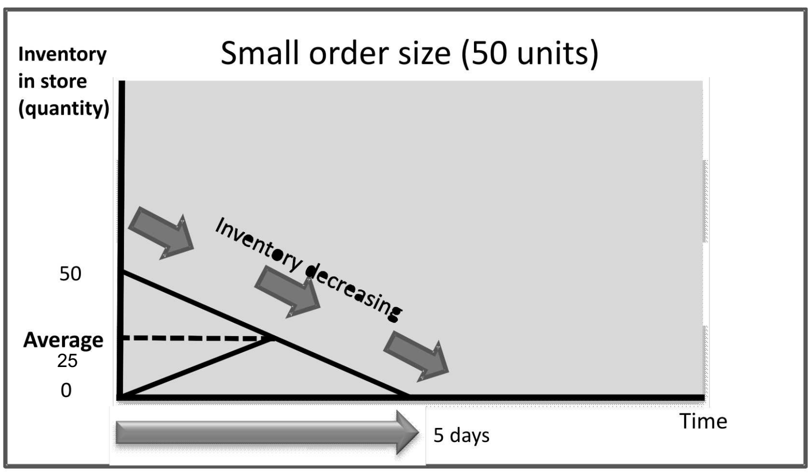


FIGURE 4.1: Average inventory, effect of order size

You can see from the graphs above that the variable portion of the carrying cost would be higher when the average inventory held is higher.

ORDERING COSTS

Ordering costs are the relevant costs of ordering inventory and may include delivery and transport costs, as well as the administrative cost of preparing and processing the order. Again, these costs only include the costs that will fluctuate if order numbers/quantities fluctuate.

If purchases are made in small quantities, the result will be frequent orders with correspondingly high ordering costs in total.

The quantity to order at a given time should therefore be determined by balancing the following factors:

- The total cost of carrying inventory
- The total cost of ordering materials

Inventory situation	Size of orders	Frequency of orders	Annual ordering costs	Annual carrying costs
Over stocked	Large	Low	Low	High
Under stocked	Small	High	High	Low

The total ordering and the total carrying costs move in opposite directions: when the size of the order increases, the ordering costs decrease and the carrying costs increase. The order quantity at which annual carrying and ordering costs are minimised is known as the economic order quantity (EOQ).

4.2 Determining EOQ

EOQ

The EOQ is the quantity of inventory to be ordered at one time in order to minimise annual ordering and carrying costs.

NOTE

The costs used in the EOQ model are only those costs that will **vary or change** depending on the **level** of the inventory. You will agree that costs that are unaffected by the size of the order are irrelevant and should be excluded. Examples of the latter are the storekeeper's salary.

We will look at the following methods for finding the EOQ:

- The tabular method
- The formula method

Activity 4.3

Use the tabular method to find the EOQ.

To illustrate the tabular method, assume the following data:

- Annual demand (requirement) for inventory is 2 400 units.
- Variable cost of placing an order is R25.
- Variable cost of carrying one unit for one year is R3.

REQUIRED

Use the tabular method to find the EOQ.

Solution to Activity 4.3

Based on this data, comparisons can be made of various order sizes (randomly selected).

Order quantity	**50**	**50**	**200**	**300**	**800**	**1 200**	**2 400**
Number of orders (annual demand ÷ order quantity)	48	16	12	8	3	2	1
Average inventory (order quantity ÷ 2)	25	75	100	150	400	600	1 200
Relevant annual costs	R	R	R	R	R	R	R
Ordering costs (number of orders x R25)	1 200	400	$\boxed{300}$	200	75	50	25
Carrying costs (average inventory x R3)	75	225	$\boxed{300}$	450	1 200	1 800	3 600
Total **R**	1 275	625	600	650	1 275	1 850	3 625

Lowest

Of the order sizes calculated, 200 is the most economical order. This means that an order must be placed every month (since 2400 ÷ 200 = 12). The average inventory level will be 100 units (200 x 50%).

NOTE

The EOQ will always be where the ordering costs and the holding costs are equal to each other. In the table above you will notice that, at 200 units, the ordering costs and the carrying costs amount to R300.

Using the formula method to find the EOQ

Determining the economic order by means of a table is a lengthy process and may not provide the most accurate answer. A formula is therefore the preferred method of calculating EOQ. The formula for the EOQ is the *square root* of a fraction, whose *numerator* is twice the product of the annual item demand and the cost per order, and whose *denominator*is the product of the unit price and the annual carrying rate.

Key formula: EOQ

Mathematically, the EOQ formula is expressed as follows:

$$\frac{2 \quad U \quad C}{H \quad P \quad i}$$

Where:

2 = a constant
C = variable cost of placing an order
U = annual usage (*demand*)
H = other variable inventory holding cost (*excl. interest*) per annum per unit
i = interest rate or required return (*should be used when it is provided*)
P = purchase price per unit (*should be used when it is provided*)

The following assumptions were made in developing the EOQ model:

- The annual demand is known.
- The demand rate (daily consumption/usage) is known and uniform.
- There are no quantity discounts, that is, the purchase price per unit remains constant regardless of quantity ordered.
- Ordering costs are a known function of the number of orders (ie variable).
- Carrying costs are a known function of average inventory (ie variable).
- Stockouts are not intentionally permitted. (*A stockout is when you have ordered too little and the requisition cannot be filled.*) If it is a requisition from a production department, it means the production process will come to a halt due to a shortage of material inventory.

NOTE

The impact of quantity discounts on order size will be discussed in MAC3701.

Activity 4.4

Nkandla Ltd. consumes 1 000 kg of materials per year. The variable ordering cost is R5 per order placed. The relevant annual carrying cost incurred was as follows:

Warehouse rent (average)	R1 per kg (or R5 000 in total)
Theft and fire insurance	R0,20 per kg
Desired return on investment	R0,80 per kg

REQUIRED

a. Calculate the EOQ.
b. Calculate the relevant annual variable ordering and carrying cost based on the EOQ.

Solution to Activity 4.4

a. Calculate the EOQ.

We ignore the warehouse rent, because this is a fixed cost that does not vary with the size of the order.

EOQ $= \frac{2 \quad U \quad C}{H}$

$= \frac{2 \quad 1\,000 \quad 5}{R0\;20 \quad R0\;80}$

$=$ 100 kg

The EOQ for this material is 100 kg or 10 orders per year.

b. Calculate annual variable cost.

Annual ordering cost	=	10 x R5 = R50
Average inventory on hand	=	100 x $^1/_2$ = 50 units
Annual carrying cost	=	50 x (R0,20 + R0,80) = R50

Activity 4.5

Soweto Ltd. uses the EOQ model to determine the quantity of raw material to order. You are provided with the following details about raw material:

Average usage per week	6 000 units
Number of production weeks per year	50
Purchase price per unit	R25,00
Variable cost of placing an order	R40,00
Variable carrying costs per unit per year (including interest)	R6,00

REQUIRED

Calculate the following:

a. The annual usage units.
b. The EOQ in units Soweto Ltd. should order.
c. The number of orders Soweto Ltd. should order in a year.
d. The total purchase price for the year.

Solution to Activity 4.5

a. Annual usage	=	50 weeks x 6 000
	=	300 000 units
b. EOQ	=	$\frac{2 \quad U \quad C}{H}$
	=	$\frac{2 \quad 300\,000 \quad R40}{6}$
	=	2 000 units
c. $\frac{\text{Annual usage}}{\text{EOQ}}$	=	$\frac{300\,000}{2\,000}$
	=	150 orders
d. Annual usage x cost price per unit		
	=	300 000 units x R25
	=	R7 500 000

5 Summary

In this study unit, we discussed the accounting entries for materials received and issued. We then investigated the EOQ technique as a tool for managing inventory levels.

In the next study unit, we will explore how labour costs are accounted for.

Self-assessment Activity

QUESTION 1

A company has collected the following data for a given year:

EOQ (in units)	5 000
Total variable ordering cost to place purchase orders for the year	R10 000
Variable cost to place one order	R50
Variable cost to carry one unit for one year	R4

REQUIRED

a. What is the annual usage in units?
b. Calculate the total annual variable carrying costs based on the EOQ.
c. Assuming units are ordered in lots (order size) of 50 000 units, what would the financial implication be for variable costs?

(NB: Show detailed calculations.)

QUESTION 2

Presented below is the information about the material purchases and issues by Jobe Ltd. The company uses a perpetual inventory system.

a. Issued from direct materials R 4 100
b. Issued from factory maintenance supplies R275
c. Return of direct materials to the storeroom R1 400
d. Purchases of raw material on credit R17 900
e. Return raw materials (bought on credit to supplier) R 5 200

REQUIRED

Prepare the necessary journal entries to record the above transactions.

QUESTION 3

Topshopela Ltd, a regional supermarket chain, orders 320 000 cans of frozen apple juice per year from a Ladysmith distributor. A can of apple juice delivered to Topshopela's central warehouse costs R0,50, including freight charges. The company borrows funds at a 10% interest rate to finance inventories. Topshopela's purchasing agent calculates that it costs R15 (variable cost) to place an order for frozen juice and that the variable annual holding expense (insurance, electricity, and handling) is R0,10 for each can of juice.

REQUIRED

a. Calculate the EOQ.
b. Calculate the related total annual ordering costs and carrying costs.
c. What would the financial implications be if only one order was placed for the year instead of ordering at EOQ level?

Solution to Self-assessment Activity

QUESTION 1

a. Annual usage in units

Let annual usage be "a".

$\therefore$ EOQ = $\frac{2 \quad a \quad R50}{R4}$

5 000 = 25a

$(5\ 000)^2$ = 25a

25a = 25 000 000 units

a = 1 000 000 units

OR

Total number of orders = $\frac{\text{annual order cost}}{\text{cost to place 1 order}}$

= $\frac{10\ 000}{50}$

= 200

Annual demand = number of orders x EOQ

= 200 x 5 000

= 1 000 000 units

b. Total annual variable carrying costs

	R
Carrying costs [5 000 units ÷ 2] x R4	10 000

c. If ordered in lots of 50 000 units

	R
Ordering costs would be (1 000 000 ÷ 50 000) x R50	1 000
Carrying costs [50 000 ÷ 2] x R4	100 000
Total costs	101 000

∴ The implication would be an increase of R81 000 made up as follows:

Total costs	R101 000
Less: Ordering costs	R 10 000
Less: Carrying costs	R 10 000
Difference	R 81 000

QUESTION 2

			R	R
a.& b.	Dt	WIP	4 100	
		Manufacturing overheads	275	
		Ct Materials inventory control		4 375
b.	Dt	Materials inventory control	1 400	
		Ct WIP		1 400
c.	Dt	Materials inventory control	17 900	
		Ct Accounts payable		17 900
d.	Dt	Accounts payable	5 200	
		Ct Materials inventory control		5 200

QUESTION 3

a. EOQ $= \dfrac{2 \quad U \quad C}{H \quad P \quad i}$

$= \dfrac{2 \quad 320\ 000 \quad R15}{R0\ 10 \quad R0\ 50 \quad 10\%}$

$=$ 8 000 cans

b.

	R
Ordering costs (320 000/8 000) x R15	600
Carrying costs (8 000/2) x R0,15	600
Total inventory costs	1 200

c.

	EOQ level	320 000 level
No of orders	40	1
Annual ordering costs: (see b.)	600	
(1 x R15)		15
Annual carrying costs: (see b.)	600	
(320 000/2) x R0,15		24 000
Total costs	1 200	24 015

If the company places one order, it will incur additional variable expenses of R22 815 (R24 015 – R1 200).

STUDY UNIT 5

Labour

In this study unit

- **Labour cost control**
  - The human resources department (HR)
  - The time keeping department
  - The time clock method
  - The salary/payroll department
  - The cost accounting department
- **Payroll accounting**
  - Schemes & types of remuneration
  - Payroll legislation terms and acronyms
  - Cost accounting terms for payroll costs
  - The role of labour and technology
  - Direct, indirect and non-manufacturing labour cost
- **Accounting entries for labour remuneration**
  - Entries in financial accounting records
  - Entries in cost accounting records

1 Introduction

In the previous study unit, we discussed the treatment of materials in the general ledger and for costing purposes. In this study unit, we will focus on labour costs.

The word "labour" is generally associated with human effort, and labour cost is indeed a major cost element in production processes that are still not completely automated. In accounting systems, labour cost is a vital cost factor that requires constant measurement, control and analysis. Labour costs represent amounts paid to any employee, be he or she the manager, supervisor, office clerk or cleaner. Total labour cost consists of the following:

- The gross amount due to an employee
- Employee benefits

An equitable wage rate or salary structure requires an analysis, description and evaluation of each job in the plant or office. Employee benefits, such as the employer's contribution to pension or provident funds and medical aid schemes, as well as vacation pay and bonuses, also form a substantial part of labour cost. In this topic, we will discuss accounting for labour-related costs in detail.

2 Labour cost control

Labour cost control starts with an adequate production-planning schedule supported by labour-hour requirements and accompanying labour costs determined in advance of production runs. You will learn more about the link between budgeted production output and the budgeted labour requirements in MAC3701. The complete labour cost control process begins with the product design and continues until the product is sold and delivered. The departments that should cooperate in this process include the human resources (HR) department, the production planning department, the timekeeping department, the payroll department and the cost accounting department.

2.1 The HR department

Every enterprise requires labour stability. To achieve this and to ensure that the enterprise benefits from maximum labour performance, the right person needs to be appointed in each post. In large organisations, the HR department is responsible for personnel selection, while the heads of departments are responsible for the final appointment of personnel. In small enterprises, the manager appoints new personnel.

The HR department also determines the pay scales for each job grade and negotiates annual increases in benefits with the labour unions. This is usually done by the HR recruitment department and union negotiations take place in the joint bargaining forum.

The reasons why any employee decides to resign voluntarily need to be investigated to ensure that there is no underlying problem that is having a detrimental effect on the organisation's performance. Employees are discharged when they are found to be unsuitable for the posts in which they were appointed or when they are found to be guilty of misconduct. The right procedures should be followed to avoid unnecessary labour dissatisfaction and to ensure that the organisation is complying with labour legislation.

Labour turnover increases when the frequency of resignations and the appointment of new employees increase. To determine labour turnover, the number of resignations is totalled as a percentage of the labour force in a certain period. Management should always guard against a high labour turnover, because it tends to lead to greater costs being incurred in the human resources department and to poor production processes, simply because the work cannot be done without suitably qualified employees.

2.2 The timekeeping department

This department is usually decentralised (individual timekeeping offices are situated close to each production or support area) and therefore proper management in this area is vital. The time officers report to a head timekeeper or supervisor. It is the duty of this department to keep accurate records, not only for each employee's time at work, but also for the type of work he/she performs. When employees are paid on an hourly basis, time recording is even more critical.

2.2.1 The time clock method

This automated electronic method is normally used in organisations that employ a large labour force.

> **TIME CLOCK CARDS**
>
> Time clock cards record the arrival and departure times of each employee. Each employee takes the card with his/her number from the rack and punches it in. This may also be done electronically (with or without fingerprint identification).

The timekeeper uses the time clock information to keep a record of each employee's hours spent at work. Manual recording of times on time sheets or job cards, however, is prone to error or even deliberate deception and is therefore unreliable. A time clock card or an automated time-keeping system is more accurate.

> **TIME SHEETS OR TICKETS**
>
> Employees fill in time sheets or tickets for hours worked on each job (job code) or area of work (area code). The time ticket shows the specific use that has been made of the time acquired from the employee and is similar to the *materials requisition card*.

The costing department calculates the cost of hours worked.

TIME SHEET:						
EMPLOYEE NAME: .... **DATE:** .... **DEPARTMENT:**				**CLOCK CODE:** .... **WEEK NO:**		
JOB NO	STARTING TIME	FINISHING TIME	QUANTITY	INSPECTION	HOURS	RATE

FIGURE 5.1: Example of a time ticket

> **JOB CARD**
>
> Each employee receives a job card showing the work to be done and the expected time it should take. The employee records the starting time and finishing time for each job. Breaks for tea and lunch may be noted on the card as standard times.

The accounting department is responsible for calculating the hours actually spent and the cost of these hours.

JOB CARD		
JOB NO: .... **OPERATION NO:**		**DEPARTMENT:** .... **DATE:** ....
TIME STARTED: .... **TIME FINISHED:** .... **HOURS ON JOB:**		**TIME ALLOWANCE:** ....
DESCRIPTION OF JOB	**HOURS**	**RATE COST:** ....
EMPLOYEE NO: .... **SIGNATURE:**		**CERTIFIED BY:** ....

FIGURE 5.2: Example of a job card

2.3 The salary/payroll department

The duties of this department can be summarised as follow:

- Calculate the gross and net wage or salary for each employee.
- Pay wages and salaries.

It is compulsory, by law, to draw up a payroll for each department. The payroll will indicate the time in employment, the amount earned and the deductions for each individual.

2.4 The cost accounting department

This department is responsible for allocating the labour costs incurred by the administrative, selling and other support departments, as well as the labour costs incurred by the production cost centres or departments. Direct labour costs are allocated to the production or jobs using daily or weekly job cards.

Management accounting provides reports to all levels of management inside the organisation for the purposes of planning, control and performance evaluation. Labour costs is controlled mainly by comparing:

- What needs to be done (production units) and the time allowed for it (hours).
- What has actually been done and the actual time taken to do it.
- Anticipated or allowed labour cost and actual labour costs incurred.

3 Payroll accounting

The accounting procedures for controlling and determining payroll costs and liabilities are straightforward, but somewhat detailed. Wages and salaries can be recorded in a payroll in several ways (eg in a manual register or by means of an accounting software package).

As mentioned before, clock cards can be used to record the labour time ``*purchased*'', while time (sheets) tickets can be used to record ``*performance received*''. The recorded data are then processed by following the two-step procedure described below:

- **Calculating and preparing the payroll**. The payroll is prepared from the clock cards. The final calculated payroll is recorded in the payroll journal or payroll record. This record should show gross wage, deductions and the net wage due to an employee.
- **Distributing payroll costs to jobs, processes and departments**. The individual time (sheets) tickets show the use made of the time purchased from each factory employee. The tickets for each employee should agree with the employee's gross wages for the week. The details on the time (sheets) tickets are used to allocate costs at predetermined rates to individual jobs, processes or support and administrative departments.

Different types of remuneration systems are used, depending on the type of work carried out.

3.1 Types of remuneration

Before describing types of remuneration, we need to answer the following question: What exactly is remuneration?

> **REMUNERATION**
>
> Remuneration is the amount an **employer** pays to an **employee** or on behalf of an employee (eg employer contributions to a medical aid scheme) for services rendered in terms of the employment agreement.

In practice, the following remuneration schemes are to compensate the workforce:

- **A fixed monthly salary.** The employee receives a fixed salary regardless of the quantity of work done or time spent on it. This form of remuneration is usually found to apply to employees in supervisory and administrative functions.
- **The time-wage (clock) system.** In this system, the worker is paid in accordance with *the number of hours* that he/she works, and *not based on performance*. Basic (normal) wage is determined as *ordinary clock hours (ordinary hours of work) x basic (ordinary) rate per hour.*
- **The piece-wage system.** In this system, the worker is paid for the work he/she has done and not according to the time spent on it. In other words, payment is based on the output attained instead of the duration of the work. Gross wage is determined as *number of units produced x basic rate per unit.*

3.2 Terms and acronyms used in payroll legislation

Key LEGISLATIVE terms:

Term/Acronym	Definition
UIF	Unemployment Insurance Fund
UI Act	Unemployment Insurance Act, 63 of 2001
UIC Act	Unemployment Insurance Contribution Act, 4 of 2002
BCOE Act	Basic Conditions of Employment Act, 75 of 1997
4^{th} Schedule	Fourth Schedule to the Income Tax Act
IT Act	Income Tax Act, 58 of 1962
PAYE	Pay As You Earn, also known as "employees' tax"
SARS	South African Revenue Service
Employee	Section 1 of the UIC Act defines an employee for UI contribution purposes as any natural person who receives any remuneration or to whom remuneration accrues in respect of services rendered or to be rendered by that person, but excluding an independent contractor.
Employer	Section 1 of the UIC Act and paragraph 1 of the 4th Schedule to the IT Act define an employer as any person who pays or is liable to pay a person an amount by way of remuneration.
Ordinary hours of work	Section 9 of the BCOE Act provides that an employer may not require or permit an employee to work more than 45 hours in any week; and nine (9) hours in any day if the employee works for five days or fewer in a week; eight (8) hours in any day if the employee works for more than five days in a week.
Normal wage	Normal wage is the amount of money paid or payable to an employee **in respect of ordinary hours of work** or, if they are shorter, the hours an employee ordinarily works in a day or week.
Week	Section 1 of BCOE Act defines a week, in relation to an employee, as the period of seven (7) days within which the working week of that employee ordinarily falls.
Overtime	Section 1 BCOE Act defines overtime as the time that an employee works during a day or a week in **excess of ordinary hours of work**. Section 10(1) (a and b) of the BCOE Act provides that an employer may not require or permit an employee to work overtime, except in accordance with an agreement, of more than ten (10) hours' overtime a week.
Overtime wage/ earnings	Section 10(2) of the BCOE Act provides that an employer must **pay at least one-and-a-half (1,5) times the employee's wage for overtime worked**. Furthermore, Section 16(1) of BCOE Act provides that an employer must pay an employee who works on a **Sunday double** the employee's wage for each hour worked, unless the employee ordinarily works on a Sunday, in which case the employer must pay the employee at one-and-a-half times the employee's wage for each hour worked.

3.3 Cost accounting terms used in payroll costs

OVERTIME PREMIUM

An overtime premium is an *additional* amount paid over and above the normal rate/ time.

The overtime premium paid to all factory employees for both direct and indirect labour is considered to be part of indirect labour costs. It therefore forms part of manufacturing overheads and is not traced directly to any job or product.

If an employee earns R100 an hour and works two hours overtime on a Saturday, the overtime wages will amount to R100 x 1,5 x 2 = R300. The overtime premium is only 50% x R100 = R50 per overtime hour which, in this case, will amount to 2 x R50 = R100. This cost will be charged to indirect labour costs. The R200 of the R300 overtime wages that was costed at the normal rate will be classified as direct or indirect labour, depending on the employee's job specification.

GROSS REMUNERATION

Gross remuneration is an amount earned by the employee for total hours worked. It includes overtime wages or earnings, and other allowances that the employee is entitled to in terms of the employment contract, such as a travel allowance, or a guaranteed bonus/13th cheque. These amounts are amounts due to the employee.

TAXABLE INCOME

Taxable income is the balance of the gross remuneration remaining after deducting any contribution by the employee concerned to any pension fund (provident funds are excluded).

NOTE

To simplify calculations in MAC2601, the contributions by employees to a pension fund will be limited to and calculated based on the normal wage/salary earnings only (ie excluding all overtime remuneration).

COST TO COMPANY (CTC)

This represents the total amounts expended by the employer *to and on behalf of* the employee. It is equal to the gross remuneration plus employer contributions to retirement funds and medical aid schemes, memberships of professional bodies etcetera.

NET REMUNERATION

Net remuneration is the amount remaining after all deductions from gross remuneration. This is also referred to as the 'take home pay'.

Various *labour-related deductions* are made from gross remuneration:

- **Pension and provident fund contribution**. Section 11(k) of the IT Act limits the deductions for tax (and PAYE) purposes in respect of pension fund contributions by employees to 7,5% of pensionable remuneration. *Contributions to a provident fund are not allowed as a deduction for tax purposes.*

NOTE

To simplify matters, in this study guide the contributions by employees to retirement funds will be limited to pension funds.

- **PAYE**: 4th Schedule (par 2–12) provides that the employer must deduct employees' tax, also known as PAYE. You will learn more about this later on in your taxation modules. For now, all you need to know is that PAYE must be calculated on the employee's taxable income.
- **UIF**: Contributions to UIF are the compulsory contributions payable in terms of the UIC Act to fund benefits available to employees in terms of this Act. In terms of Section 6 of the UIC Act, the amount of the contribution payable by an employee must be equal to 1% of the gross remuneration paid to him/her by his/her employer. The amount of the contribution payable by an employer must be equal to 1% of the gross remuneration paid to that employee.
- **Sundry deductions**: These deductions include medical aid contributions, trade union subscription fees, voluntary retirement annuity fund contributions, and the repayment of loans granted by the employer.

Activity 5.1

The following information pertains to Mr Godfrey Sikhakhane, a factory employee at Mboma Ltd. The company's normal working hours per week are 40 hours. The basic rate is R20 per hour and the overtime rate is times one and a half the normal rate. In the week ended 31 May, Mr Sikhakhane worked 45 hours. His deductions and employer contributions for the week were as follows:

Pension fund

Employee contribution	7,5% (based on normal wage)
Employer contribution	8% (based on normal wage)

Medical aid contribution

Employee contribution	R48
Employer contribution	R96

PAYE	18% of taxable income

UIF

Employee contribution	1% (based on gross wage)
Employer contribution	1% (based on gross wage)

REQUIRED

a. Calculate the net wage payable to Mr Sikhakhane.
b. Calculate the total cost to company in respect of Mr Sikhakhane.

Solution to Activity 5.1

a. Net wages	**R**
Normal wage – ordinary hours (R20 x 40 hours)	800,00
Overtime pay (R20 x 1,5 x 5 hours)	150,00
Gross remuneration	950,00
Less: Pension fund contribution (R800 x 7,5%)	60,00
Taxable income	890,00
Less: Other deductions	217,70
PAYE (R890 x 18%)	160,20
UIF (R950 x 1%)	9,50
Medical aid	48,00
Net wage payable	672,30

b. Total cost to company	**R**
Gross remuneration	950,00
Pension fund contribution (R800 x 8%)	64,00
UIF (R950 x 1%)	9,50
Medical aid	96,00
Total cost to company	1 119,50

3.4 The role of labour and technology

Before we go on to discuss the various types of labour, we will first discuss the role of labour in a modern manufacturing environment.

In the 1960's, Joan Woodward was one of the leading British researchers who looked at the impact of technical complexity in the manufacturing process of organisations. In 1965, she studied the structure and technology of more than 100 British manufacturing organisations. She classified these organisations into three categories, based on the level of technology used:

- **Small-batch production** is used to manufacture a variety of custom (made-to-order) products. Each item is made slightly differently to meet customers' individual specifications. *Workers' time can be traced to specific jobs*. Car repairs/services or custom-built motorbikes are examples of small-batch production. You will learn more about this in the topic on job costing.
- **Mass production** is used to manufacture a large number of identical products in an assembly-line system. Because the product passes from stage to stage until completion, workers are highly dependent on one another. Equipment may be sophisticated, and workers often follow detailed instructions while performing simplified jobs. *Workers' time can still be traced to specific production batches that were completed or handled by the workers*. An example of an organisation that uses mass production is a company that manufactures electronic products, or a motorcar assembly plant. You will learn more about this in the topic on process costing.

- **A continuous production process** is used by organisations that manufacture products by continuously feeding raw materials, such as solids, liquids and gases, through a highly programmed or automated system. Such systems are equipment (production plant) intensive and can often be operated by a relatively small labour force. Typical examples are automated bottling plants, chemical plants and oil refineries. In these scenarios, *workers' time can no longer be traced to individual products, because automated machines complete the production process and the human input consists of simply monitoring the equipment*. You will learn more about this in the topic on process costing.

Even though this was a few decades ago, it is still applicable to the manufacturing environment today. Now that you have a better understanding of the different roles in the manufacturing setup, we will deal with the cost accounting classification of labour costs.

3.5 Direct, indirect and non-manufacturing labour cost

DIRECT LABOUR

The term *direct labour cost* is reserved for those labour costs that can be physically and conveniently **traced to individual units of products**.

Wages for those employees who contribute to the physical conversion of a product fall into this category (eg carpenters, bricklayers and machine operators [where the machine operator drills, say, three holes into each unit at a time]). This is usually the case in small-batch production and mass production.

INDIRECT LABOUR

Labour costs that **cannot be physically traced** to the manufacture of individual product units are known as *indirect labour costs,* and are treated as part of manufacturing overheads, along with indirect materials.

Indirect labour includes the labour costs of supervisors, material handlers and factory maintenance personnel and cleaners. It also includes the labour costs of machine operators in an automated process where large numbers of units are processed continuously by machines or robots. In this case, the operator simply monitors the machines and his/her time cannot be traced to individual units. This is usually the case in continuous-process production environments.

NOTE

- The *overtime **premium*** paid to both direct and indirect labour employees is usually considered part of manufacturing overheads and is not traced to any job or product directly. However, in a job costing system, it might be booked to a specific job.
- The labour costs of people employed in *non-manufacturing* departments are treated as administrative overheads and selling and distribution costs. These costs are NOT allocated to products, but are treated as period costs.

Activity 5.2

Dundee Ltd. has 61 employees of whom 52 employees work in production and 9 employees work in the service departments. The normal hourly rates paid are R24,00 for direct wages and R19,50 for indirect wages. Overtime is payable at 1,5 times the basic rate. The following additional information applies to the latest period:

Hours worked:

Normal direct	25 520 hours	
Normal indirect	4 430 hours	
Overtime direct	2 120 hours	
Overtime indirect	380 hours	
Deductions were as follows:		
Pension fund contribution		7,5% of the normal wage
Medical aid contribution – direct		R14 529,12
– indirect		R3 455,40
UIF		1% of the gross wage
Tax (PAYE)		18% of taxable income

REQUIRED

From this information, calculate the following:

a. Total gross wages as per the payroll (before cost allocations)
b. Taxable income of direct labour employees
c. Net wages of indirect labour employees
d. The total overtime premium
e. Total amounts allocated to direct and indirect labour costs

---

Solution to Activity 5.2

a. Total gross wages

	R
Normal wage:	
Direct wage (25 520 hrs x R24)	612 480
Indirect wage (4 430 hrs x R19,50)	86 385
Overtime:	
Direct employees (2 120 hrs x R24 x 1,5)	76 320
Indirect employees (380 hrs x R19,50 x 1,5)	11 115
Total gross wages	786 300

NOTE

The grouping above is based on the classification of the **type of** labourer on the payroll and when the hours were clocked. It does not represent the cost classification. The cost classification of the wages is dealt with in section e below.

b. The taxable income of the direct labour employees

	R
Normal wage	612 480
Overtime	76 320
Gross wage	688 800
Less: Pension fund (R612 480 x 7,5%)	45 936
Taxable income of direct labour employees	642 864

c. The net wages of the indirect labour employees

	R
Normal wage	86 385,00
Overtime	11 115,00
Gross wage	97 500,00
Less: Pension fund (R86 385 x 7,5%)	6 478,88
Taxable income	91 021,12
Less: Sundry deductions	20 814,20
PAYE (R91 021,12 x 18%)	16 383,80
Medical aid	3 455,40
UIF (R97 500x 1%)	975,00
Net wages of indirect labour employees	70 206,92

d. The total overtime premium

	R
Overtime premium:	
Direct employees (2 120 hrs x R24,00 x 0,5)	25 440
Indirect employees (380 hrs x R19,50 x 0,5)	3 705
Total overtime premium	29 145

e. The total amount allocated to direct and indirect labour costs

	R			R
Overtime premium (from d.)	29 145	**OR**	Direct overtime	25 440
Indirect wages (4 810* hrs x R19,50) normal rate	93 795		Indirect gross	97 500
Total manufacturing overheads (indirect)	122 940			122 940

* Total indirect hours worked = normal hours + overtime = 4 430 + 380 = 4 810

Total direct labour cost

= normal hours + overtime

= 25 520 + 2 120 = 27 640 x R24 = R663 360

Proof	**R**
Direct labour cost	663 360
Indirect labour cost	122 940
Total gross wages (cost to company)	786 300

4 Accounting entries in respect of labour remuneration

To record the accounting entries for labour costs, two sets of detailed records are kept, one for **financial accounting** and the other for **cost accounting**. The accounting entries required are set out below.

4.1 Entries made in the financial accounting records

For each payroll period, net wages due to employees and the liability for all amounts withheld from wages result in the following entry:

	Debit	Credit
Payroll/Wages control account	xxx	
Pension fund contribution (employee's contribution)		xxx
PAYE		xxx
UIF (employee's contribution)		xxx
Medical aid contribution (employee's contribution)		xxx
Net wages payable		xxx

The *employer* contributions are accounted for as follows:

	Debit	Credit
Payroll/Wages control account	xxx	
Pension fund contribution		xxx
UIF		xxx
Medical aid contribution		xxx

For each payroll period, when wages are paid to employees and deductions paid over to various institutions, the following journal entry will be made:

		Debit	Credit
Net wages payable		xxx	
Pension fund contribution	(employer and employee)	xxx	
PAYE		xxx	
UIF	(employer and employee)	xxx	
Medical aid contribution	(employer and employee)	xxx	
Bank			xxx

4.2 Entries made in cost accounting records

To charge the total labour cost to appropriate jobs, processes and departments, these entries are made in the cost accounting records:

	Debit	Credit
WIP (direct labour hours @ labour recovery rate)	xxx	
Manufacturing overheads (indirect labour hours @ labour recovery rate)	xxx	
Administrative (non-manufacturing) overheads	xxx	
Payroll/Wages control account		xxx

(The calculation of the wage or labour recovery rate is discussed later on in this study unit.)

Activity 5.3

Using the data provided in **Activity 5.1**, we will now illustrate all the necessary journal entries to record the transaction that occurred in the given payroll period.

	Debit R	Credit R
Wages control	950,00	
Net wages payable		672,30
Pension fund		60,00
PAYE		160,20
UIF		9,50
Medical aid		48,00
Recording the net wage payable and liabilities of amounts withheld in the general ledger		
Wages control	169,50	
Pension fund (R800 x 8%)		64,00
UIF		9,50
Medical aid		96,00
Recording the employer's contribution in the general ledger Note: The employer's contribution to third parties is not taken into account in the calculation of net wages payable, because it is not due to the employee.		
Wages payable	672,30	
Pension fund (R60 + R64)	124,00	
PAYE	160,20	
UIF (R9,50 + R9,50)	19,00	
Medical aid (R48 + R96)	144,00	
Bank		1 119,50
Recording the payment of wages and withholdings in the general ledger		
When the labour costs are charged to a specific job, the accounting entries are as follows:		
WIP (direct labour) (45 hours @ R20 per hr + employer contributions)	1 069,50	
Manufacturing overheads (overtime premium) (5 x R20 x 50%)	50,00	
Wages control account		1 119,50
Recording the labour costs in the cost ledger		

Activity 5.4

Sandile is a house painter working for Isiphalaphala Ltd. You receive the following information on Sandile for the week ended 28 November:

Normal working week	40 hours
Normal wage	R20 per hour
Overtime hours	10 hours
Overtime rate	Times one and a half
Employee's deductions:	
Pension	7,5% of normal wage
Medical aid	R16
UIF	1% of gross wage
PAYE	18% of taxable income
Employer's contribution:	
Pension	2% of normal wage
Medical aid	R48

REQUIRED

a. Calculate Sandile's net pay for this week.
b. Prepare the journal entry when charging direct labour to work-in-process.
c. Calculate the overtime premium per hour.
d. Prepare the journal entry when charging overtime to indirect manufacturing costs.
e. Determine the amount due to the pension fund and medical aid on a weekly basis.

Solution to Activity 5.4

a. Net pay

	R
Normal wage (40 hours x R20)	800,00
Overtime (10 hours x R20 x 1,5)	300,00
Gross wage	1 100,00
Less: Pension (7,5% x R800)	60,00
Taxable income	1 040,00
Less: Deductions:	214,20
Medical aid	16,00
UIF (1 100 x 1%)	11,00
PAYE (18% x R1 040)	187,20
Net wage	825,80

b. Journal entry

Dr Work-in-process	R1 064	
Ct Payroll control account		R1 064

[(50 hours x R20) + (2% x R800) + R48]

NOTE

Remember to include the overtime *hours*, but at *normal* rates. The overtime premium is charged to manufacturing overheads.

c. Overtime premium

Overtime rate	R30 per hour
Normal rate	R20 per hour
Overtime premium	R10 per hour

d. Journal entry

Dt Manufacturing overheads	R100	
Ct Payroll control account (10 hours x R10)		R100

e. Amounts due to pension fund and medical aid

Pension (R800 x 9,5%*)	R76
Medical aid (R16 + R48)	R64

* Employee's contribution + employer's contribution = 7,5% + 2% = 9,5%

5 Labour recovery rate

Direct labour costs are assigned to the products manufactured, processes or jobs completed according to the number of hours worked per job card. These hours are then multiplied by the budgeted labour recovery rate.

BUDGETED LABOUR RECOVERY RATE

The budgeted labour recovery rate is the expected/budgeted labour cost per hour.

In addition to the gross amount due to an employee, employee benefits such as the employer's share of the pension fund contribution and the medical aid scheme, vacation pay and bonuses form a **substantial** part of labour cost. Organisations that require more accurate costing of cost objects would therefore incorporate employee benefits into direct labour costs by means of the labour recovery rate. Employee benefits of direct labourers are therefore included in the labour costs charged directly to work-in-process and are NOT booked to manufacturing overheads for indirect allocation later.

It is vital to determine the expected or budgeted number of hours for a certain future period and the corresponding direct labour costs accurately. Although, in practice, a rate is calculated per department or cost centre (for all employees), in the examples used in this section, we will calculate the total budgeted annual expenditure per hour for one employee. This exercise involves the following two basic calculations:

1. Expected/Budgeted productive hours
2. Total budgeted labour costs/cost to company

Key formula: BUDGETED LABOUR RECOVERY RATE

$$= \frac{\text{total budgeted annual labour cost step2}}{\text{total budgeted annual productive hours step1}}$$

The budgeted annual productive hours can further be based on either clock hours, or work hours. This will result in a budgeted clock hour rate, or a budgeted work hour rate.

CLOCK HOURS

Clock hours are the hours that the employees clock in to be on the premises. Gross remuneration is normally based on hours clocked by the employee. Clock hours would include normal working hours as well as any overtime hours actually worked.

IDLE TIME

Idle time for cost *accounting purposes* is when the employee is clocked in, but not actively working owing to tea, lunchtime or scheduled meetings. (This definition might be different from that in the BCOE Act.)

A certain amount of idle time is normal and unavoidable, owing to the stipulations of the BCOE Act and operational requirements (eg the BCOE Act prescribes when employees should have tea breaks etc). Also, of course, businesses normally schedule weekly or daily planning meetings. Machine breakdowns, materials shortages and the like also result in abnormal (avoidable) idle time. The labour costs incurred during abnormal idle time are ordinarily treated as a period cost instead of a direct labour cost.

PRODUCTIVE WORK HOURS

Productive work hours are the hours that the employees are expected to be physically working in the production process or on jobs. These hours correspond to the job card hours.

The productive work hours are calculated by subtracting a percentage for normal idle time due to scheduled tea breaks, meetings etcetera from the clock hours.

NOTE

Do not confuse the productive work hours above for costing purposes with the "normal working hours" of the BCOE Act.

We will illustrate this in the next activity.

Activity 5.5

A junior engineer in a chemical company earns R80 per hour. The company operates a five-day, 40-hour week. Each worker is entitled to 15 working days' annual leave, and a holiday bonus equal to two weeks' normal pay.

There are 12 paid public holidays annually. Idle time allowed is equal to 5% of available clock time. The company contributes 16% of normal wage (including vacation pay) to the pension fund and R13 312 to the medical aid fund. Apply a 52-week year.

REQUIRED

Calculate the budgeted hourly labour recovery rate per work hour.

Solution to Activity 5.5

The budgeted hourly labour recovery rate would be determined as follows:

Step 1: Calculate the annual productive time

				Hours
Number of clock hours in a year	52 weeks	x	40 hours	2 080,0
Less: Vacation hours	15 days	x	8 hours	120,0
Less: Public holidays	12 days	x	8 hours	96,0
Available clock hours				1 864,0
Less: Normal idle time	5%	x	1 864 hours	93,2
Annual productive work hours				1 770,8

Step 2: Calculate the total annual labour cost

		R
Normal wage (52 – 3)	49 weeks x 40 hours x R80	156 800
Vacation pay	3 weeks x 40 hours x R80	9 600
Bonus pay	2 weeks x 40 hours x R80	6 400
Pension fund: employer contribution	16% x R166 400 ①	26 624
Medical aid fund: employer contribution		13 312
		R212 736

① R166 400 = R156 800 + R9 600

Step 3: Calculate the hourly recovery rate

Labour recovery rate

$$= \frac{\text{total annual labour cost step2}}{\text{total annual productive work hours step1}}$$

$$= \frac{\text{R212 736}}{\text{1 770 8hours}}$$

= R120,14 per productive work hour

NOTE

The vacation days are in addition to the public holidays. Both are deducted from available hours. On the other hand, the employee is paid for these days, irrespective of when they occur during the year. They therefore form part of the annual labour cost.

Activity 5.6

Ezakheni Ltd. is a small business that manufactures computer stands. It is situated in KwaZulu-Natal. The business wishes to determine the available productive time to be used in the calculation of the hourly recovery rate for the forthcoming year. Nakiwe Mkhwanazi, the business's wage clerk, prepared the following wage summary for Mike Mvelase, who works at the assembly department:

Normal wage rate	R15 per hour
Holiday bonus	R4 800

Ezakheni Ltd. makes the following contributions:

16% of normal wage (including vacation pay) to the pension fund
14% of normal wage (including vacation pay) to the medical aid fund

Additional information

- The company operates on a 45-hour week (Mon–Fri) for 52 weeks a year.
- Vacation leave is 20 workdays per employee annually. There are 10 paid public holidays per year.
- Idle time makes up 5% of available clock time.

REQUIRED

Calculate the following:

a. annual productive work hours
b. the normal annual wage cost
c. the total annual labour costs
d. the productive work hour labour recovery rate

Solution to Activity 5.6

a. Annual productive hours

	Hours
Number of clock hours in a year (45 hours x 52 weeks)	2 340,0
Less: Public holidays (10 days x 9 hours)	90,0
Less: Vacation hours (20 days x 9 hours)	180,0
Total clock hours available for production	2 070,0
Less: Idle time (2 070 x 5%)	103,5
Annual productive hours	1 966,5

b. Normal annual wage cost

Number of weeks in a year	52 weeks
Less: Vacation weeks	4
Actual working weeks	48

Normal annual wages = 48 weeks x 45 hours x R15
= R32 400

NOTE

Normal wage cost refers to the wage paid for ordinary hours of work. It normally excludes the paid vacation leave.

c. Total annual labour costs

	R
Annual normal wage	32 400
Vacation pay (R15 x 180 hours)	2 700
	35 100
Bonus pay	4 800
Pension fund contribution (R35 100 x 16%)	5 616
Medical aid contribution (R35 100 x 14%)	4 914
Total annual labour costs	50 430

d. Labour recovery rate

$$= \frac{\text{total annual labour costs}}{\text{annual productive hours}}$$

$$= \frac{\text{R50 430}}{\text{1 966 5}}$$

= R25,64 per work or productive operating hour

6 Summary

In this study unit, we have discussed the following:

- The different types of remuneration
- How to calculate gross and net pay
- How to allocate labour costs appropriately
- How to calculate a labour recovery rate

In the next study unit, we will investigate overheads and the treatment of these overheads in depth.

Bibliography

Please refer to the bibliography at the end of study unit 6.

Self-assessment Activity

QUESTION 1

Ekuvukeni Ltd's ledger shows the following balances (basic earnings) at the end of May:

	R
Direct labour	60 000
Indirect labour	20 000
Sales salaries	12 000
Office salaries	8 000

No overtime earnings or other remuneration were payable.

The following deductions must be taken into consideration:

PAYE	18% of taxable income
Pension fund	7,5% of basic earnings
UIF	1% of gross earnings
Medical aid	R10 000

The company makes the following contributions on behalf of its employees and treats these as indirect costs:

Pension fund	16% of basic earnings
Medical aid – direct labour	R6 000
Medical aid – indirect labour	R2 000
Medical aid – sales staff	R1 200
Medical aid – admin staff	R800
UIF	1% of gross earnings

NOTE

Basic earnings exclude overtime and bonuses. Gross earnings include these. In this question, there is no overtime or bonuses, so the two amounts are equal.

REQUIRED

Prepare the following:

a. the journal entry to record the payroll liability (excluding employer contribution)
b. the journal entry to distribute the payroll cost in a. above
c. the journal entry to record the employer's contributions and distribute it in one compound entry

QUESTION 2

Wasbank Ltd. has four employees deployed in the manufacturing department on its payroll.

NAME	WAGE PER WEEK	PAID LEAVE IN DAYS
Khosi	R800	15
Busisiwe	R700	15
Zanele	R900	10
Sphiwe	R600	10

The company works a 45-hour clock week (five days per week). There are 12 public holidays annually, 10 of which occur during the course of the working week throughout the year. Pension contributions and UIF contributions are calculated at 7,5% and 1% of the gross wage respectively, and Wasbank Ltd. contributes the same amount. PAYE is levied at the rate of 18% of taxable income.

REQUIRED

a. Draw up the company's payroll for one week (exclusive of employer contributions).
b. Calculate the hourly recovery rate for each of the employees (work or clock rate).
c. The following hours were recorded for week 33 for each employee:

Khosi	44 hours on job cards
Busisiwe	42 hours on job cards
Zanele	45 hours on job cards
Sphiwe	43 hours on job cards

Calculate the amount that would be debited to the WIP account.

NOTE

Since there is no allowance for normal idle time, in this case, the clock hours would be equal to the productive work hours.

Solution to Self-assessment Activity

QUESTION 1

a.

Dt	Payroll control account		
	(R60 000 + R20 000 + R12 000 + R8 000)	R100 000	
	Ct Pension fund (7,5% x R100 000)		R 7 500
	PAYE [18% x (R100 000 – R7 500)]		R16 650
	UIF (1% x R100 000)		R1 000
	Medical aid		R10 000
	Net wages payable		R64 850

b.

Dt	WIP (direct labour)	R60 000	
	Manufacturing overheads	R 20 000	
	Non-manufacturing overheads:		
	Marketing salaries	R12 000	
	Administrative salaries	R8 000	
	Ct Payroll control account		R100 000

c.

Dt	WIP (16% x R60 0000) + R6 000 + R600	R16 200	
	Manufacturing overheads		
	(16% x R20 0000) + R2 000 + R200	R7 400	
	Marketing salaries (16% x R12 000) + R1 200 + R120	R3 240	
	Administrative salaries (16% x R8 000) + R800 + R80	R2 160	
	Ct Pension fund (16% x R100 000)		R16 000
	Medical aid (R6 000 + R2 000 + R1 200 + R800)		R10 000
	UIF (1% x R100 000)		R1 000

QUESTION 2

a. Payroll

NAME	GROSS WAGE	7,5% PENSION CONTRIBUTION	TAXABLE INCOME	18% PAYE	1% UIF CONTRIBUTION	NET WAGE
	R	R	R	R	R	R
Khosi	800,00	60,00	740,00	133,20	8,00	598,80
Busisiwe	700,00	52,50	647,50	116,55	7,00	523,95
Zanele	900,00	67,50	832,50	149,85	9,00	673,65
Sphiwe	600,00	45,00	555,00	99,90	6,00	449,10
Total	3 000,00	225,00	2 775,00	499,50	30,00	2 245,50

b. Labour recovery rate

First, calculate productive time.

	Khosi and Busisiwe	Zanele and Sphiwe
Number of weeks per year x 5 days	52 x 5	52 x 5
Number of weekdays Less: Leave	260 15	260 10
Total number of days Less: Public holidays	245 10	250 10
Number of productive days x 9 hours (45-hour week/5 days per week = 9 hours per day)	235 x 9	240 x 9
Total productive hours	2 115	2 160

NOTE

Examination technique: in order to save time, we grouped employees with the same working conditions together.

Then, calculate total annual wage.

	Khosi	Busisiwe	Zanele	Sphiwe
	R	R	R	R
Gross wage per week Employer contributions ①	800,00 68,00	700,00 59,50	900,00 76,50	600,00 51,00
Weekly labour cost x 52	868,00 X52	759,50 X52	976,50 X52	651,00 X52
Total direct labour cost per year	45 136	39 494	50 778	33 852

① The employer contribution percentages are the same as those contributed by the employee. Use the information from the table in a.

② The employer's contribution to the pension fund and UIF is an expense over and above the gross wage. The employee's remuneration package or cost to company therefore forms the total direct labour cost.

Hourly work recovery rate

Khosi:	R45 136	÷2 115	=	R21,34 per hour
Busisiwe:	R39 494	÷2 115	=	R18,67 per hour
Zanele:	R50 778	÷2 160	=	R23,51 per hour
Sphiwe:	R33 852	÷2 160	=	R15,67 per hour

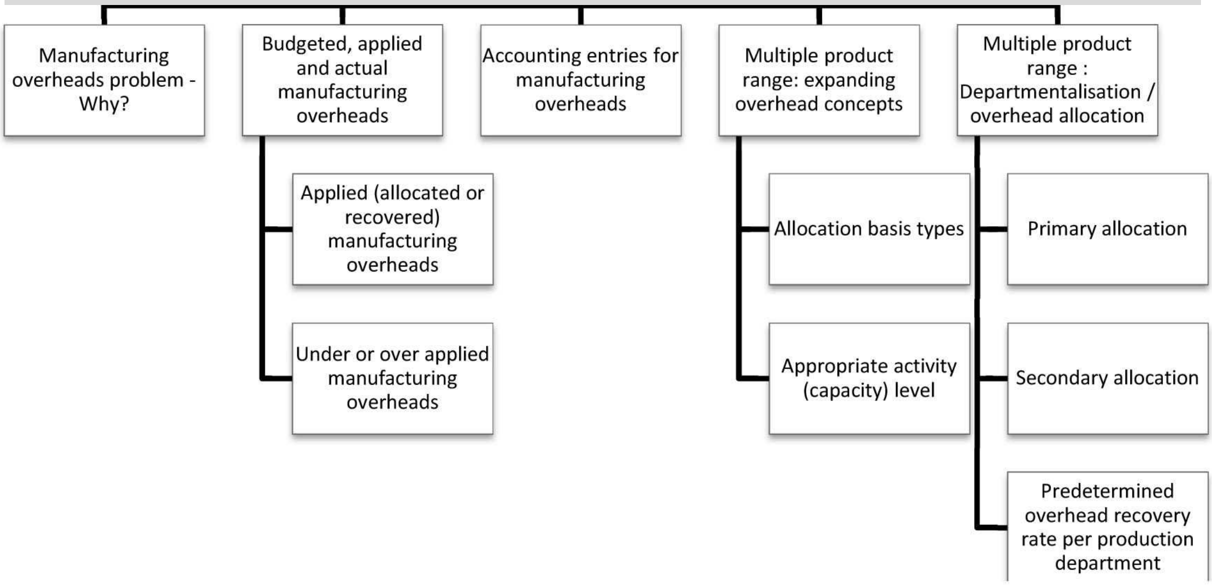
c. Amount debited to WIP account

Khosi:	R21,34 x 44 hours	=	R938,96
Busisiwe:	R18,67 x 42 hours	=	R784,14
Zanele:	R23,51 x 45 hours	=	R1 057,95
Sphiwe:	R15,67 x 43 hours	=	R673,81
		=	R3 454,86

STUDY UNIT 6

Overheads

In this study unit



1 Introduction

In the previous study unit, we discussed how labour costs are accounted for. In this study unit, we will investigate how overheads are accounted for.

As you know, one of the objectives of cost and management accounting is to provide information to management about the costs of the products manufactured, the services rendered, and the processes used in the manufacture of products. This information is needed for decision-making. The sum of the three cost elements – direct material, direct labour and manufacturing overheads makes up the cost of the product or service. Other cost objects (ie geographical areas) can even include non-manufacturing expenses such as marketing expenses. However, for this study unit we will focus on products and services as cost objectives.

While direct material and labour can easily be traced to the product or service, manufacturing overheads cannot be traced directly to individual products or services, because they include indirect costs. We will be examining the systems or methods identified to address this problem.

2 Why do manufacturing overheads present a problem?

Earlier, in topic 1, we explained that all manufacturing costs that cannot easily be traced directly to an individual product unit are called indirect costs. These can be grouped together as manufacturing overheads, and consist of indirect materials, indirect labour costs and other indirect expenses. Indirect expenses or costs are items such as electricity, depreciation on production equipment, and insurance for production assets.

The factor common to these costs, however, is that there is no direct link between their incurrence and units of output produced. This causes cost accountants endless problems in assigning these costs to output to establish a cost per unit. We will demonstrate the problem with a simple example, using one product only.

The following relates to the total actual production costs for a table manufacturer for the latest financial year:

Month	1	2	3	4	5	6	7	8	9	10	11	12	Total
Direct raw material (wood)	200	200	100	300	200	100	0	100	200	300	200	100	2 000
Direct labour	240	240	120	360	240	120	0	120	240	360	240	120	2 400
Overheads	1 320	1 345	1 320	1 360	1 330	1 310	1 305	1 285	1 315	1 390	1 365	1 355	16 000
Monthly product costs (R)	1 760	1 785	1 540	2 020	1 770	1 530	1 305	1 505	1 760	2 050	1 805	1 570	20 400
Total items produced	2	2	1	3	2	1	0	1	2	3	2	1	20
Resources consumed:													
Wood (m^3)	20	20	10	30	20	10	0	10	20	30	20	10	200
Hours	16	16	8	24	16	8	0	8	16	24	16	8	160

- Each table requires 10 m^3 of wood and eight labour hours to complete.
- The overheads consist of a production supervisor's salary of R750 per month and other monthly indirect raw materials (glue, nails etc) and indirect costs (eg electricity).

Answer the following questions:

a. Select any two months and then determine the unit cost per table in terms of the **raw materials** and **labour costs**. Repeat the exercise based on the total figures for the year. What did you notice about each of your answers?

b. Select any two months and then determine the unit cost per table in terms of the overhead costs. Repeat the exercise based on the total figures for the year. What did you notice about each of your answers?

Hopefully, you obtained any of the following per unit answers:

a.

Month	1	2	3	4	5	6	7	8	9	10	11	12	Total
Direct raw material (wood)	R100	R100	R100	R100	R100	R100	R100	R100	R100	R100	R100	R100	R100
Direct labour	R120	R120	R120	R120	R120	R120	R120	R120	R120	R120	R120	R120	R120

NOTE

Did you notice that **all the unit costs are the same for every unit produced in any period**? Why do you think that is?

b.

Month	1	2	3	4	5	6	7	8	9	10	11	12	Total
Overheads R	660	672,50	1 320	453,33	665	1 310	0	1 285	657,50	463,33	682,50	1 570	800

NOTE

Did you notice that **in no month are the unit costs the same**? Why do you think that is?

From these observations, we can state the following:

Referring back to the cost concepts covered in topic 1, we can conclude that, in a., we are dealing with variable costs because the cost per unit is constant, but in total it varies with production. In b., we are dealing with a mixed cost, that is, one that contains both fixed and variable costs, because the cost per unit changes from period to period.

In answering the question ''What does it cost to produce 1 table?'', we can clearly conclude that direct costs can be traced to each unit produced. (Each unit requires 10 m^3 wood at R10 per m^3, and eight labour hours at R15 per hour.) In terms of its direct costs, each table costs R220.

However, in terms of its overheads, the price per unit varied from R0 to R1 570 per unit, with an average price of R800 per unit. Does one take the cost for month 6 of R1 310 or, worse still, the cost for month 7 of R0 when determining the overhead cost of a table? Or does the average price of R800 make more sense?

The range of prices for each respective month **fluctuates drastically** and leaves one in no position to state the cost of overheads per unit. The average price of R800, however, is meaningful and seems representative of the overhead cost per unit.

What is perhaps less clear is that this **average actual overhead cost** of R800 per unit only becomes known at the **end of the year**. Assigning each unit the same overhead cost of R800 (ie avoiding fluctuations) can only be achieved by obtaining the total overhead cost for the year and dividing this by the total output for the year.

This, however, presents another problem. This data is only available at the end of each year, which is too late for the purposes of costing production and making this information available for sales. This information is already required during month 1, because the production output needs to be sold and costs determined for pricing and other decisions.

This example thus illustrates the two main issues regarding overheads:

a. overhead cost **per unit fluctuates greatly** as output fluctuates; and
b. **data** required to eliminate these fluctuations are only **available after the event** (too late).

How can these issues be resolved?

The most suitable solution to resolve the dual problem identified above is to apply a budgeted allocation rate (based on the total budgeted overheads and the total budgeted production output), as briefly explained as follows, using the data from the example above:

Assume the following **budgeted data** was available:

At the start of the year, the enterprise budgeted to produce, say, 22 tables.
At the start of the year, the enterprise budgeted to incur manufacturing overheads of, say, R16 500.

The budgeted overhead allocation rate per table would therefore amount to R750. (R16 000 $\div$ 22)

Budgeting the data up front ensures that a constant amount of overheads are included in the costing for each table. Although it will not be accurate (in this case it was R50 out on the eventual actual data), the benefits from using this method to cost a product outweighs any objections. This elementary concept will be further explained in the rest of this study unit.

3 Budgeted, applied and actual manufacturing overheads

We have acknowledged that it is difficult to assign a representative manufacturing overhead cost to products or services. Several products, product lines or departments share these costs. This causes a problem of determining how much should be assigned to each individual product. However, the objective remains that the unit cost for overheads should be as accurate as possible.

As explained in the introductory example, the only way to assign overhead cost to products is to use a budgeted overhead rate based on the following:

- budgeted estimates; and
- these budgeted estimates are established before the accounting period begins.

We have identified that waiting until the accounting period is over in order to determine actual overhead costs could be too late. Furthermore, if we base the overhead rates on actual costs and activity, the unit costs would fluctuate substantially for every month, simply because of random fluctuations in activity. You will see later the impact of activity level on the overhead allocation rate. It is therefore better to use a predetermined budgeted allocation rate.

NOTE

The actual cost of overheads is therefore not used to cost the product or service. Budgeted overheads are absorbed into the costs of each product as the period progresses, using the budgeted predetermined overhead allocation or recovery rate.

3.1 Applied manufacturing overheads

The use of a predetermined, budgeted overhead allocation rate to cost a product introduces a new term, namely ''applied overheads''. A clear distinction therefore has to be made between the following:

ACTUAL OVERHEADS:	These are the actual overhead costs incurred during a period.
BUDGETED OVERHEADS:	These are overhead costs estimated before, or at the start of a financial year.
APPLIED OVERHEADS:	These are the total overheads included/allocated to the cost of the products based on the predetermined, budgeted allocation or recovery rate. For each **actual** unit produced, a **budgeted rate** will be assigned, thus accounting for the total applied overheads.

OVERHEAD RECOVERY RATE:

The formula for calculating a predetermined, budgeted overhead recovery rate is:

$$\frac{\text{Budgeted manufacturing overhead costs} \quad \text{numerator}}{\text{Estimated production} \quad \text{denominator}}$$

The predetermined overhead recovery rate is also referred to as the *overhead absorption rate, overhead applied rate,* or the *overhead allocation rate*.

NOTE

Only actual and applied overheads are recorded in the financial records (general ledger) of an organisation. The budgeted data is only there for control purposes and usually only appears in the management reports or the costing system database for decision-making purposes.

We will start the discussion on allocation rates, using one overall rate and assuming one product only. later on, we will add more rates and products.

Activity 6.1

The following data relates to a manufacturer of a single product:

Budgeted (estimated) overhead costs for the year	R200 000
Budgeted production output	250 units

At the end of the financial year, the company actually produced 242 units at an actual overhead cost of R196 020.

REQUIRED

Calculate the applied manufacturing overhead costs for the year.

Solution to Activity 6.1

Budgeted allocation rate per unit	R200 000 / 250 units	=	R800
Applied manufacturing overheads			
= 242 units x R800		=	R193 600

This amount of R193 600 represents the amount to be included in the total production cost of the product.

3.2 Under or over applied manufacturing overheads

Since the budgeted predetermined rate is based on estimated production activities and manufacturing overheads, applied overheads will usually not agree with the actual overheads incurred. The costs actually incurred during the year is recorded in the records of an organisation as and when it is incurred. The amount applied is the amount allocated periodically to the cost of the products manufactured in the period. The difference between the actual and applied amounts is known as either an under or over application (recovery), based on whether the applied overheads were either more or less than the actual overheads.

> **UNDER OR OVER APPLIED OVERHEADS**
>
> If the applied overheads are less than the actual overheads, this is known as an under application. Over applied overheads occur when applied overheads are greater than the actual overheads.

The following are possible causes for under- or over applied overheads:

- The budgeted overhead application rates were incorrectly predetermined.
- The total actual overheads are more or less than what was budgeted for.
- The activity in the basis used for allocation (the denominator) is higher or lower than estimated (we will discuss the impact of this denominator later on in more depth).

Activity 6.2

Refer to the data for Activity 6.1.

REQUIRED

Calculate the under or over applied manufacturing overheads where the budgeted rate is R800 per unit.

Solution to Activity 6.2

Applied manufacturing overheads amount to (R800 x 242)	R193 600
Actual manufacturing overheads were	R196 020
Hence there is an under application of	R2 420

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4 Accounting entries in respect of manufacturing overheads

Actual overhead costs incurred are debited to the manufacturing overheads account (and not to the WIP account). The following will, however, occur in the WIP account every time a unit is produced:

The budgeted overhead rate will be charged to the WIP account. Bear in mind that the direct costs (raw materials and labour) will also accumulate in this account in direct proportion to output as production increases. This account thus accumulates costs as units are produced, which in turn ensures that a constant cost of production output is determined.

The credit entry for the budgeted overhead rate charged to the WIP account (mentioned above) is entered in the manufacturing overheads account. This will result in the manufacturing overhead account reflecting a balance equal to the under or over application.

The data provided in Activity 6.1 will thus be recorded as follows:

Manufacturing overheads

Bank / Accounts payable (actual)	R196 020	WIP (applied overheads)	R193 600

WIP

Material and labour (actual)	XX XXX		
Manufacturing overheads (applied)	193 600		

This also shows that production cost amounted to RXX XXX plus only R193 600 of the actual overheads. Thus R2 420 overheads were under applied in the cost of production. This is the balance of the manufacturing overheads account.

The under- or over applied overheads balance must be cleared at the end of the period. This balance is disposed of by debiting cost of sales by the amount under applied during the year.

	Debit R	Credit R
Cost of sales [*under applied overheads*]	2 420	
Manufacturing overheads		2 420

When overheads are over applied (the actual overheads are less than the applied overheads), the cost of sales is credited with the amount over applied during the year.

NOTE

The under or over applied overheads is a period cost, that is, it is written off or credited directly to profit in the period and it is not included in the valuation of inventory or the calculation of production cost.

The objective of management would be to minimise the under/over applied overheads balance year on year. The implication of a minimal balance in this account would be that, although a budgeted rate was used to cost production, it virtually represents actual overheads and the following would therefore apply:

- The overheads cost included in each unit are really representative of actual cost.
- The unit cost of each output is normalised, that is, it does not fluctuate.
- Together with the direct costs (raw material and labour), the cost per unit output is known and available for pricing and other decisions.

This largely eliminates the problems of costing production output as identified at the start of this study unit. However, it depends on effective budgeting and control procedures.

At this point, it must be emphasised that the focus has been on an enterprise that only produces a single product. In practice, of course, this is a highly unlikely scenario. In the remainder of this study unit we will therefore focus on how we will need to adapt the above concepts when an organisation produces a range of different products.

5 Multiple range of products: expanding on the overhead concepts to date

The example provided at the start of this study unit has been slightly adjusted to include the production of chairs also. The data for the year is thus as follows (**assume now that this represents the *budgeted* data for the year)**:

Month	1	2	3	4	5	6	7	8	9	10	11	12	Total
Direct raw material (wood)	440	520	460	540	440	380	240	260	280	620	600	420	5 200
Direct labour	420	480	390	540	420	330	180	240	300	600	540	360	4 800
Overheads	1 320	1 345	1 320	1 360	1 330	1 310	1 305	1 285	1 315	1 390	1 365	1 355	16 000
Units (products) produced													
Chairs	6	8	9	6	6	7	6	4	2	8	10	8	80
Tables	2	2	1	3	2	1	0	1	2	3	2	1	20
Total items (products) produced	8	10	10	9	8	8	6	5	4	11	12	9	100
Resources consumed:													
Wood (m^3)	44	52	46	54	44	38	24	26	28	62	60	42	520
Hours	28	32	26	36	28	22	12	16	20	40	36	24	320

- Each table requires 10 m^3 of wood and eight labour hours to complete.
- Each chair requires 4 m^3 of wood and two labour hours to complete.
- The overheads consist of a production supervisor's salary of R750 per month and other monthly indirect raw materials (glue, nails etc) as well as indirect costs (eg electricity).

If one recalls the original example, where only tables were manufactured, the actual overheads of R800 per unit were determined as follows:

Overheads per table R16 000 / 20 units = R800

If you apply this approach to the new scenario with two products:

Overheads per table and chair R16 000 / (20 + 80) units = R160

This indicates that each table and chair costs R160 in terms of overheads. We added the tables and chairs together to obtain the 100 units above (total items produced). It is not surprising to note that each unit of output in the scenario above (whether a table or a chair), is assigned with exactly the same overhead cost!

The **fundamental error** in this approach is that tables and chairs are two different kinds of products and the units (20 + 80) cannot be added together in the allocation of overheads.

In fact, when determining a predetermined, budgeted overhead rate in instances where **more than one product is produced,** this dilemma is resolved as follows when dealing with the total budgeted overheads for the year:

- A **suitable common allocation basis (denominator) is adopted** to apportion the total budgeted overheads between the range of products types, that is, in our example, R16 000 between the tables and chairs. The selection of a suitable allocation basis is dealt with below.

- The total **applied budgeted overheads for each product type** are then apportioned to each unit, based on the number of units budgeted for that product type.

This culminates in an overhead recovery rate for each product type.

5.1 What types of allocation bases (denominators) can be used?

Some of the appropriate bases that can be used to calculate the predetermined overhead rate include the following:

Non-financial bases

- direct labour hours (appropriate in a labour-intensive environment)
- raw material quantities (appropriate where the raw material volumes drive the overhead cost)
- machine hours (appropriate in machine-intensive or automated environments)
- physical units of output (only applicable where the range of units is very similar)

Financial bases (total overhead costs expressed as a percentage of ...):

- total direct labour cost
- total direct material cost
- total prime costs

The overriding consideration in determining this basis is to identify, as accurately as possible, the cause-and-effect relationship between the overhead costs and the allocation basis.

Using the data in our example provided above for the tables and chairs manufacturer, the first two non-financial bases, for example, will result in the following:

Based on direct labour hours:

Budgeted allocation rate
= R16 000 / [(20 x 8hrs) + (80 x 2hrs) = 320 hours] = R50 per direct labour hour

Thus, the total overheads will be apportioned as follows:	**Tables**	**Chairs**
Based on R50 per hour (160; 160)	R8 000	R8 000
Budgeted overheads per unit (÷ 20; ÷ 80)	R400	R100

Based on direct raw materials:

Budgeted allocation rate
= R16 000 / [(20 x 10 m^3) + (80 x 4 m^3) = 520 m^3] = R30,77 per m^3

Thus, the total overheads will apportioned as follows:	**Tables**	**Chairs**
Based on R30,77 per m^3 (200 m^3; 320 m^3)	R6 154	R9 846
Budgeted overheads per unit (÷ 20; ÷ 80)	R307,70	R123,08

Activity 6.3

The budgeted manufacturing overhead costs for Cost Centre 66 for the forthcoming period is R200 000 at an activity level of 100 000 *direct labour hours*. The *direct labour cost* is budgeted at R400 000. What is the organisation's predetermined overhead allocation rate for each of these allocation bases?

Solution to Activity 6.3

Predetermined overhead rate

$$= \frac{\text{budgeted manufacturing overheads}}{\text{budgeted direct labour hours}} \quad \text{OR} \quad \frac{\text{budgeted manufacturing overheads}}{\text{budgeted direct labour cost}}$$

$$= \frac{\text{R200 000}}{\text{100 000 hours}} \qquad\qquad = \frac{\text{R200 000}}{\text{R400 000}}$$

= R2,00 per direct labour hour = R0,50 for each R1 of direct labour cost

5.2 What is an appropriate activity (capacity) level to use for the selected basis (denominator)?

Once you have selected an appropriate allocation basis (eg machine hours), you have to determine what you are going to use as the estimated activity level for that basis. You can see from the mathematical formula above that the level of the denominator will have a big impact on the size of the allocation rate. This, in turn, influences the cost of the product. It is therefore of the utmost importance that management carefully consider the level at which to set the allocation basis.

Furthermore, and in addition to *any* of the bases selected, an organisation has a range of four capacity levels to choose from:

- **Theoretical** maximum capacity is the volume of activity that could be attained under **ideal** operating conditions (ie with no allowance for inefficiency).
- **Practical** capacity is the volume of activity that could be attained taking into account all unavoidable interruptions (eg stoppages for maintenance).
- **Normal average long-run** capacity is the average level of operating activity that is sufficient to meet the demand for the organisation's product for several years. It is normally used when sales fluctuate from one period to another.
- **Budgeted** capacity is the required activity needed for the next budget period.

NOTE

In terms of International Accounting Standards – IAS2 – the **correct capacity level** to use for the allocation of fixed manufacturing overhead is the **normal average long-run capacity**. This prevents undue fluctuation in the cost of the product from year to year.

In the next activity, you will see the impact of the activity level on the product cost.

Activity 6.4

Bondela Manufacturers is a manufacturer of bags. The fixed cost for operating machine A amounts to R35 000 per annum (fixed for the next three years). The remaining useful life of the machine is three years. The following information is available:

- The maximum annual operating hours for the machine are 50 weeks x 8 hours x 5 days per week.
- Under normal situations, Bondela can manufacture 10 bags per operating hour.
- Bondela only manufactures bags to order.
- It is estimated that Bondela will manufacture and sell 14 000 bags in the next year and 15 000 and 16 000 bags will be manufactured in the following years.
- Bondela has calculated that 12,5% of capacity will be allocated for unavoidable interruptions (eg planned maintenance of the machine).

Bondela Manufacturers allocates fixed overhead manufacturing cost based on machine hours.

REQUIRED

a. Calculate the overhead application rate if the following activity levels are used as the denominator:

   i. the theoretical maximum capacity
   ii. the practical capacity
   iii. the normal, average long-run capacity
   iv. the budgeted activity (limit your calculation to year 1 only)

b. Calculate the fixed overhead cost per unit for each of the denominator levels in a.

Solution to Activity 6.4

a. and b.

i. The theoretical maximum capacity as denominator:

Maximum hours = 50 weeks x 8 hours x 5 days = 2 000 hours
Overhead rate = R35 000/2 000 hours = R17,50 per hour
Per unit = R17,50 ÷ 10 = R1,75

ii. The practical capacity as denominator:

Practical available hours = (50 weeks x 8 hours x 5 days) x 87,5% = 1 750 hours
Overhead rate = R35 000/1 750 hours = R20,00 per hour
Per unit = R20 ÷ 10 = R2,00

iii. The normal, average long-run capacity as denominator:

Long-run hours required = (14 000 + 15 000 + 16 000) bags/10 bags per hour
= 4 500 hours

Average hours required per annum = 4 500 hours/3 years = 1 500 hours
Overhead rate = R35 000/1 500 hours = R23,33 per hour
Per unit = R23,33 $\div$ 10 = R2,33

iv. The budgeted activity as denominator (for year 1 only):

Budgeted hours required = 14 000 bags/10 bags per hour = 1 400 hours
Overhead rate = R35 000/1 400 hours = R25,00 per hour
Per unit = R25 $\div$ 10 = R2,50

NOTE

Notice the difference between ii. and iii./iv. Although the machine is physically capable of delivering 1 750 hours (produce 17 500 bags) in ii., the allocation basis level in iii/iv. is determined by the market demand for the product, that is, the estimate of how many bags will be sold.

The average long-run demand will usually be based on the sales that will be generated over the life of the plant or machine (ie how many years/months it can be operated before it will have to be disposed/dismantled and replaced).

NOTE

The choice of the level at which to set the allocation basis is one of the most important decisions that the cost accountant makes. Overheads constitute a major portion of most organisations' cost structure. The overhead recovery rate, therefore, has a significant impact on product cost.

If the question does not indicate any other capacity level, you may use the budgeted activity level for the period under review

If the question does not indicate any other capacity level, you may use the budgeted activity level for the period under review.

The following activities will reinforce some of the principles covered thus far:

Activity 6.5 Under- or over-applied manufacturing overheads
Activity 6.6 Under- or over-applied manufacturing overheads
Activity 6.7 Under- or over-applied manufacturing overheads (using different recovery bases)
Activity 6.8 Accounting entries for manufacturing overheads
Activity 6.9 General short questions

Activity 6.5

Refer back to Activity 6.3. Assume that overhead costs are allocated based on direct labour hours and that actual direct labour hours worked for the period were 95 000. Actual manufacturing overheads amounted to R191 500.

REQUIRED

Determine the under or over recovery of manufacturing overhead costs for the period.

Solution to Activity 6.5

Applied manufacturing overheads	=	95 000 hours x R2 per direct labour hour
	=	R190 000
Actual manufacturing overheads	=	R191 500
Under applied	=	R1 500

Activity 6.6

The budgeted and actual data for Cost Centre 70 for February were as follows:

	Budgeted	**Actual**
Manufacturing overheads	R6 000	R6 312
Direct labour hours	800	792
Direct labour cost	R1 600	R1 705
Direct materials	R3 000	R2 947
Machine hours	1 200	1 172
Units produced	45	46

The appropriate predetermined overhead rate is based on budgeted direct labour hours. You can assume that February represents an average month.

REQUIRED

a. Calculate the under or over applied manufacturing overheads.
b. Prepare the T-account for the manufacturing overhead account.
c. Make a journal entry for the under or over recovery for February.

Solution to Activity 6.6

a. The predetermined overhead rate is R7,50 per hour (R6 000 ÷ 800 hours).

Applied manufacturing overheads amount to (792 hours x R7,50)	R5 940
Actual manufacturing overheads were	R6 312
Therefore there is an under application of (R6 312 – R5 940)	R372

b. T-account

Manufacturing overheads

Bank/accounts payable (actual)	6 312	WIP (applied overheads)	5 940
		Cost of sales	372
	6 312		6 312

WIP

Material and labour (actual)	4 652		
Manufacturing overheads (applied)	5 940		

c. Dt Cost of sales (under recovery) R372
Ct Manufacturing overheads R372

Activity 6.7

The budgeted cost information below is obtained from the budget of Guduza Herbs, a manufacturing pharmaceutical, for the year ended 31 March 20XX.

	R
Direct material	100 000
Direct labour	150 000
Prime cost	250 000
Manufacturing overheads	150 000
Total costs	400 000

Additional information:

Budgeted direct labour hours	75 000
Budgeted machine hours	50 000
Budgeted production (units)	50 000
Actual units produced	49 750
Actual machine hours	49 500
Actual direct labour hours	74 300
Actual manufacturing overheads	R142 500

REQUIRED

a. Calculate six possible predetermined overhead recovery rates.
b. Determine the applied manufacturing overhead costs based on direct labour hours and machine hours.
c. Comment on the budgeted, applied (based on direct labour hours) and actual manufacturing overhead costs, giving reasons why they differ.

Solution to Activity 6.7

a. Predetermined overhead rates

Units of output rate = $\frac{\text{budgeted manufacturing overheads}}{\text{budgeted units produced}}$

= $\frac{\text{R150 000}}{\text{50 000 units}}$

= R3,00 per unit produced

Direct labour hour rate = $\frac{\text{budgeted manufacturing overheads}}{\text{budgeted direct labour hours}}$

= $\frac{\text{R150 000}}{\text{75 000 hours}}$

= R2,00 per direct labour hour

Machine hour rate = $\frac{\text{budgeted manufacturing overheads}}{\text{budgeted machine hours}}$

= $\frac{\text{R150 000}}{\text{50 000 hours}}$

= R3,00 per machine hour

Prime cost rate = $\frac{\text{budgeted manufacturing overheads}}{\text{budgeted prime cost}}$

= $\frac{\text{R150 000}}{\text{R250 000}}$

= 60% of prime costs or R0,60 for every R1 of prime cost

Direct material cost rate = $\frac{\text{budgeted manufacturing overheads}}{\text{budgeted material cost}}$

= $\frac{\text{R150 000}}{\text{R100 000}}$

= 150% of material costs or R1,50 for every R1 of raw material cost

Direct labour cost rate = $\frac{\text{budgeted manufacturing overheads}}{\text{budgeted labour cost}}$

= $\frac{\text{R150 000}}{\text{R150 000}}$

= 100% of labour costs or R1,00 for every R1 of labour cost

b. Applied manufacturing overheads

Applied manufacturing overheads based on direct labour hours:
= R2 x 74 300 hours
= R148 600

Applied manufacturing overheads based on machine hours:
= R3 x 49 500 hours
= R148 500

c. **Budgeted manufacturing overheads** of R150 000 were merely estimates made before the start of the financial year.

Applied manufacturing overheads of R148 600, based on direct labour hours, were allocated during the year by multiplying the actual direct labour hours by the predetermined overhead rate (calculated on the basis of the budgeted overheads). This is very close to the budgeted overhead cost, because the actual direct labour hours did not differ substantially from the hours budgeted.

Actual overheads of R142 500 were the actual amounts spent, but only known at the end of the period. The difference between actual overheads and applied overheads indicates an over application (recovery) of R6 100 (R142 500 – R148 600), which could be the result of incorrectly estimating the budgeted overhead costs and activity levels.

The over recovery should be written off against cost of sales.

Activity 6.8

The following information was obtained from the accounting records of Jobe Ltd. as at 31 December:

	R
Actual manufacturing overheads	250 000
Applied manufacturing overheads	240 000
Goods completed	770 000
Direct material	360 000
Direct labour	170 000

REQUIRED

Prepare the T-accounts for manufacturing overheads, WIP and cost of sales for the period, including the closing-off entries.

Solution to Activity 6.8

The relevant ledger accounts are:

Manufacturing overheads

	R		R
Bank/accounts payable	250 000	WIP (applied overheads)	240 000
		Cost of sales (under applied overheads)	10 000
	250 000		250 000

WIP

	R		R
Material	360 000	Finished goods	770 000
Labour	170 000		
Manufacturing overheads	240 000		
	770 000		770 000

Cost of sales

	R		R
Manufacturing overheads (under applied)	10 000		

Activity 6.9

At 31 December, the manufacturing overheads account for a manufacturing company is as follows:

Manufacturing overheads

	R		R
	385 000		395 000
	10 000		

REQUIRED

a. What was the amount for the actual manufacturing overheads?
b. What manufacturing overheads were applied to work-in-process?
c. What does the balance of R10 000 represent?
d. Prepare the journal entry for disposing of the manufacturing overhead balance.

Solution to Activity 6.9

a. R385 000
b. R395 000
c. Over applied overheads
d. Journal entry

	Debit R	Credit R
Manufacturing overheads	10 000	
Cost of sales		10 000

6 Multiple range of products: departmentalisation/allocation of overheads

In the examples and activities until now, we have determined **one** overhead recovery rate for the organisation as a **whole**. This is called a *plant-wide rate* or *blanket overhead rate.*

> **BLANKET OVERHEAD RATE**
>
> All the manufacturing overheads (for all production departments) are added together and allocated, based on one collective allocation basis common to all products and all production/service departments.

In most instances, this is very inaccurate, since different products consume the production costs of different production departments in differing proportions.

For example:

Product	Dept A	Dept B	Dept C	Dept D	Dept E
X12	X	X		X	
L253		X	X		
W4	X	X	X	X	X
O322			X		X

Allocation of manufacturing overheads (via a budgeted rate) can be carried out in more detail in those cases, such as the above, where different products are processed through different production departments.

In order to achieve a more accurate and fairer overhead allocation, a predetermined overhead recovery rate should instead be calculated for each production department (based on the principles explained to date). A completed product would then only be charged for its actual activity usage in each of the production departments where processing and conversion takes place. For instance, in the example above, product X12 would only be allocated a portion of the overheads of production departments A, B and D, and none from the others. On the other hand, department A allocates its manufacturing overheads only to product X12 and W4 and not to any other products.

Remember, that the direct material and labour costs are still traced directly to the products based on their usage (requisitions/job or time cards). There is no "allocation" of direct costs.

NOTE

Departmental recovery rates essentially do not apply to organisations that produce only a single product. This is because all the manufacturing overhead costs are incurred to produce the one and only product. It is therefore not necessary to determine how much is allocated by which department. For example:

	Dept K	Dept L	Dept M
Only product	X	X	X

DEPARTMENTAL OVERHEAD RATE

Overhead recovery rates are determined for each department separately, based on the individual department's overhead costs and an appropriate allocation basis, depending on the type of activity that takes place in that specific department.

The manufacturing overhead costs attributable to each production department must therefore be determined (budgeted). This is referred to as the **departmentalisation of manufacturing overheads**.

Treatment of manufacturing overheads where separate departments exist should be dealt with as follows:

1. **Primary allocation/apportionment**, where ALL overhead expenses (eg rent, salaries, insurance etc) are divided among ALL the departments in the organisation, including the service departments (ie maintenance, scheduling) and non-production departments (ie administration and sales, where necessary). Accumulation of a department's overhead cost either occurs directly (eg depreciation on plant in department A will only reside in department A's costs) or by apportionment (eg total rent paid, common to all departments, will be apportioned amongst the various departments).
2. **Secondary allocation**, where the accumulated overhead costs (from step 1 above) of *service departments* are allocated to the production and non-production departments for which they (the service/support department) render services. This is carried out by means of an allocation rate or service charge. An example: the maintenance department reallocates its total accumulated manufacturing overheads to the respective production departments (maintenance of production plant and equipment) and the dispatch department (maintenance of delivery vehicles). In this way, all production-related overheads are finally accumulated solely in the various production departments.
3. A recovery rate (as explained before) is determined for each respective production department depending on its own overhead and allocated service costs, and using a basis suitable to its activities. Each production department will therefore have its own recovery rate.
4. Each departmental overhead rate is then applied to actual activity data for each product type it processes in order to calculate the total applied manufacturing overheads.

Steps 1 and 2 are referred to as the first-stage allocations. These allocations involve the allocation of manufacturing related overheads to production departments (also called cost centres). Steps 3 and 4 are referred to as second stage allocations. These allocations involve allocating manufacturing overhead costs to products and other cost objects.

Each of these steps will now be discussed in more detail.

6.1 Primary allocation of overheads

In the **primary allocation** stage, every overhead item (eg depreciation, salaries, rent, electricity etc) are assigned directly/apportioned to the organisation's production, service (support) and non-manufacturing departments on appropriate bases. Each of these departments is referred to as a cost centre, because each department is mainly controlled and managed on the basis of the costs it incurs.

Production departments are identified based on the type of goods they produce or the activities they perform.

Examples are production departments for cutting, assembling, drilling and finishing.

In a production environment, a number of **service departments** provide **support functions** to the production departments and, at times, to other service departments as well. A service department might also render services to non-production departments.

Examples of service departments are production scheduling, maintenance, quality control, information technology and HR. Service departments play a vital role in the overall manufacturing process and provide auxiliary support to production departments and the rest of the organisation. In highly technical production environments, these departments may contribute a substantial amount to the total manufacturing overhead costs.

NOTE

Overhead costs such as rental, insurance etc will also be apportioned to non-manufacturing departments (eg marketing, dispatch and administration departments). These non-manufacturing overhead costs will be EXCLUDED from the costs eventually accumulated in the various production departments. These costs are classified as period costs.

For the primary allocation of overheads (as well as secondary allocation), it is necessary to find a **suitable basis** for the apportionment of individual cost items among the various departments. The basis will be determined by the *causal relationship between the cost and the ultimate allocation activity*. The allocation basis used to allocate a particular department's costs should drive these costs. For example, the area utilised (m^2) by each department would be the most appropriate basis for the apportionment of the rental cost for a factory building to the various departments.

Activity 6.10

Gobe Ltd. has a production, service and administration department; the following budgeted information is available:

	Production	Service	Administration
Number of employees	53	5	2
Number of copies made (Xerox)	3 000	1 250	5 100
Value of machines and equipment	R70 000	R20 000	R10 000
Floor area (m2)	1 150	100	50

The following budgeted overhead costs are applicable:

	R
Buildings insurance	23 600
Machinery insurance	12 400
Cafeteria	11 400
Maintenance of copy machines	16 000
Protective overalls	3 600
Indirect material:	
Production	14 000
Service	2 400
Administration	1 500

REQUIRED

Complete the primary allocation of overheads to the respective departments.

Solution to Activity 6.10

Calculation of primary allocation of overheads

Cost item	Allocation basis	Total R	DEPARTMENTS Production R	Service R	Administration R
Buildings insurance	Area	23 600	1 150/1 300 x R23 600 = R20 877	100/1 300 x R23 600 = R1 815	50/1 300 x R23 600 = R908
Machinery insurance	Value	12 400	R70 000/100 000 x R12 400 = R8 680	R20 000/100 000 x R12 400 = R2 480	R10 000/R100 000 x R12 400 = R1 240
Cafeteria	Employees	11 400	53/60 x R11 400 = R10 070	5/60 x R11 400 = R950	2/60 x R11 400 = R380
Maintenance of copy machines	Copies made	16 000	3 000/9 350 x R16 000 = R5 134	1 250/9 350 x R16 000 = R2 139	5 100/9 350 x R16 000 = R8 727
Protective overalls	Employees	3 600	53/60 x R3 600 = R3 180	5/60 x R3 600 = R300	2/60 x R3 600 = R120
Indirect material	NONE		14 000	2 400	1 500
Primary allocation of overheads			61 941	10 084	12 875

The R12 875 will not end up being allocated to the cost of the products.

NOTE

Did you notice that the indirect material usage was not apportioned, since it was debited directly to each department based on the completed stores requisitions?

6.2 Secondary allocation of service (support) overheads

Secondary allocation refers to the re-apportionment of a service department's overhead costs to all the other departments to the extent that this service department renders a service or supports these other departments.

Some service departments also render services to other service departments. For instance, the payroll department and the HR department provide services to production, maintenance, and administration departments AS WELL AS to each other.

INTERDEPARTMENTAL SERVICES

When one ***service*** department renders services to another ***service*** department, this type of service is regarded as an interdepartmental service.

Apportioning of these may cause a spiral effect (eg Dept A debits Dept B which, in turn, debits Dept A again, etc). There are various methods available for the treatment of these interdepartmental service costs. You will learn more about this in MAC3701.

In this module, we will limit interdepartmental services to one other service department. In other words, no reciprocal services will apply or *we will provide you with the amount of costs allocated to production departments from the service departments.*

Activity 6.11

Marklin Company Ltd. has three production departments (P1, P2 and P3) and two service departments (S1 and S2).

The **budgeted** overheads for the year for the different departments are as follows (the primary apportionment has already been carried out):

		At a factory capacity of 80%				
	Total	**Dept P1**	**Dept P2**	**Dept P3**	**Dept S1**	**Dept S2**
	R	R	R	R	R	R
Variable costs	112 600	60 000	25 000	17 600	6 000	4 000
Fixed costs	117 000	60 000	35 000	22 000	–	–
	229 600	120 000	60 000	39 600	6 000	4 000

A survey of the factory and its activities reveals the following at a factory capacity of 80%:

Department	Investment in equipment	Machine hours	Direct labour hours	Direct labour cost
	R			R
P1	200 000	8 000	32 350	120 000
P2	150 000	6 000	15 650	60 320
P3	100 000	2 000	10 000	80 000
S1	20 000			
S2	50 000			

Service departmental costs are allocated to production and service departments on the following bases and in the following sequence:

Department S1 – Investment in equipment

Department S2 – Machine hours

Department P1 uses direct labour hours as a basis for calculating its predetermined overhead rate.

REQUIRED

a. Calculate the total budgeted overheads that will be used in the calculation of the overhead rates for each of the production departments.
b. Calculate the budgeted overhead recovery rate for department P1.
c. Calculate the budgeted overheads for department P3 if the company decides to operate at 90% capacity.

Solution to Activity 6.11

NOTE

It is important to **first allocate** the overheads of the service department that renders services to the other departments.

a. Total budgeted overheads

	Total	Dept P1	Dept P2	Dept P3	Dept S1	Dept S2
Primary allocations	229 600	120 000	60 000	39 600	6 000	4 000
Allocation dept S1 ①	–	2 400	1 800	1 200	(6 000)	600
	229 600	122 400	61 800	40 800		4 600
Allocation dept S2 ②	–	2 300	1 725	575		(4 600)
Total budgeted overheads	229 600	124 700	63 525	41 375		

① Allocation basis for department S1 (R6 000)

Department	Investment in equipment R
P1	200 000
P2	150 000
P3	100 000
S1	***EXCLUDED***
S2	50 000
	500 000

NOTE

Always remember to exclude own department (ie the department that one is allocating) from the allocation basis. In ① we are allocating service department S1's cost, so we exclude the R20 000 investment in equipment relating to S1 to avoid being left with an unallocated amount.

Allocation as follows:

P1 = R200 000 / R500 000 x R6 000 = R2 400
P2 = R150 000 / R500 000 x R6 000 = R1 800
P3 = R100 000 / R500 000 x R6 000 = R1 200
S2 = R 50 000 / R500 000 x R6 000 = R 600

② Allocation basis for department S2 (R4 600)

Department	Machine hours
P1	8 000
P2	6 000
P3	2 000
S1	***NONE***
S2	***EXCLUDED (& NONE)***
	16 000

Allocation as follows:

P1 = 8 000 hours / 16 000 hours x R4 600 = R2 300
P2 = 6 000 hours / 16 000 hours x R4 600 = R1 725
P3 = 2 000 hours / 16 000 hours x R4 600 = R 575

b. Budgeted overhead rate for department P1

Budgeted overheads/budgeted direct labour hours

= R124 700 / 32 350 hours

= R3,85

c. Budgeted overheads for department P3 if the company decides to operate at 90% capacity

R22 000 fixed costs ③ + (R19 375 variable costs ④ x $\frac{90}{80}$)

= R22 000 + R21 796

= R43 796

NOTE

We only adjust the variable costs for the change in manufacturing volume.

③ Given. None of the two service departments have any fixed costs, which means that the overheads allocated to P3 will only consist of variable costs.

④ Variable costs for department P3:

Total budgeted overheads (as (a))	R41 375
Less: Fixed costs③	R22 000
	R19 375

Activity 6.12

Mkhize Ltd. has two service departments (the human resource – HR department and the maintenance department) and two production departments (cutting and assembly).

The service and cost data for these departments are provided below.

	SERVICES PROVIDED TO:			
SERVICES PROVIDED BY:	**Service**		**Production**	
	HR	**Maintenance**	**Cutting**	**Assembly**
HR	–	20%	35%	35%
Maintenance	–	–	60%	40%
Department's accumulated costs – based on primary allocations	R940 000	R506 000	R2 160 000	R1 440 000

10% of the HR department's time is spent servicing the finance department.

REQUIRED

Prepare a schedule for apportioning the service departments' costs.

NOTE

- First, allocate the overhead costs of the service department that renders services to *other service departments*.
- Then obtain the total for the other service departments.
- Then allocate the remaining service department's costs to the production departments.

Solution to Activity 6.12

	Production departments		Service departments		Non-production
	CUTTING	ASSEMBLY	HR	MAINTENANCE	FINANCE
	R	R	R	R	R
Own costs	2 160 000	1 440 000	940 000	506 000	
Secondary allocation: HR	35%: 329 000	35%: 329 000	(940 000)	20%: 188 000	10%:94 000
				694 000	
Maintenance	60%: 416 400	40%: 277 600	–	(694 000)	
Total	2 905 400	2 046 600	①–	① –	② 94 000

NOTE

① Can you see that the service departments end up with zero balances? All their overhead support costs are re-apportioned. The objective, at each stage, is to obtain appropriate accumulated costs, thereby ensuring that the total costs that end up in each production department are as appropriate as possible.

② The HR costs allocated to the finance department are non-production costs and are treated as period costs (administrative overheads).

6.3 The predetermined overhead recovery rate per production department

In the third step of the departmentalisation of manufacturing overheads, a predetermined overhead **recovery rate per production department** is calculated. This is used to allocate the manufacturing overheads to production (ie the products absorb these costs). Earlier in this topic, we encountered the various bases that can be used to calculate the rate. Machine hours, labours hours and units manufactured are normally used. See section 5.1.

The following is an example of a section of a job-order cost sheet where a job progressed through various departments before being finalised. Each department had its own budgeted allocation rate:

Date	Production department	Allocation basis	Actual hours/ cost	Budgeted rate (R)	Allocated cost (R)
30/12	Cutting	Direct labour hours	150	6	900
30/12	Assembly	Direct labour hours	160	5	800
30/12	Finishing	Direct labour hours	180	5	900
30/12	Upholstery	Direct labour cost	R3 000	80%	2 400
Total applied manufacturing overheads					5 000

FIGURE 6.1: Overheads in a job-order costing system

Activity 6.13

Mogale Ltd. is a manufacturing concern with two production departments, PD1 and PD2, as well as two service departments, SD1 and SD2.

Total budgeted manufacturing overhead costs of R480 000 for the year must be allocated to the production departments in order to determine the overhead recovery rate per production department.

The overhead costs are allocated on the following basis:

Production departments		Service departments	
PD1	**PD2**	**SD1**	**SD2**
60%	25%	10%	5%

Secondary allocation is based on service provision. Service department SD2 renders a service to both production departments based on the ratio of their respective machine hours, whereas SD1 provides an equal service to the production departments.

The production departments' overhead recovery rates are based on machine hours. The budgeted machine hours for the period are as follows:

Production departments	
PD1	**PD2**
12 000	6 000

REQUIRED

Determine the overhead recovery rates for PD1 and PD2 respectively.

Solution to Activity 6.13

Calculation of total overhead costs to be recovered from each production department by a primary and secondary allocation of overheads

	PD1	PD2	SD1	SD2
Total manufacturing overheads: R480 000 (given) (Calculation 1)	288 000	120 000	48 000	24 000
(Calculation 2)	16 000	8 000		(24 000)
(Calculation 3)	24 000	24 000	(48 000)	–
Budgeted overheads	328 000	152 000	–	–
Machine hours	12 000	6 000		
Overhead recovery rate (Calculation 4)	R27,33	R25,33		

Calculation 1

Total overheads = R480 000 (given)

PD1	PD2	SD1	SD2
R480 000 x 60% = R288 000	R480 000 x 25% = R120 000	R480 000 x 10% = R48 000	R480 000 x 5% = R24 000

Calculation 2

Service department SD2 renders services to the two production departments based on their machine hours:

PD1	PD2
R24000 x $\frac{12\ 000}{18\ 000}$ = R16 000	R24 000 x $\frac{6\ 000}{18\ 000}$ = R8 000

Calculation 3

Service department SD1 renders equal services to the two production departments.

PD1	PD2
R48 000 x $\frac{1}{2}$ = R24 000	R48 000 x $\frac{1}{2}$ = R24 000

Calculation 4: Overhead recovery rate per production department

PD1	PD2
$\frac{\text{Total overheads}}{\text{Budgeted labour hours}}$ $= \frac{328\ 000}{12\ 000}$ = R27,33	$\frac{\text{Total overheads}}{\text{Budgeted labour hours}}$ $= \frac{152\ 000}{6\ 000}$ = R25,33

7 Summary

In this study unit, we discussed the following:

- How to identify the main reasons for applying a budgeted predetermined overhead recovery rate when costing products in terms of manufacturing overheads
- How to distinguish between budgeted, applied (recovered) and actual manufacturing overheads
- How to calculate the under or over recovery of overheads
- How to account for overheads in an organisation's financial records
- How to differentiate between the approaches required for organisations that produce a single product range and organisations that produce a multiple product range
- How to choose an appropriate allocation basis and a suitable denominator (capacity) level
- How to distinguish between a blanket overhead rate and a departmental overhead rate
- How to apply primary and secondary allocations of overheads when determining departmental overhead rates

Self-assessment Activity

QUESTION 1

Gobiqolo Ltd. uses direct machine hours as the basis for allocating overheads to production. Budgeted overheads for the next year are R100 000 and budgeted machine time 31 250 hours. These hours are equal to the average long-term capacity utilisation of the machines.

By the end of the year, total machine time was 33 000 hours and the actual overhead cost was R112 000. The company produced 5 000 units of its product.

REQUIRED

a. Calculate the budgeted overhead recovery rate.
b. Determine the amount of applied overheads during the year.
c. Calculate the under or over applied overheads for the year.
d. Determine the overhead cost component per unit manufactured in order to value the inventory.

QUESTION 2

A company uses a predetermined overhead rate based on average long-term machine hour utilisation. The budgeted factory overheads for a year were estimated at R760 000, but the actual factory overheads incurred amounted to R738 000. The actual machine hours were 119 000.

During the year, the company applied overheads to the amount of R714 000.

REQUIRED

Calculate the following:

a. Budgeted machine hours
b. The under or over applied manufacturing overheads

QUESTION 3

Terror Ltd. manufactures toys. The monthly average **budgeted fixed** production related overhead cost amount to R219 500. The budgeted overhead recovery rate is based on the following methodology:

1. The primary allocation takes place on the following basis:

Production department	P1	–	40%
	P2	–	20%
	P3	–	20%
Service department	S1	–	10%
	S2	–	10%

2. Secondary allocation is on a service provision basis. Service department S2 renders a service to all other departments, whereas service S1 provides a service to production departments only. Secondary allocation and the budgeted fixed overhead recovery rate are based on labour hours.

	P1	**P2**	**P3**	**S1**	**S2**
Labour hours	1 500	1 000	500	100	50

Management would like you to estimate the overhead costs of the toys for December. The following **actua**l information is available so far:

Month	**Hours**	**Total overhead costs (R)**
June	10 000	365 000
July	10 100	366 500
August	10 200	368 000
September	10 260	368 900
October	10 360	370 400
November	10 400	371 000
December	10 300	?

REQUIRED

Calculate the following:

a. the total **budgeted fixed** overheads to recover per production department
b. the **budgeted** fixed overhead recovery rate per production department
c. the **actual** fixed cost (total) and variable cost (per unit) for the six months using the high-low method
d. the **forecast** overheads for December, assuming your answer in c. is correct

QUESTION 4

Ekuvukeni (Pty) Ltd. manufactures lawn-trimming devices. The company uses a departmental overhead recovery rate based on two production departments, assembly (A) and finishing (F), and two service departments, maintenance (M) and stores (S). The management accountant estimates the budgeted factory and support overhead costs for the forthcoming financial year as follows:

	R
Canteen expenses	23 500
Depreciation on machinery	40 000
Rent for factory building	24 500

For allocating factory overheads on an equitable basis, the following budgeted information is available:

	Production departments		Service departments	
	A	**F**	**M**	**S**
Requisition direct materials (R)	25 200	14 800		
Estimated machine hours	800	400	–	–
Estimated direct labour hours	2 100	900	–	–
Number of employees employed	16	12	8	4
Machinery at cost (R)	240 000	80 000	60 000	20 000
Floor space (m^2)	1 100	500	100	300

Additional information

- The maintenance department's costs will be reapportioned based on machine value, whereas the stores department's costs will be reapportioned based on requisitions for direct materials.
- The maintenance department renders services to all departments, whereas the stores department provides services to the production departments.
- The two service departments are located in the factory building.

REQUIRED

a. Calculate the total factory overhead costs for the production departments (assembly and finishing) to be recovered in the forthcoming year. *(Where applicable round off to the nearest R1.)*

b. Calculate the budgeted overhead recovery rate for the assembly department based on direct labour hours. *(Round off to two decimal places.)*

Solution to Self-assessment Activity

QUESTION 1

a. Overhead rate

$$= \frac{\text{budgeted overhead cost}}{\text{budgeted machine hours}} = \frac{\text{R100 000}}{\text{31 250 hours}}$$
$$= \text{R3,20 per machine hour}$$

b. Applied overheads

= actual machine hours x overhead rate
= 33 000 x R3,20
= R105 600

c. Under or over application (recovery)

= Actual overheads less applied overheads
= R112 000 – R105 600
= R6 400 under applied

d. Cost per unit

$$= \frac{\text{applied overhead cost}}{\text{number of units produced}} = \frac{\text{R105 600}}{\text{5 000}}$$
= R21,12 per unit

NOTE

Only the applied overhead cost is debited to the WIP account. We therefore only use the costs accumulated in the WIP account to value the output or units produced. The under recovery of overheads is written off directly in the statement of comprehensive income and does not form part of the inventory value (ie it is a period cost).

QUESTION 2

a. Budgeted machine hours

Predetermined overhead rate $= \dfrac{\text{applied overheads}}{\text{actual machine hours}}$

$= \dfrac{\text{R714 000}}{\text{119 000 hours}}$

$=$ R6 per machine hour

Budgeted machine hours therefore $= \dfrac{\text{budgeted overheads}}{\text{predetermined overhead rate}}$

$= \dfrac{\text{R760 000}}{\text{R6}}$

$=$ 126 667 hours

b. Under or over application

Applied overheads – actual overheads

= R714 000 – R738 000

= R24 000 under applied

NOTE

In practice, the management accountant would enquire from the production manager why there was such a drop in the production level. Perhaps there were unexpected machine breakdowns or a new competitor entered the market, resulting in a drop in demand for this organisation's products?

QUESTION 3

a. Budgeted fixed overheads per department

COST ITEM	TOTAL	P1	P2	P3	S1	S2
Primary allocation:	$\boxed{219\ 500}$	87 800	43 900	43 900	21 950	21 950
Secondary allocation:						
S2 Calc (1)		10 621	7 081	3 540	708	(21950)
					22 658	Nil
S1 Calc (2)		11 329	7 553	3 776	(22 658)	
	219 500	109 750	58 534	51 216	–	–

Calculation (1): S2's costs are allocated based on ***all the other departments' hours***:

$$P1 \quad = \quad R21\ 950 \times \frac{1\ 5}{1\ 5 \quad 1\ 0 \quad 0\ 5 \quad 0\ 1}$$

$$= \quad R10\ 621$$

$$P2 \quad = \quad R21\ 950 \times \frac{1\ 0}{3\ 1}$$

$$= \quad R7\ 081$$

etcetera

Calculation (2): S1's costs are allocated based on ***only the three production departments' hours***:

$$P1 \quad = \quad R22\ 658 \times \frac{1\ 5}{1\ 5 \quad 1\ 0 \quad 0\ 5}$$

$$= \quad R11\ 329$$

$$P2 \quad = \quad R22\ 658 \times \frac{1\ 0}{3\ 0}$$

$$= \quad R7\ 553$$

etcetera

NOTE

Can you see that the final total budgeted fixed overheads of the three production departments add up to the total of the three production department's own fixed costs, plus that of the two service departments?

You should always check that these amounts agree. *Remember, however, that this total EXCLUDES services rendered to marketing, administration and other non-manufacturing related departments.*

b. Budgeted fixed overhead recovery rate per labour hour

$$= \quad \frac{\text{overheads to recover}}{\text{labour hours}}$$

P1	$\frac{109\ 750}{1\ 500}$	=	R73,17
P2	$\frac{58\ 534}{1\ 000}$	=	R58,53
P3	$\frac{51\ 216}{500}$	=	R102,43

c. Actual fixed and variable overheads

$$b \quad = \quad \frac{\text{difference between highest and lowest related costs}}{\text{difference between highest and lowest hours}}$$

$$= \quad \frac{371\ 000 \quad 365\ 000}{10\ 400 \quad 10\ 000} = \text{R15 per hour (variable)}$$

a = Y – bx
= 371 000 – 15 (10 400) = R215 000 (total fixed cost)

d. Forecast overhead costs

Y = a + bx
= 215 000 + 15 (10 300)
= R369 500

NOTE

Did you notice that, in this case, we asked you to forecast the costs for the next month using the latest information, based on the actual results so far, rather than the budgeted information?

QUESTION 4

a. Total manufacturing overhead cost

		Production dept		Service dept		
	Allocation basis	**A**	**F**	**M**	**S**	**Total**
		R	R	R	R	R
Primary allocation						
Canteen expenses	No. of employees	9 400	7 050	4 700	2 350	23 500
Depreciation on machinery	Machinery @ cost	24 000	8 000	6 000	2 000	40 000
Rent on factory building	Floor (m^2)	13 475	6 125	1 225	3 675	24 500
		46 875	21 175	11 925	8 025	88 000
Secondary allocation	Value of machine					
	Calculation 1	8 418	2 806	(11 925)	701	
				—	8 726	
	Direct materials					
	Calculation 2	5 497	3 229		(8 726)	
		60 790	27 210	–	–	88 000

Calculation 1

The service department that renders services to other departments is allocated first. Ignore its own machine's cost price and only allocate based on **other departments' costs:**

A = R11 925 x $\frac{240}{240 \quad 80 \quad 20}$

= R8 418

F = R11 925 x $\frac{80}{340}$

= R2 806

S = R11 925 x $\frac{20}{340}$

= R701

Calculation 2

$$A = R8\,726 \times \frac{25\,200}{25\,200 \quad 14\,800}$$

$$= R5\,497$$

$$F = R8\,726 \times \frac{14\,800}{40\,000}$$

$$= R3\,229$$

a. $\frac{\text{Budgeted overhead costs}}{\text{Budgeted labour hours}}$

$$= \frac{R60\,790}{2\,100 \text{ labour hours}}$$

$$= R28{,}95 \text{ per labour hour}$$

NOTE

Since there were no service and support overhead costs allocated to non-manufacturing departments, the total of the overhead cost accumulated in the production departments equal that of the total factory and support departments.

Comprehensive Self-assessment Activity

The following activity will combine the knowledge you have gained in the three individual study units. In this activity, you are required to value the inventory produced. This activity will include tracing direct material and labour costs and allocating manufacturing overheads to cost products.

QUESTION 1

Lotus Manufacturers manufactures a single product. The sales volumes differ from year to year.

The budgeted variable cost of this product is made up as follows:

Direct material	3 metre at R3,10 per metre
Direct labour	2 hours
Indirect labour recovery rate	R7,50 per hour
Variable manufacturing overhead recovery rate	R1,70 per hour
Variable selling cost	R6,30 per unit

Variable manufacturing overheads varies with labour hours worked. The total budgeted fixed manufacturing overhead cost amounts to R120 000 for the period. Fixed manufacturing overheads are recovered based on direct labour hours. The average long-run capacity utilisation of the plant is 1 500 units per annum.

REQUIRED

a. Calculate the budgeted product cost of one unit.

b. Calculate the total budgeted profit if Lotus manufactures and sells only 1 400 units at a price of R130 per unit.

Solution to Comprehensive Self-assessment Activity

QUESTION 1

a. Calculation of the budgeted product cost of one unit

	R
Direct material (3 m x R3,10)	9,30
Direct labour (2 hours x R7,50)	15,00
Variable manufacturing overheads (2 hours x R1,70)	3,40
Variable selling – *not production cost* → not part of product cost	–
Total variable costs per unit	27,70
Fixed costs ① (2 hours x R40)	80,00
	107,70

① Calculating the fixed overhead recovery rate:

$$= \frac{\text{total fixed overheads}}{\text{total direct labour hours average long run capacity}}$$

$$= \frac{\text{R120 000}}{\text{1 500 x 2 hours}}$$

= R40 per direct labour hour

b. Calculate the total budgeted profit if Lotus manufactures and sells 1 400 units

	R
Sales (1 400 x R130)	182 000
Less:	
Variable product cost of one unit (R27,70 x 1 400)	38 780
Variable selling and administrative overheads (1 400 x R6,30)	8 820
Fixed costs	120 000
Total net profit	14 400

OR

	R
Sales (1 400 x R130)	182 000
Less:	
Production cost (R107,70 x 1 400)	150 780
Less: Fixed production cost under recovered ②	8 000
Gross profit	23 220
Variable selling and administrative overheads (1 400 x R6,30)	8 820
Total net profit	14 400

② Total budgeted fixed production cost	120 000
Allocated to production (1 400 x 2 hours x R40)	(112 000)
Budgeted under recovery	8 000

NOTE

Did you notice that the allocation basis that was used (long-run average capacity utilisation) differs from the budgeted production capacity utilisation? See Study unit 6, section 5.2. In such a case there would be a under or over recovery of budgeted fixed production overheads.

Bibliography

Woodward, J. 1965. *Industrial organization: theory and practice*. Oxford: University Press.

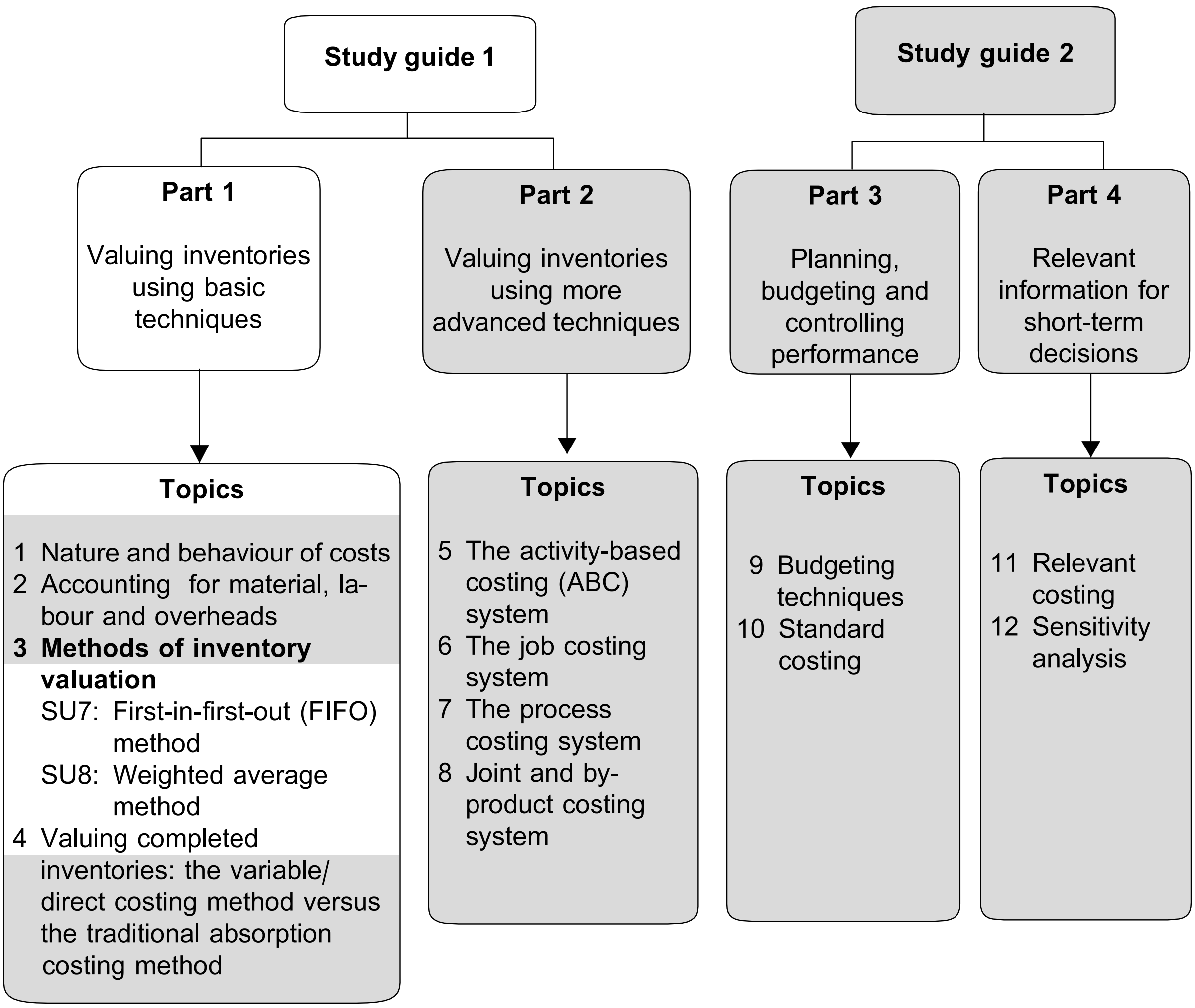
Methods of inventory valuation

LEARNING OUTCOMES

After studying this topic, you should be able to:

– value inventory on the first-in-first out (FIFO) basis
– value inventory on the weighted average basis

STUDY UNIT	TITLE
Study unit 7	First-in-first-out (fifo) method
Study unit 8	Weighted average method



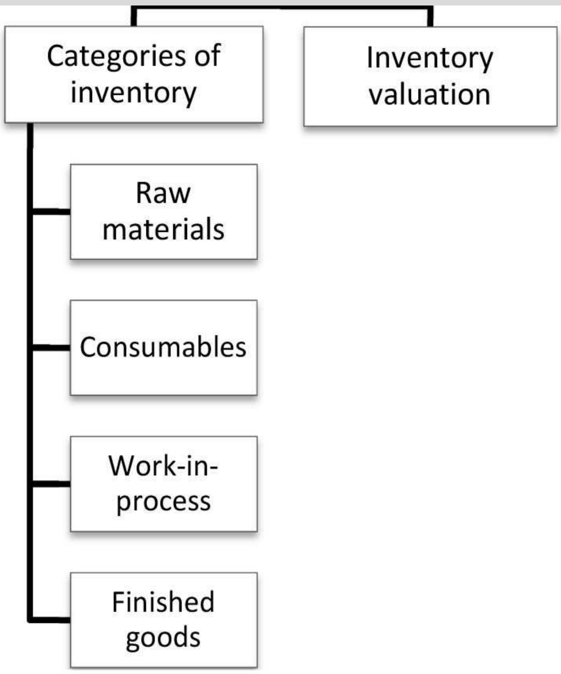
Introduction

In the previous topic, you learned how manufacturing and support costs (service costs) are allocated to the production process (via the WIP account) and how an individual unit is ultimately costed. In this topic, we will focus on the valuation of **purchased** inventory items in circumstances where the cost price fluctuates during the period. Methods of valuing manufactured inventory is covered in the topics on job costing, process costing, joint and byproduct costing and standard costing.

STUDY UNIT 7

First-in-first-out (FIFO) method

In this study unit



1 Introduction

In this study unit, we will discuss the different kinds of inventories and explain how to apply the FIFO method of inventory valuation.

> **INVENTORY VALUATION**
>
> Inventory valuation is the process of assigning costs to inventory.

The cost associated with each issue of materials poses a problem, simply because the same materials currently in store could have been purchased at different prices. To complicate matters further, it is often difficult to keep track of the actual individual physical materials issued to production, because units of the same inventory type look alike (eg all 30 mm screws look the same).

An *accounting assumption* therefore has to be made in order to calculate and record the cost of each inventory item issued from the stores.

Popular methods of calculating the cost of materials are:

- The FIFO method (covered in this study unit)
- The weighted average method (covered in the next study unit)

- Standard cost (covered later on in Topic 10)
- Specific identification (individual items are identified in a stock count and the historical cost price determined). This is not a very common accounting method and we will not be discussing it.

In this topic, we will only address the FIFO- and the weighted average method.

2 Categories of inventory

> **INVENTORY**
>
> Inventory can be defined as any tangible property bought, manufactured, processed, developed, or sold by an organisation in the ordinary course of business.

A manufacturing organisation will have the following four categories of inventory:

- Raw materials
- Consumables
- Work-in-process
- Finished goods

> **RAW MATERIALS**
>
> Raw materials are the inventory used in the manufacturing process. Raw materials are natural, unprocessed or partially processed materials that are converted into a more refined product.

These types of materials, which are used in the manufacturing process, will be classified as direct materials.

> **CONSUMABLES**
>
> Consumables refer to smaller items kept in the stores that are used by all departments (manufacturing, support and administrative). Consumables are items which, as the term suggests, are consumed. They can be destroyed, wasted or spent.

Examples are stationery, refreshments, light bulbs, oils, filters, small parts etcetera.

When issued to production and production support departments, these items are classified as indirect materials. If they are issued to non-manufacturing departments, they are classified as non-production overheads.

> **WORK-IN-PROCESS (WIP)**
>
> Work-in-process inventory refers to partially completed products or components that cannot be classified as finished products.

> **FINISHED (OR COMPLETED) GOODS, PRODUCTS, UNITS OR INVENTORY**
>
> Finished goods inventory refers to the finished products on the factory floor, in the finished goods store, in transit, at warehouse distribution points and in retail outlets. These goods are ready for sale.

NOTE

Although this study unit deals with raw materials and consumables inventory, the same methods also apply to finished goods inventory or ready-to-sell trading inventory.

3 The FIFO method

FIFO

According to the FIFO method, the accounting assumption is that materials received or purchased first are issued first. We assume that the units are issued in the order received: the oldest units first and then the units received from the next batch etcetera.

NOTE

① It is important to note that the *flow of materials does not dictate the flow of costs*. The flow of materials is the order in which the materials are actually issued for use in the factory, while the flow of costs is the order in which unit costs are assigned to the materials issued. The FIFO method can be used even if materials are physically issued in a different order.

② In the inventory ledger, returns to suppliers are treated as negative purchases (receipts), whereas returns from the factory are handled as negative issues. With regard to the returns from the factory, *it is assumed that the last issues would be returned first, thus keeping their purchase date for aging purposes*.

③ During times of inflation (price increases), the use of the FIFO method will result in issues to production being made at ‘‘cheaper’’ prices. Profits will therefore be higher until issues take place at the new or latest price. The inverse will happen in times of deflation (price decreases).

Activity 7.1

The warehouse clerk of Wasbank Ltd. presents you with the following information on material NKR:

Date		**Transaction details**
Feb		
1	Opening inventory	250 units @ R1,50 each
2	Purchased	750 units @ R1,80 each
5	Issued	300 units to production
11	Purchased	500 units @ R1,90 each;
	freight charges of R150 were paid for this order	
12	Returned	200 units bought on 2 February, to the supplier
13	Issued	500 units to production
21	Returned	150 excess units from factory to stores

REQUIRED

Calculate the value of inventory at 21 February using the FIFO method of inventory valuation.

Solution to Activity 7.1

FIFO method

Date	Receipts			Issues			Balance		
Feb	Quantity	Price R	Amount R	Quantity	Price R	Amount R	Quantity	Price R	Amount R
1							250	1,50	375
2	750	1,80	1 350				250 750	1,50 1,80	375 1 350
5				250 50	1,50 1,80	375 90	700	1,80	1 260
11	500	2,20	1 100				700 500	1,80 2,20	1 260 1 100
12	(200)	(1,80)	(360)				500 500	1,80 2,20	900 1 100
13				500	1,80	900	500	2,20	1 100
21				(150)	(1,80)	(270)	150 500	1,80 2,20	270 1 100
							650		1 370

Explanation

Date

2 Two batches are available: 250 units at R1,50, which came in first, and 750 units at R1,80, which came in last.

5 A quantity of 300 units is issued: 250 units at R1,50 are issued first, then the balance of 50 units from the 750 units at R1,80.

11 The freight charges of R150 must be added to the cost of the batch. [(500 x R1,90) + R150] = R1 100; R1 100 ÷ 500 = R2,20)

12 The 200 units are returned at the price at which they were purchased on 2 February. (Returns are treated as negative receipts and subtracted from the balance.)

13 The first batch of 500 units at R1,80 is issued. The batch of 500 units at R2,20 is still in inventory.

21 The units returned from the factory are from the last issue. (Returns from the factory are treated as negative issues and added to the balance.)

The value of the inventory on hand at 21 February is R1 370.

NOTE

Can you see that, for accounting and costing purposes, separate *batches* are kept for the different purchase prices? *Physically* the warehouse clerk would make no distinction in the units that are kept on the warehouse shelves or in the inventory bin. Note that, in practice, in the case of perishable materials or inventory, inventory might be identified according to expiry date and strictly issued based on FIFO principles.

4 Summary

In this study unit, we explained the difference between the physical flow of materials and the flow of costs based on the accounting assumption of the FIFO method.

In the next study unit, we will explore how to apply the weighted average method to value inventories on hand.

Self-assessment Activity

QUESTION 1

Gobiqolo Ltd. recorded the following purchases and issues for the material "Smile" for the month of November:

Date	**Transaction details**	
November		
01	Opening inventory	500 units @ R5,50
02	Purchased	2 500 units @ R5,80
06	Issued	1 000 units to production
10	Purchased	3 000 units @ R6,00
15	Issued	500 units to production
20	Production returned	200 units issued on 15 November to the store
26	Issued	2 700 units to production
30	Returned	250 units purchased on 10 November to the supplier

REQUIRED

a. Calculate the value of the following:
   i Closing inventory as at 30 November by using the FIFO method of inventory valuation
   ii Issues to production

b. Show the journal entry for recording the transaction on 20 November.

QUESTION 2

An extract from the records of Umthente Ltd. shows the following data about the raw material with inventory code DKH123:

Date	**Transaction**	**details**
1/10	Opening inventory	50 units @ R6,30
3/10	Purchases	1 000 units @ R5,25
5/10	Issues	1 000 units
6/10	Purchases	500 units @ R5,40
	Freight cost paid R50,00	
7/10	Returned	20 units to the store (issued on 5 October)
8/10	Issues	400 units
9/10	Returned to the supplier	10 units bought on 6 October

REQUIRED

a. Calculate the total cost of materials issued so far during the month using the FIFO method of inventory valuation.
b. Prepare a journal entry for the returns on 9 October.

QUESTION 1

a. FIFO method

Date	Receipts			Issues			Balance		
Nov	Quantity	Price R	Amount R	Quantity	Price R	Amount R	Quantity	Price R	Amount R
01							500	5,50	2 750
02	2 500	5,80	14 500				500 2 500	5,50 5,80	2 750 14 500
06				500 500	5,50 5,80	2 750 2 900	2 000	5,80	11 600
10	3 000	6,00	18 000				2 000 3 000	5,80 6,00	11 600 18 000
15				500	5,80	2 900	1 500 3 000	5,80 6,00	8 700 18 000
20				(200)	(5,80)	(1 160)	1 700 3 000	5,80 6,00	9 860 18 000
26				1 700 1 000	5,80 6,00	9 860 6 000	2 000	6,00	12 000
30	(250)	(6,00)	(1 500)				1 750	6,00	10 500
				Total		23 250			

The value of the closing inventory is R10 500 at 30 November, and the value of issues to production is R23 250.

b. Journal entry

Dt Materials inventory control account	R1 160	
Ct WIP		R1 160

QUESTION 2

a. FIFO method

Date	Receipts			Issues			Balance		
Oct	Quantity	Price R	Amount R	Quantity	Price R	Amount R	Quantity	Price R	Amount R
01							50	6,30	315,00
03	1 000	5,25	5 250				50 1 000	6,30 5,25	315,00 5 250,00
05				50 950	6,30 5,25	315,00 4 987,50	50	5,25	262,50
06	500	① 5,50	2 750,00				50 500	5,25 5,50	262,50 2 750,00
07				(20)	(5,25)	(105,00)	70 500	5,25 5,50	367,50 2 750,00
08				70 330	5,25 5,50	367,50 1 815,00	170	5,50	935,00
09	(10)	② (5,40) (0,10)	54,00 1,00				160	5,50	880,00
					Total	7 380,00			

The total cost of materials issued is R7 380.

① [(500 x R5,40) + R50] ÷ 500 = R5,50

② Refer to journal in b.

b. Journal entry

Dt Accounts payable/supplier	R 54	
Sundry expenses	1	
Ct Raw materials control account		R 55

Returning inventory for credit and writing off portion of original transport costs not recoverable from supplier.

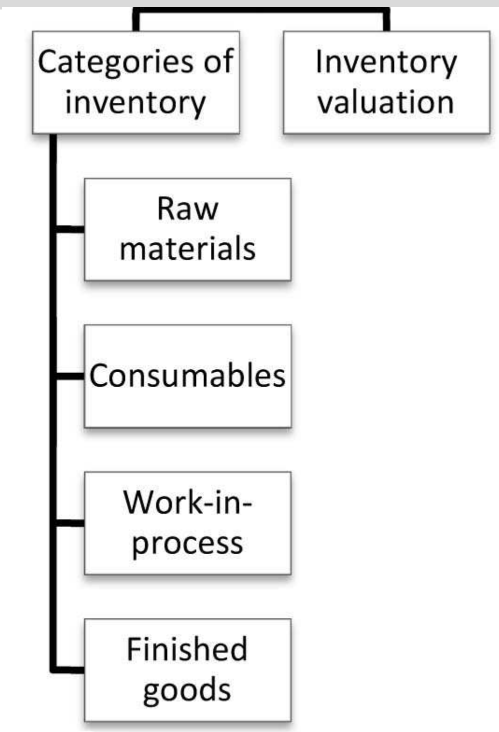
NOTE

The supplier would only refund or give credit to the value of the purchase price. The transport costs relating to the units returned therefore have to be written off.

STUDY UNIT 8

Weighted average method

In this study unit



1 Introduction

In the previous study unit, we explained the FIFO method of inventory valuation. In this study unit, we will explain how the weighted average method works.

2 Weighted average method

WEIGHTED AVERAGE METHOD

The weighted average method makes no assumptions about the flow of materials. The issuing of materials at a weighted average cost *assumes* that each batch taken from the storeroom is made up of the same quantities from each consignment in inventory at the date of issue. No attempt is made to identify when the units were purchased.

NOTE

① The weighted average method divides the total cost of all materials of a particular class by the number of units on hand for that class in order to find the average price. The result is therefore the average price.

② After an issue to production, there should not be any change in the cost price per unit in the balance column of the inventory ledger, because the units are issued at the average price. However, there could be a small difference due to rounding.

③ However, with every receipt or purchase returned to the supplier, as well as those returned from the factory, the new weighted average price should be determined.

Activity 8.1

Using the Wasbank Ltd. data from the FIFO illustration shown in Activity 7.1 and calculate the value of inventory at 21 February using the weighted average method of inventory valuation.

Solution to Activity 8.1

THE WEIGHTED AVERAGE METHOD

Date	Receipts			Issues			Balance		
	Quantity	Price	Amount	Quantity	@ average price	Amount	Quantity	Average price (calc)	Amount
Feb		R	R		R	R		R	R
1							250	1,50	375,00
2	750	1,80	1 350,00				250 750 1 000	1,725	375 1 350 1 725,00
5				300	1,725	517,50	700	1,725	1 207,50
11	500	2,20	1 100				700 500 1 200	1,923	1 207,50 1 100,00 2 307,50
12	(200)	(1,80)	(360)				1 200 (200) 1 000	1,948	2 307,50 (360,00) 1 947,50
13				500	1,948	974,00	500	1,947	973,50
21				(150)	(1,948)	(292,20)	**650**	**1,947**	**1 265,70**

Explanation

Date

2	The average price of the units in inventory after the receipt must be calculated: Add the units and the total cost Divide the total cost by the total units to obtain the average price per unit.	 (250 + 750 = 1000) (R375 + R1 350 = R1 725) (R1 725 ÷ 1000 = R1,725)
5	All the units are issued at the average price. To determine the balance, calculate the value of the units in inventory at the average price.	(700 x R1,725 = R1 207,50)
11	A new average price is calculated after each receipt.	(R2 307,50 ÷ 1 200 = R1,923)
12	Units are returned to the supplier at the actual cost price. A new average price is calculated.	(R1 947,50 ÷ 1 000 = R1,948)
13	All the units are issued at the average price. The rounding causes a small change in the average.	
21	Units are returned from the factory at the average price at which they were last issued.	

NOTE

The average price per unit is rounded off to three decimals. This may result in *very small* changes in the average price after issues or returns to or from production, because the average price is the result of total cost of inventory divided by the units on hand.

The value of the inventory on hand at 21 February is R1 265,70.

3 Summary

In this study unit, you learnt how to value inventory on hand and issues to production using the weighted average method.

Self-assessment Activity

QUESTION 1

Use the same information given in Question 1 of the previous self-assessment activity.

REQUIRED

If the weighted average method of inventory valuation was used, at what unit cost would the issue on 15 November be made? (Show all your calculations.)

QUESTION 2

Use the same information given in Question 2 of the previous self-assessment activity.

REQUIRED

What is the total value of the closing balance on 8 October when the weighted average method of inventory valuation is used?

Comprehensive Self-assessment Activity

QUESTION 3

The following transactions took place in a manufacturing company during the month of September for materials item number 555:

01/09	Opening inventory	1 000 units @ R7,00 per unit
05/09	Purchased	2 500 units @ R7,05 per unit
07/09	Issued to production	600 units
10/09	Purchased	1 400 units @ R7,15 per unit
11/09	Issued to production	500 units
13/09	Issued to production	2 400 units
17/09	Returned from production – from the issue of 7 September	100 units
21/09	Received an invoice	400 units for R3 200
	Freight charges	R80
22/09	Returned to supplier (invoice of 10/09)	200 units
25/09	Auditors made a surprise inventory count	?

REQUIRED

a. If the company uses the FIFO method of inventory valuation, what is the value of item 555 (which the auditors should have found on hand)?

b. If the weighted average method of inventory valuation was used, at what unit cost would the issue on 11 September have been made?

Note: Show your workings. Round off to three decimal places.

QUESTION 1

Weighted average method

Date	Receipts			Issues			Balance		
	Quantity	Price	Amount	Quantity	@ average price	Amount	Quantity	Average price calc	Amount
Nov		R	R		R	R		R	R
01							500	5,50	2 750
02	2 500	5,80	14 500				500 2 500 3 000	5,75	2 750 14 500 17 250
06				1 000	5,75	5 750	2 000	5,75	11 500
10	3 000	6,00	18 000				2 000 3 000 5 000	5,90	11 500 18 000 29 500
15				500	5,90	2 950	4 500	5,90	26 550

The 500 units will be issued at R5,90 per unit on 15 November.

QUESTION 2

Weighted average method

Date	Receipts			Issues			Balance		
	Quantity	Price	Amount	Quantity	@ average price	Amount	Quantity	Average price calc	Amount
Oct		R	R		R	R		R	R
01							50	6,30	315
03	1 000	5,25	5 250				50 1 000 1 050	5,30	315 5 250 5 565
05				1 000	5,30	5 300	50	5,30	265
06	500	5,50	2 750				50 500 550	5,482	265 2 750 3 015
07				(20)	(5,30)	(106)	550 20 570	5,475	3 015 106 3 121
08				400	5,475	2,190	170	5,476	931

The closing balance on 8 October is R931.

QUESTION 3

a. FIFO method

Date	Receipts			Issues			Balance		
Sep	Quantity	Price R	Amount R	Quantity	Price R	Amount R	Quantity	Price R	Amount R
01							1 000	7,00	7 000
05	2 500	7,05	17 625				1 000 2 500	7,00 7,05	7 000 17 625
07				600	7,00	4 200	400 2 500	7,00 7,05	2 800 17 625
10	1 400	7,15	10 010				400 2 500 1 400	7,00 7,05 7,15	2 800 17 625 10 010
11				400 100	7,00 7,05	2 800 705	2 400 1 400	7,05 7,15	16 920 10 010
13				2 400	7,05	16 920	1 400	7,15	10 010
17				(100)	(7,00)	(700)	100 1 400	7,00 7,15	700 10 010
21	400	8,20	3 280				100 1 400 400	7,00 7,15 8,20	700 10 010 3 280
22	(200)	(7,15)	(1 430)				100 ① 1 200 400	7,00 7,15 8,20	700 8 580 3 280
25							1 700		**12 560**

① 1 400 – 200 = 1 200 left from the 10 September consignment.

The value of the inventory on hand at 25 September is R12 560.

b. Weighted average method

Date	Receipts			Issues			Balance		
	Quantity	Price	Amount	Quantity	@ average price	Amount	Quantity	Average price calc	Amount
Sep		R	R		R	R		R	R
01							1 000	7,00	7 000,00
05	2 500	7,05	17 625				1 000 2 500 3 500	 7,036	7 000,00 17 625,00 24 625,00
07				600	7,036	4 221,60	2 900	7,036	20 403,40
10	1 400	7,15	10 010				2 900 1 400 4 300	 7,073	20 403,40 10 010,00 30 413,40
11				500	7,073	3 536,50	3 800	7,073	26 876,90

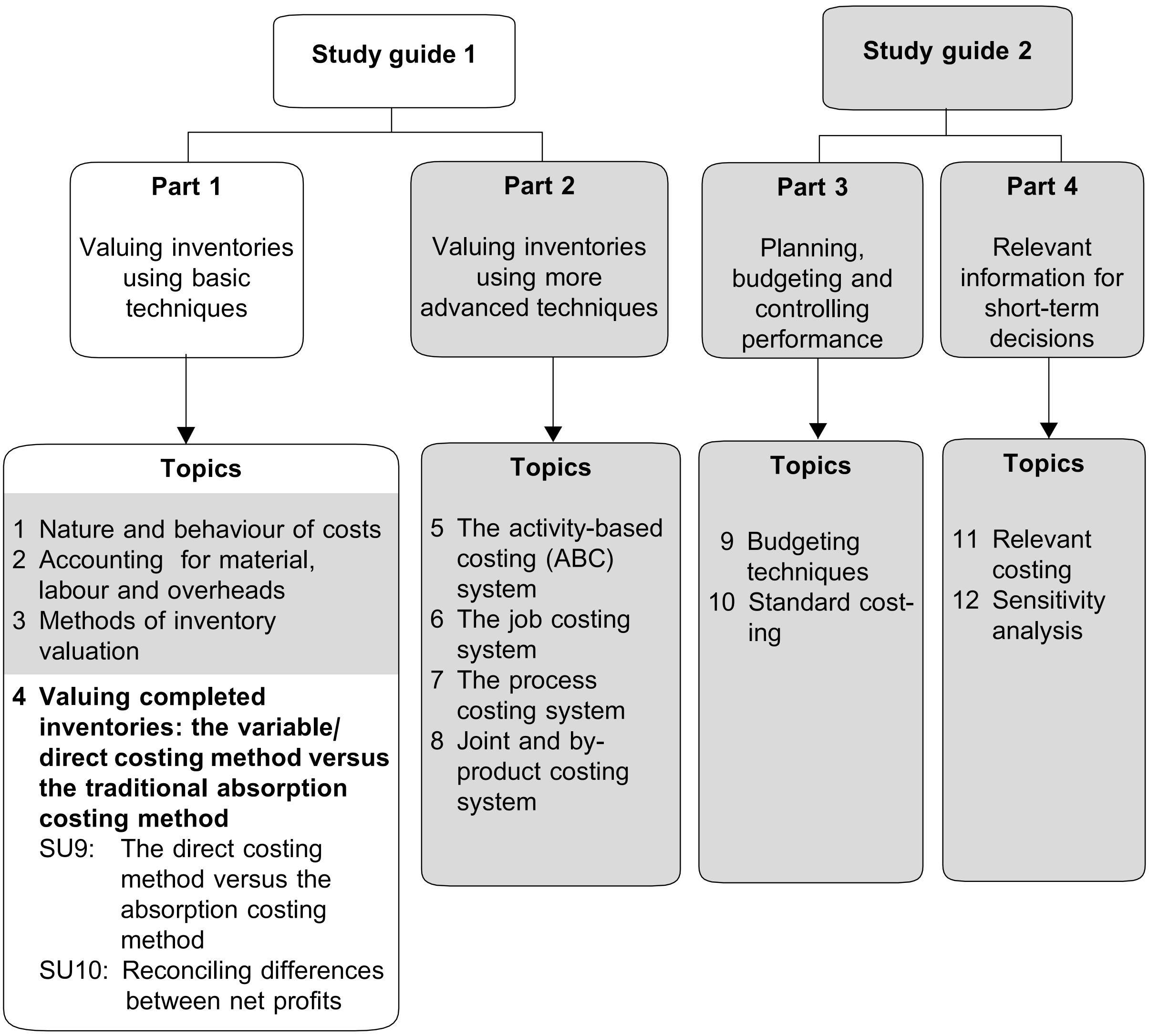
The issue on the 11 September would be made at R7,073 per unit.

Valuing completed inventories: the variable/direct costing method versus the traditional absorption costing method

LEARNING OUTCOMES

After studying this topic, you should be able to:

- identify the differences between the direct and absorption costing method
- draft the income statements according to both the direct and absorption costing method by using different inventory valuation methods
- reconcile the difference between the direct and absorption costing methods' net profits
- identify which method is most appropriate in different circumstances



STUDY UNIT	TITLE
Study unit 9	The direct costing method versus the absorption costing method
Study unit 10	Reconciling differences between net profits

Introduction

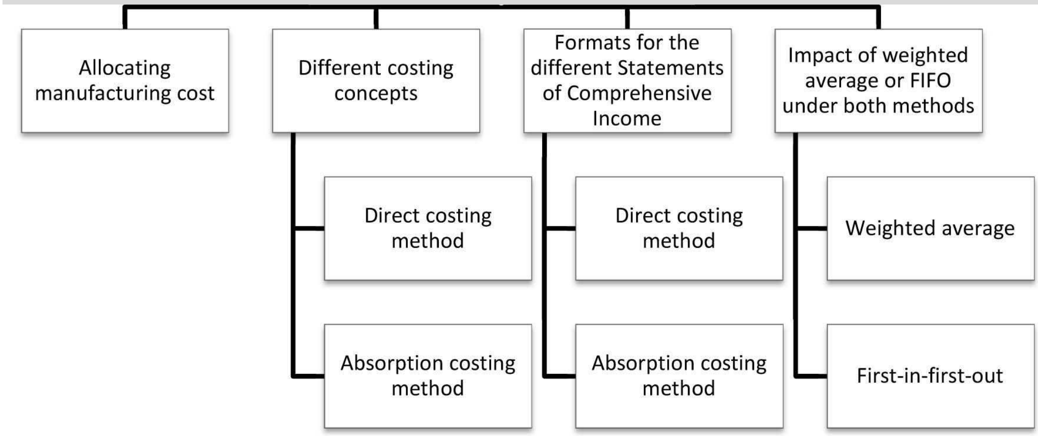
In this topic we are going to discuss two different methods of cost determination: the direct costing method and the traditional absorption costing method. The differences between the two methods in terms of presentation formats and cost determination will be explained. In this topic, we shall be extending the concepts of topic 3 on the FIFO method vs weighted average (WAM) method of inventory valuation to manufactured inventory.

We will then proceed to draft a statement of comprehensive income for both costing methods and reconcile any differences between the net profits. We will conclude this topic by discussing the uses, and the advantages and disadvantages of both costing methods.

STUDY UNIT 9

The direct costing method versus the absorption costing method

In this study unit



1 Introduction

In this study unit we are going to define both the absorption costing and direct costing method. For both methods, we will demonstrate how the Statement of Comprehensive Income is presented and we will also explain how to use each method to value closing inventory.

2 Allocating manufacturing cost

In order to calculate the manufacturing cost per unit, the most important objective of product costing is to allocate the total manufacturing cost incurred during a certain period to the total number of units manufactured during that period. In a traditional absorption costing method the manufacturing cost per unit is calculated simply by dividing the total manufacturing cost for a certain period by the number of units manufactured during the period in question.

For example:

Total manufacturing cost for 10 000 units	=	R50 000,00
$\therefore$ Cost per unit	=	R5,00

When the unit cost is known, it becomes easier to allocate the total manufacturing cost between units that are still in inventory and the units that have been sold. We need this information to be able to calculate the net profit of the enterprise for the period, which is one of the most important goals of cost accounting.

Two methods of cost determination have been developed, based on different schools of thought. These two methods are: the direct/variable costing method and the absorption/ full costing method. Each of the two costing methods has different applications. For Financial Accounting purposes or IFRS, the absorption costing method is prescribed, but for various decision-making purposes the direct costing method may provide more useful information.

3 Different costing concepts

DIRECT COSTING METHOD (OR VARIABLE / MARGINAL)

Only **variable manufacturing costs**, namely direct materials, direct labour and variable manufacturing overheads, are taken into account when inventory is valued **Variable selling and distribution** costs are added to arrive at the total variable cost. **All** variable costs are therefore accounted for to arrive at marginal income. Variable non-manufacturing costs, as well as **ALL** fixed costs, will be treated as period costs.

ABSORPTION COSTING METHOD

The **absorption costing** method includes **both variable** and **fixed manufacturing costs** in the product cost. It excludes all non-manufacturing costs, which are treated as period costs.

PRODUCT COST (DIRECT COSTING SYSTEM)

Product cost is the **variable** cost incurred in the **manufacturing** of a product.

PRODUCT COST (ABSORPTION COSTING SYSTEM)

Product cost is the **variable** plus the **fixed** costs incurred in the **manufacturing** of a product.

NOTE

In topic 1 we mentioned that there would be a variation in the basic definition of ‘‘product cost’’ when we come to topic 4. The product cost will depend on the costing system (direct or absorption) and, therefore, on the costs to be included in the valuation of inventory.

When the absorption costing method is used, budgeted fixed manufacturing costs are recovered on the basis of the budgeted number of units manufactured during the period or budgeted total production hours. You will remember (refer to study unit 6, in the section on overheads) that this is referred to as the ‘‘fixed production overhead allocation rate’’

The product therefore ‘‘absorbs’’ both variable and fixed manufacturing costs. The larger the number of units manufactured, the lower the absorption unit cost, because the same amount of total fixed manufacturing costs are recovered by a larger number of products.

The following diagram compares the cost flows of **manufacturing cost** for the direct and absorption costing methods:

DIRECT COSTING METHOD

Direct material Direct labour Variable manufacturing overheads	Included in cost of all goods produced	Only debited against income when goods are sold
Fixed manufacturing overheads		Debited immediately against income for the accounting period under review

ABSORPTION COSTING METHOD

Direct material Direct labour Variable manufacturing overheads **Fixed manufacturing overheads**	Included in cost of all goods produced	Only debited against income when goods are sold

CONTRIBUTION

Amount for which product is sold less all variable costs.

You will remember from study unit 3 (cost-volume-profit analysis) that, when contribution is determined, all fixed costs (manufacturing and non-manufacturing) are written off against income as period costs for the period in which they are incurred. However, variable selling and distribution costs are also **deducted** to arrive at contribution.

For example, let us say the selling price per unit is **R50**, the variable manufacturing cost per unit is **R27** and the variable selling cost per unit is **R8;** in this case, the contribution would be **R15.** However**,** the **R8** is **not** applied when inventory is valued.

NOTE

① We only allocate FIXED MANUFACTURING costs to products in the absorption costing method. Fixed selling, distribution and administrative costs are NEVER allocated to products. They are expensed in the same way as for the direct costing method.

For the direct costing method, variable selling and distribution costs are only DEDUCTED to arrive at the contribution figure. They are NEVER included in the valuation of inventory, because they are only incurred once the product is sold!

4 Presentation formats of the different statements of comprehensive income

When applying either costing method, you should note that each has very specific formats in which the statement of comprehensive income should be presented. You will forfeit marks for using the incorrect format.

a.
Direct costing method

Sales

Less: Variable cost of sales

Direct material
Direct labour
Variable manufacturing overheads
Variable selling and distribution cost ①

= contribution

Less: Fixed cost

Fixed manufacturing overheads ②
Fixed selling and distribution cost
Administrative cost

= net profit before tax

b.
Absorption costing method

Sales

Less: Manufacturing cost of sales

Direct material
Direct labour
Variable manufacturing overheads
Fixed manufacturing overheads ②

= gross profit

Less: Other cost

Fixed selling and distribution cost
Variable selling and distribution cost ①
Administrative cost

= net profit before tax

NOTE

VERY IMPORTANT: When there is neither opening nor closing inventory on hand, statements of comprehensive income drafted according to the direct and absorption costing methods will result in the same net profit. If there is inventory on hand, the difference in net profit shown in income statements drafted according to the two methods can be reconciled by taking into account the differences between opening and closing inventory values (according to the two methods). This will be explained further in study unit 10.

We will now illustrate the application of the different formats by means of an example.

Activity 9.1

Statement of comprehensive income

ABC Ltd. manufactures a single product. The particulars for February 20X1 are as follows:

Units manufactured and sold	18 750
Selling price per unit	R 100
Manufacturing cost:	
– Variable	R468 750
– Fixed	R187 500
Selling and administrative cost:	
– Variable selling cost (R5,00 per unit)	R 93 750
– Fixed selling cost	R 50 000
– Fixed administration cost	R 12 500

REQUIRED

a. Draft the statement of comprehensive income for the month ended 28 February 20X1 according to the:

   i. direct costing method
   ii. absorption costing method

b. Do the same as in a. above, but assume that only 15 000 of the 18 750 units were sold during February 20X1.

Solution to Activity 9.1

a. **Scenario 1: no opening or closing inventory**

   i. Direct costing method

ABC LTD

Contribution statement of comprehensive income for the month ended 28 February 20X1

		R
Sales (18 750 x 100)		1 875 000
Less: Variable cost		562 500
	Variable manufacturing cost	468 750
	Variable selling cost	93 750
Contribution		1 312 500
Less: Fixed cost		250 000
	Manufacturing	187 500
	Selling	50 000
	Administration	12 500
Net profit before tax		1 062 500

   ii. Absorption costing method

ABC LTD

Statement of comprehensive income for the month ended 28 February 20X1

		R
Sales (18 750 x 100)		1 875 000
Less: Manufacturing cost of sales		656 250
	Variable	468 750
	Fixed	187 500
Gross profit		1 218 750
Less: Selling and administrative cost		156 250
	Variable selling	93 750
	Fixed selling	50 000
	Administration	12 500
Net profit before tax		1 062 500

NOTE

① According to both costing methods, the net profit is R1 062 500.This is because there was neither opening, nor closing inventory on hand.

② It is very important that you apply the different formats correctly.

b. **Scenario 2: closing inventory**

i. Direct costing method

ABC LTD

Contribution statement of comprehensive income for the month ended 28 February 20X1

		R
Sales (15 000 x R100)		1 500 000
Less: Variable cost of sales		450 000
Opening inventory	–	
Variable manufacturing cost	468 750	
Less: Closing inventory (3 750 ② x R25 ①)	93 750	
Variable manufacturing cost	375 000	
Variable selling cost (15 000 x R5)	75 000	
Contribution		1 050 000
Less: Fixed costs		250 000
Manufacturing	187 500	
Selling	50 000	
Administration	12 500	
Net profit before tax		800 000

① $\frac{\text{Total variable manufacturing cost}}{\text{Total units manufactured}}$

$= \frac{R468\ 750}{18\ 750}$

= R25 variable manufacturing cost per unit

② Opening inventory + production sales = closing inventory (in units)
0 + 18 750 – 15 000 = 3 750

ii. **Absorption costing method**

ABC LTD

Statement of comprehensive income for the month ended 28 February 20X1

		R
Sales (15 000 x R100)		1 500 000
Less: Manufacturing cost of sales		525 000
Opening inventory	–	
Manufacturing cost – variable	468 750	
– fixed	187 500	
	656 250	
Less: Closing inventory (3 750(from (i)) x R35 ③)	131 250	
Gross profit		975 000
Less: Selling and administrative cost		137 500
– Variable selling (15 000 x R5)	75 000	
– Fixed selling	50 000	
– Administration	12 500	
Net profit before tax		837 500

③ $\frac{\text{Total manufacturing cost}}{\text{Total units manufactured}}$

$= \frac{R656\ 250}{18\ 750}$

= R35 manufacturing cost per unit

NOTE

Note that the net profits as calculated by the two costing methods differ. This is because there was inventory on hand and, in the case of the absorption costing method, fixed manufacturing costs are included in the value of the closing inventory and deferred to the balance sheet until sold.

When the quantity (units) of inventory on hand increases, the direct costing method will show a lower net profit than the absorption costing method. This is because the absorption costing method will incorporate a portion of the fixed manufacturing cost (since it is a debit on the balance sheet) for the period in the cost of inventory on hand. The cost of closing inventory is **held back** for future periods; in other words, it includes a portion of fixed manufacturing cost.

5 Impact of the weighted average method and the FIFO method on both costing methods

Now that you understand the difference in formats, we will use the next two examples to illustrate what happens to profit if we change the inventory valuation method. In topic 3 we worked with purchased inventory, or raw materials. In this study unit, we will now apply the same concepts to manufactured inventory. We will now treat the manufacturing cost per unit the same as the **purchase price**. You will remember from topic 3 that, if we use FIFO, the **oldest** inventory is issued first from the store at the price at which it was acquired. In this study unit, this means that the oldest manufactured inventory is sold first. If we use the weighted average method, a new average price is calculated every time that new inventory is acquired. In this study unit, issues or sales are then at the new average price per manufactured unit.

Activity 9.2

Different inventory valuation method: the weighted average method

The following information was obtained from the accounting records of XYZ Ltd. for the year ended 31 December 20X0 and from the budget for 20X1:

	Actual 20X0 Units	**Budgeted 20X1 Units**
Inventory at the beginning of the year	Nil	7 000
Production for the year	168 000	154 000
Sales for the year	161 000	140 000
Fixed cost:	**R**	**R**
Manufacturing	252 000	336 000
Sales and administration	252 000	252 000
Variable cost per unit:		
Manufacturing	8,40	11,20
Selling cost	2,80	2,80
Selling price per unit	28,00	35,00

The enterprise uses the **weighted average method** of inventory valuation. Refer to topic 3 if you need to revise this method and how it is applied.

REQUIRED

Draft the budgeted statements of comprehensive income for the year ending 31 December 20X1 according to:

a. the direct costing method; and
b. the absorption costing method in order that the differences between the two approaches are clearly illustrated.

Show the calculations to the nearest rand.

You may assume that:

i. the 20X1 budgeted opening inventory was correctly valued at the 20X0 actual closing values; and
ii. in 20X0, the actual number of units produced and actual fixed manufacturing cost were equal to budget, resulting in the budgeted fixed overhead allocation rate being the same as that based on the actual figures provided above.

Solution to Activity 9.2

a. Weighted average method: direct costing

XYZ LTD

Budgeted contribution statement of comprehensive income for the year ended 31 December 20X1

		R
Sales (140 000 x R35)		4 900 000
Less: Variable cost of sales		1 942 957
Opening inventory (7 000 x R8,40)	58 800	
Variable manufacturing cost (154 000 x R11,20)	1 724 800	
Cost of goods available for sale	1 783 600	
Less: Closing inventory	232 643 ①	
Variable manufacturing cost of sales	1 550 957	
Variable selling cost (140 000 x R2,80)	392 000	
Contribution		2 957 043
Less: Fixed cost		588 000
Manufacturing	336 000	
Selling and administrative	252 000	
Net profit before tax		2 369 043

	Units
① Opening inventory (168 000 – 161 000) = given	7 000
Budgeted production for the year	154 000
Units available for sale	161 000
Less: Budgeted sales for the year	140 000
Budgeted closing inventory	21 000

Calculation of the value of 21 000 units in the closing inventory:

$$\frac{\text{Units of closing inventory}}{\text{Units available for sale}} \times \frac{\text{variable cost of goods available for sale}}{1}$$

$$= \frac{21\ 000}{161\ 000} \times \frac{R1\ 783\ 600}{1}$$

$$= R232\ 643$$

NOTE

① Can you see that the variable manufacturing cost of the opening inventory is INCLUDED in the figure used to calculate the weighted average cost per unit?

② Do you think it is prudent to budget for such an increase in inventory on hand

b. Weighted average method: absorption costing method

XYZ LTD

Budgeted statement of comprehensive income for the year ended 31 December 20X1

		R
Sales (140 000 x R35)		4 900 000
Less: Manufacturing cost of sales		1 852 261
Opening inventory	69 300①	
Manufacturing cost:		
Variable (154 000 x R11,20)	1 724 800	
Fixed	336 000	
Cost of goods available for sale	2 130 100	
Less: Closing inventory	277 839②	
Gross profit		3 047 739
Less: Selling and administrative cost		644 000
Variable (140 000 x R2,80)	392 000	
Fixed	252 000	
Net profit before tax		2 403 739

① Calculation of the value of opening inventory:

Manufacturing cost for 20X0:	R
Variable (168 000 x R8,40)	1 411 200
Fixed	252 000
Cost of manufacturing 168 000 units	1 663 200

Calculation of the value of the 7 000 units in opening inventory:

$$\frac{\text{Units of closing inventory}}{\text{Units manufactured}} \quad \text{x} \quad \frac{\text{manufacturing cost}}{1}$$

$$= \frac{7\ 000}{168\ 000} \quad \text{x} \quad \text{R1 663 200}$$

= R69 300 value of opening inventory (20X0)

or

	R
Variable cost per unit	8,40
Fixed cost per unit R252 000/ 168 000	1,50
	9,90
Number of units (7 000 x R9,90)	R69 300

② Calculation of the value of closing inventory:

Calculation of the value of the 21 000 units in the closing inventory:

$$\frac{\text{Units of closing inventory}}{\text{Units available for sale}} \quad \text{x} \quad \frac{\text{value of goods available for sale}}{1}$$

$$= \frac{21\ 000}{161\ 000\ (7\ 000 + 154\ 000)} \quad \text{x} \quad \frac{\text{R2 130 100}}{1}$$

= R277 839 value of closing inventory

NOTE

① The closing inventory for the previous period is the opening inventory for the current period.

② The number of units in inventory remains the same regardless of costing method or inventory valuation method.

Activity 9.3

Different inventory valuation methods: FIFO method

We use the same information and "REQUIRED" as in Activity 9.2, but now the company uses the **FIFO method** of inventory valuation.

Solution to Activity 9.3

a. FIFO: direct costing

XYZ LTD

Budgeted contribution statement of comprehensive income for the year ended 31 December 20X1

		R
Sales (140 000 x R35)		4 900 000
Less: Variable cost of sales		1 942 957
	Opening inventory (7 000 x R8,40)	58 800
	Variable manufacturing cost (154 000 x R11,20)	1 724 800
	Cost of goods available for sale	1 783 600
	Less: Closing inventory	235 200 ①
	Variable manufacturing cost of sales	1 548 400
	Variable selling cost (140 000 x R2,80)	392 000
Contribution		2 959 600
Less: Fixed cost		588 000
	Manufacturing	336 000
	Selling and administrative	252 000
Net profit before tax		2 371 600

① R11,20 x 21 000
= R235 200

b. FIFO: absorption costing method

XYZ LTD

Budgeted statement of comprehensive income for the year ended 31 December 20X1

		R
Sales (140 000 x R35)		4 900 000
Less: Manufacturing cost of sales		1 852 261
	Opening inventory from (a)	69 300
	Manufacturing cost:	
	Variable (154 000 x R11,20)	1 724 800
	Fixed	336 000
	Cost of goods available for sale	2 130 100
	Less: Closing inventory	281 018①
Gross profit		3 050 918
Less: Selling and administrative cost		644 000
	Variable (140 000 x R2,80)	392 000
	Fixed	252 000
Net profit before tax		2 406 918

① Calculation of the value of closing inventory:

$$= \frac{21\ 000}{154\ 000} \times \frac{\text{R2 060 800 (R1 724 800 + R336 000)}}{1}$$

= R 281 018

NOTE

Did you see that the closing inventory units were only valued based on the 20X1 production costs? The cost of the opening inventory was carried to cost of sales first.

6 Summary

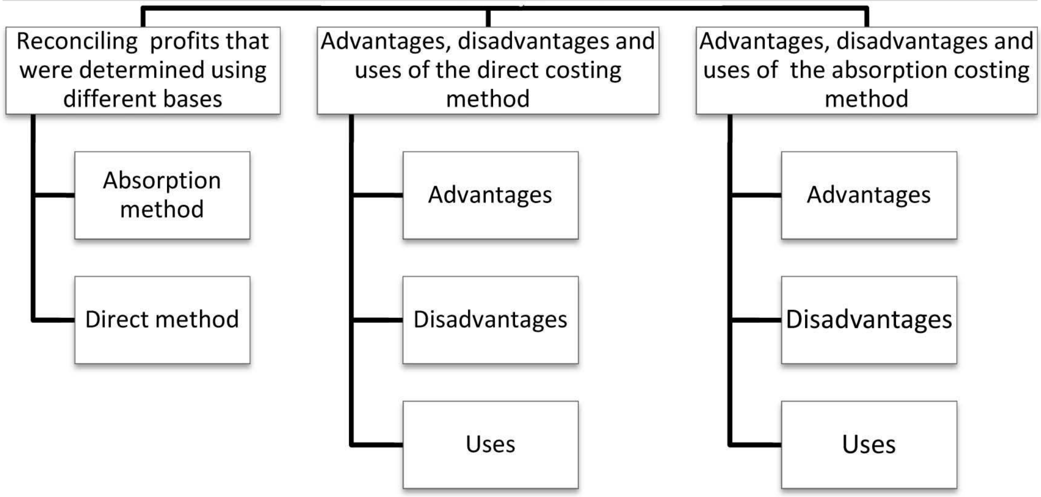
In this study unit, you learnt about the absorption and direct costing methods. You also learnt how to draft a statement of comprehensive income for both costing methods based on different inventory valuation approaches. In the next study unit we are going to reconcile the difference between net profits.

Refer to the end of study unit 10, where you will find additional self-assessment activities on these costing methods and how they work.

STUDY UNIT 10

Reconciling differences between net profits

In this study unit



1 Introduction

As illustrated in study unit 9, there is a difference between the net profits of the different costing methods (direct and absorption). Not only does the format of the two methods differ, but the valuation of inventory is also calculated differently. In the case of the absorption costing method, fixed costs are brought into calculation whereas, in the case of the direct costing method, only variable costs are taken into calculation (ie when the inventory is valued). Furthermore, whether the organisation uses the FIFO or weighted average method for valuing production inventories also has an influence on the profit.

Students are required to be able to reconcile the difference in profits. As explained above, the difference is in the inventory values. In this study unit we are going to reconcile the difference in inventory values seen in the activities set in study unit 9. Once you realise the difficulties associated with these different costing methods, you will be in a better position to appreciate the advantages and disadvantages of each method.

2 Reconciling profits using that were determined using different bases

The difference in the profits between the direct and absorption method is attributable to the amount of fixed production costs deferred to the statement of financial position as part of the closing inventory value. The activities that follow will demonstrate how we do this.

NOTE

No reconciliation of Activity 9.1 (a) is required. There were neither opening, nor closing inventory on hand and therefore net profits did not differ (all manufacturing costs were counted as cost of sales for the period).

Activity 10.1 (see Activity 9.1 (b))

	R
Net profit according to:	
Direct costing method	800 000
Absorption costing method	837 500
Difference to be reconciled	37 500
Opening inventory according to:	
Direct costing method	0
Absorption costing method	0
Difference	0
Closing inventory according to:	
Direct costing method	93 750
Absorption costing method	131 250
Difference	37 500
Reconciliation in rand value	
Opening inventory difference	0
Closing inventory difference	37 500
Difference in profits	37 500
Reconciliation in units	
Fixed cost in opening inventory (0 units)	0
Fixed cost in closing inventory (R187 500/18 750) x 3 750 units)	37 500
Difference	37 500

NOTE

Can you see that inventory levels increased (closing units vs opening units) during the period, resulting in a higher net profit reflected for the absorption costing method?

Activity 10.2 (see Activity 9.2)

	R
Net profit according to:	
Direct costing method	2 369 043
Absorption costing method	2 403 739
Difference to be reconciled	34 696
Opening inventory according to:	
Direct costing method	58 800
Absorption costing method	69 300
Difference	10 500
Closing inventory according to:	
Direct costing method	232 643
Absorption costing method	277 839
Difference	45 196
Reconciliation in rand value:	
Opening inventory difference	10 500
Closing difference	45 196
Difference in profits	34 696

	R
Reconciliation in units:	
Fixed cost in opening inventory (7 000 x R1,50)	10 500
Fixed cost in closing inventory	
(R10 500 + R336 000) / (7 000 + 154 000) = R2,1522 per unit	
21 000 units x R2,1522 per unit =	45 196
Difference	34 696

NOTE

Can you see that inventory levels increased (closing units vs opening units), resulting in a higher net profit for the absorption costing method?

Activity 10.3 (see Activity 9.3)

	R
Net profit according to:	
Direct costing method	2 371 600
Absorption costing method	2 406 918
Difference to be reconciled	35 318
Opening inventory according to:	
Direct costing method	58 800
Absorption costing method	69 300
Difference	10 500
Closing inventory according to:	
Direct costing method	235 200
Absorption costing method	281 018
Difference	45 818
Reconciliation in rand value:	
Opening inventory difference	10 500
Closing inventory difference	45 818
Difference in profits	35 318
Reconciliation in units:	
Fixed cost in opening inventory (7 000 units x R1,50)	10 500
Fixed cost in closing inventory	
R336 000/R154 000 = R2,1818 ①	
21 000 units x R2,1818 =	45 818
Difference	35 318

NOTE

① The unit increase in inventory was the same as in Activity 10.2, but with an even further increase in net profit. Using the FIFO method, the closing inventory PER UNIT was valued at R2,1818; using the weighted average method, EACH UNIT was valued at R2,1522. The net profit was therefore even higher.

② Under inflationary conditions (rising prices), FIFO method will result in a higher unit cost than the weighted average method.

③ As you can see from the activities above, the net profit reconciliation is a simple calculation. Note that net profit reconciliation is a fairly regular examination question and usually means that you can get approximately three easy marks.

3 Advantages, disadvantages and uses of the direct costing method

The direct costing method has certain advantages and disadvantages. In the following section we will look at its advantages first and then at its disadvantages. We will also look into its uses, which are based on its advantages.

3.1 Advantages

- Operating results can be presented in a readily understandable form.
- Operating results calculated according to the direct costing method are of particular importance to management especially in terms of:

– the effect of changes of output volume and product mix on the organisation's profitability;
– the calculation and adjustment of special order selling prices; and
– he significance of fixed cost as a percentage of total cost.

- The direct costing method helps to overcome the problem of allocating fixed costs and limits or eliminates the dangers attached to the over or under allocation of fixed overheads to certain products.

3.2 Disadvantages

- The revenue authorities and IFRS do not recognise the valuation of work in process and finished goods according to the direct costing method.
- The danger of over costing or under costing products in terms of overheads is undoubtedly reduced, but there is nevertheless the risk that people might try to compare the relative profitability of groups of products that are not really comparable. Suppose, for example, product A is manufactured mainly by means of manual labour and product B requires the use of expensive machinery; this means that product A will require far fewer fixed overheads than product B. If the profitability of these two groups of products were to be compared on the basis of their contributions, serious errors could result.

3.3 Uses

In practice, the direct costing method is used mainly for the following purposes:

- In general, the direct costing method should not be regarded as an independent costing method, but **merely as a method of presenting additional cost data**. It can be successfully used in conjunction with absorption and standard costing methods. If a variety of products are manufactured and/or semi-variable costs make up an important part of total cost, extreme caution is needed if the direct costing method is to be used to determine selling prices. In such cases, direct costing should be used as a guideline and not as the basis for pricing.
- Presenting cost data to management in an understandable manner.This enables management to make better decisions on issues such as the expansion or reduction of output, the utilisation of idle capacity, etcetera.
- Setting selling prices under current or expected market conditions for organisations classified as price setters. After factors such as the sales policy, the marginal cost of each product group and the prices of alternative products have been taken into account, the person responsible for setting the prices is able to decide what contribution each product group should be making to the total contribution. The selling prices of the various product groups are then calculated. You will learn more about this in third year. This subject is closely linked with strategic decision-making.
- Determining prices for special or one-off orders. You will learn more about this in part 4 – Relevant costing.

4 Advantages, disadvantages and uses of the absorption costing method

The absorption costing method has advantages and disadvantages. In the following section we will firstly look at its advantages and then at its disadvantages. We will also look into its uses (which are based on its advantages).

4.1 Advantages

- The valuation of work in process and finished goods by means of the absorption costing method is accepted by the accounting profession and revenue authorities.
- Recognises the importance of fixed cost in price determination and decision-making.
- It prevents the reporting of fictitious losses. In an organisation which relies on seasonal sales and builds up production out of season to meet the demand, the direct costing method would lead to all fixed manufacturing overheads being debited against profits.Because there are little or no sales at certain times of the year, losses would be reported out of season and large profits in season. In contrast, if the absorption costing method were applied, the same organisation would defer fixed manufacturing overheads to the balance sheet by including them in the closing inventory valuation. These overheads will only be recorded as an expense during the period in which the goods are sold. Under these circumstances, the absorption costing method offers a more logical method of calculating profits.

4.2 Disadvantages

- Fixed cost is not considered a relevant cost for short-term decision-making purposes because it is already committed; therefore the absorption costing method is seldom used in short-term decision-making.
- There is a danger attached to the over costing or under costing of fixed overheads if an incorrect or unrelated cost driver allocation base is used (refer to topic 5 on activity based costing).

4.3 Uses

In practice, the absorption costing method is used mainly for the following purposes:

- As discussed before, the absorption costing method is the mandated method for financial accounting purposes under IFRS.
- For organisations with substantial fixed costs, the absorption costing method is the preferred accounting method.

Activity 10.4

STR Ltd. is a manufacturing enterprise listed on the JSE. The board of directors has to decide what costing method the company will use for their annual financial statements. Please advise STR Ltd. on an appropriate costing method.

Solution to Activity 10.4

The absorption costing method should be used. Note that the absorption costing method is the only acceptable costing method for IFRS.

Activity 10.5

MNO Ltd. is a manufacturing enterprise. "In-house" financial statements are compiled every three months to evaluate performance and plan for future endeavours. MNO's management accountant wants your advice on which costing method should be used.

Solution to Activity 10.5

The direct costing method, because only variable costs are taken into consideration as far as product cost is concerned. For decision-making purposes, only variable costs are (usually) taken into account, which is why the direct costing method is to be recommended in this case. You will learn more about relevant costs for decision-making in topic 11.

5 Summary

In this study unit, you learnt how to reconcile the profits between the two methods. This can be summarised as follows:

Inventory levels stay the same	Direct costing net profit =	Absorption costing net profit
Inventory levels increase	Direct costing net profit <	Absorption costing net profit ①
Inventory levels decrease	Direct costing net profit >	Absorption costing net profit ②

NOTE

The abovementioned table is based on the assumption that prices are increasing (inflationary environment).

The differences arise because of the fixed production costs component included in inventory valuations that are based on absorption costing principles.

① Fixed cost deferred **to** balance sheet, because more fixed cost is carried in inventory.

② Fixed cost deferred **from** balance sheet, because the fixed cost carried in inventory is taken to the income statement.

You also learnt about the advantages and disadvantages of using both methods and the best method to use in different circumstances.

REFLECT

After studying the theory above, can you answer the following questions?

- List the advantages of the direct costing method.
- List the disadvantages of the absorption costing method.
- Describe the uses for the direct and absorption costing methods.

QUESTION 1

FRAMES LTD

The following information was extracted from the accounting records of FRAMES Ltd. for the year ended 31 August 20X0 and their 20X1 budget:

	20X0 Actual	**20X1 Budget**
Total manufacturing cost per unit	R15,15	???
Completed units beginning of the year	4 000	8 000
Manufactured for the year	35 000	???
Sales for the year (units)	???	42 000
Fixed costs		
Production	???	R325 000
Selling and administration	???	R158 000
Variable cost per unit		
Production	R10,20	R11,00
Selling and distribution	R 1,25	R 1,40

The company applies the FIFO method as its inventory valuation method.

FRAMES LTD

Budgeted statement of comprehensive income for the year ended 31 August 20X1

		R
Sales		1 050 000
Less: Cost of sales		802 144
Opening inventory	121 200	
Production costs	721 000	
Less: Closing inventory	(40 056)	
Gross profit		247 856
Less: Selling and administrative costs		(216 800)
Net profit before tax		31 056

REQUIRED

a. What is the method of cost determination used in the statement of comprehensive income above (ie the direct or absorption costing method)?
b. Calculate the budgeted number of units to be manufactured during the financial year 20X1.
c. Calculate the budgeted number of units on hand at 31 August 20X1.
d. Draft the budgeted statement of comprehensive income for the year ended 31 August 20X1 using the direct costing method.

e. Reconcile the difference in net profit before tax between the income statement given, and the income statement in d.

You may assume that:

i. The 20X1 budgeted opening inventory was correctly valued at the 20X0 actual closing values.
ii. In 20X0, the actual number of units produced and actual fixed manufacturing cost were equal to budget, resulting in the budgeted fixed overhead allocation rate being the same as that based on the actual figures provided above.

QUESTION 2

MALUMI (PTY) LTD

The following information is available for Malumi (Pty) Ltd, the manufacturer of a popular fashion accessory, for the months March, April and May 20X1:

March 20X1

Opening inventory (units)	Nil
Production (units)	81 000
Sales (units)	?

April 20X1	
Opening inventory (units)	9 000
Opening inventory value based on direct costing principles (FIFO)	R166 500
Opening inventory value based on absorption costing principles (FIFO)	R209 000

Additional information

- Fixed manufacturing costs remained the same as in March 2011.
- Variable manufacturing costs per unit remained the same as in March 2011.
- Production units increased by 10% and sales units by 5% from March 2011 figures.

May 20X1

Production costs	R2 171 500
– variable (increased by R3 per unit from April 20X1 figures)	
– fixed	R 405 515
Sales (units)	118 500
Selling price per unit (May only)	R30

Additional information: March May 20X1

Variable sales commission per unit	R 1,50

When applying the absorption costing method, you may assume (for this activity only) that the company bases the fixed cost allocation (recovery) rate in each period on the actual fixed costs and the actual production of the period. (A *budgeted* annual recovery rate is not used.)

REQUIRED

a. Calculate the closing inventory (in units) at 31 May 20X1.

b. Draft the statement of comprehensive income for the month ended 31 May 20X1 according to the direct costing method, using the weighted average method.

c. Draft the statement of comprehensive income for the month ended 31 May 20X1 according to the direct costing method, using the FIFO method.

d. Draft the statement of comprehensive income for the month ended 31 May 20X1 according to the absorption costing method, using the weighted average method.

e. Draft the statement of comprehensive income for the month ended 31 May 20X1 according to the absorption costing method, using the FIFO method.

Solution to Self-assessment Activity

QUESTION 1

a. The absorption costing method.(We calculated **gross profit**.)

b. Because we used FIFO, all the closing inventory will be valued at 20X1 production cost only. Therefore:

Production cost = (units) (variable cost per unit) + fixed costs

Let units be (x)

721 000 = (x)(11) + (325 000)

396 000 = 11x

x = 36 000 units

c. Flow of goods format

	FIFO	**Sold**	**Closing**
Opening inventory	8 000	(8 000)	
Units manufactured	36 000	(34 000)	2 000
Sold	(42 000)	42 000	
Closing inventory (from this year's production)	2 000	–	2 000

OR:

Total sold	42 000
Available for sale (8 000 + 36 000)	44 000
Closing inventory remaining	2 000

d. **Direct costing method: FIFO**

FRAMES LTD

Budgeted contribution statement of comprehensive income for the year ended 31 December 20X1

		R
Sales (42 000 x R25)		1 050 000
Less: Variable cost		514 400
Opening inventory (8 000 x R10,20)	81 600	
Variable manufacturing cost (36 000 x R11)	396 000	
Goods available for sale	477 600	
Less: Closing inventory (2 000 x R11)	22 000	
	455 600	
Variable selling cost (42 000 x R1,40)	58 800	
Contribution		535 600
Less: Fixed cost		483 000
Manufacturing	325 000	
Administrative	158 000	
Net profit before tax		52 600

NOTE

FIFO is applied, which means that we only use current period costs to value inventory.

e. **Reconciliation of net profits**

	R
Net profit according to:	
Direct costing method	52 600
Absorption costing method	31 056
Difference to be reconciled	21 544
Opening inventory according to:	
Direct costing method	81 600
Absorption costing method	121 200
Difference	39 600
Closing inventory according to:	
Direct costing method	22 000
Absorption costing method	40 056
Difference	18 056

	R
Reconciliation in rand value:	
Opening inventory difference	39 600
Closing inventory difference	18 056
Difference in profits	21 544
Reconciliation in units:	
Fixed costs in opening inventory (R15,15 – R10,20) x 8 000	39 600
Closing inventory (R325 000/36 000) x 2 000	18 056
Difference	21 544

NOTE

① Did you notice that, when the closing inventory declined compared with the opening inventory, the absorption costing method net profit declined compared with the direct costing method net profit, because fixed costs are expensed from the statement of financial position and entered on the statement of comprehensive income?

② From the above, it is clear that calculating the number of units can be very important. Note that you will not always be given this figure. Remember that, if you get stuck, to continue working, because marks are often awarded for applying principles correctly. In this activity, the production units needed to be calculated. If you struggled to calculate this figure, make a reasonable assumption so that you can go on. In every question there are easy marks as well as difficult marks. It is very important to gain these easy marks, because this can mean the difference between passing and failing.

QUESTION 2

MALUMI (PTY) LTD

a. Closing inventory for the month ended 31 May 20X1:

	March units	**April units**	**May units**
Opening inventory	–	9 000①	22 500
Plus: Production	81 000	89 100②	101 000 ⑥
Available for sale	81 000	98 100	123 500
Less: Sales	(72 000) ⑦	(75 600)⑧	(118 500) ①
Closing inventory	9 000	22 500	5 000

b. MALUMI (PTY) LTD

Contribution statement of comprehensive income for the month ended 31 May 20X1 (direct costs), using the weighted average method:

		R
Sales (118 500 x R30)		3 555 000
Less: Variable manufacturing cost of sales		(2 482 983)
Opening inventory (22 500 x R18,50④)	416 250	
Variable manufacturing cost (101 000 x R21,50⑤)	2 171 500	
Goods available for sale	2 587 750	
Less: Closing inventory (5 000 / 123 500 x 2 587 750)	(104 767)	
Less: Variable sales costs (118 500 x R1,50)		(177 750)
Contribution		894 267
Less: Fixed cost		(405 515)
Manufacturing (given)	405 515	
Sales and administration costs	–	
Net profit before tax		488 752

Notes for (a) and b):

① Given

② 81 000 x 110% = 89 100 units

③ Opening inventory April = closing inventory March

④ Since variable manufacturing cost per unit was the same in March and April, and March had no opening inventory, April's closing inventory will have the same per-unit value independent of whether the FIFO or weighted average method is being used.

Variable manufacturing cost per unit (April)	=	value of opening inventory / opening inventory units
	=	R166 500 / 9 000
	=	R18,50

⑤	Variable manufacturing cost per unit (May)	=	variable manufacturing cost per unit (April) + R3 (given)
		=	R18,50 + R3
		=	R21,50
⑥	Manufactured (units) for May	=	variable manufacturing costs/ variable manufacturing costs per unit
		=	R2 171 500/R21,50
		=	101 000

⑦ Balancing figure

⑧ 72 000 x 105% = 75 600 units

c. MALUMI (PTY) LTD

Contribution statement of comprehensive income for the month ended 31 May 20X1 (direct costing method), using FIFO

		R
Sales (118 500 x R30)		3 555 000
Less: Variable manufacturing cost of sales		(2 480 250)
Opening inventory (22 500 x R18,50 (from b))	416 250	
Variable production cost (given)	2 171 500	
Goods available for sale	2 587 750	
Less: Closing inventory (5 000 x R21,50 (from b))	(107 500)	
Less: Variable sales cost (118 500 x R1,50)		(177 750)
Contribution		897 000
Less: Fixed costs		(405 515)
Manufacturing cost	(405 515)	
Selling and administration cost	–	
Net profit before tax		491 485

d. MALUMI (PTY) LTD

Statement of comprehensive income for the month ended 31 May 20X1 (absorption costing method), using the weighted average method

		R
Sales (118 500 x R30)		3 555 000
Less: Cost of sales		(2 965 611)
Opening inventory	513 727 ①	
Variable production cost (from b)	2 171 500	
Fixed production cost (given)	405 515	
Goods available for sale	3 090 742	
Less: Closing inventory (5 000/123 500 x R3 090 742)	(125 131)	
Gross profit		589 389
Less: Variable selling costs (118 500 x R1,50)		(177 500)
Net profit before tax		411 639

Notes for (d):

① Fixed manufacturing cost included in April opening inventory of 9000 units.
= R209 000 – R166 500
= R42 500

But, in March, 81 000 units were manufactured.
Thus 81 000 / 9 000 x R42 500 = R382 500

The above means that the fixed portion of manufacturing cost to be included in the valuation of May opening inventory of 22 500 units is:

(R42 500 + R382 500) x 22 500 / 98 100 = R97 477

= opening inventory for May: value according to direct method plus fixed portion
= R416 250 + R97 477
= R513 727

e. MALUMI (PTY) LTD

Statement of comprehensive income for the month ended 31 May 20X1 (absorption costing method), using FIFO

		R
Sales (118 500 x R30)		3 555 000
Less: Cost of sales		(2 962 281)
Opening inventory	512 841 ①	
Variable manufacturing cost (given)	2 171 500	
Fixed manufacturing cost (given)	405 515	
Goods available for sale	3 089 856	
Less: Closing inventory (5 000 / 101 000 x R2 577 015②)	(127 575)	
Gross profit		592 719
Less: Selling and administration costs		(177 750)
Variable selling(118 500 x R1,50)	177 750	
Fixed	–	
Net profit before tax		414 969

NOTE

Inventory levels decreased from 22 500 to 5 000 units. Did you notice that the absorption costing net profit was lower than the direct costing method because of the fixed cost carried from the balance sheet to the statement of comprehensive income?

① Fixed manufacturing costs included in April opening inventory of 9 000 units
= R209 000 – R166 500
= R42 500

But, in March 20X1, 81 000 units were manufactured.
Thus: 81 000 / 9 000 x R42 500 = R382 500

Total manufacturing costs April = (R18,50 x 89 100 units) (variable) + R382 500 (fixed)
= R1 648 350 + R382 500 = R2 030 850

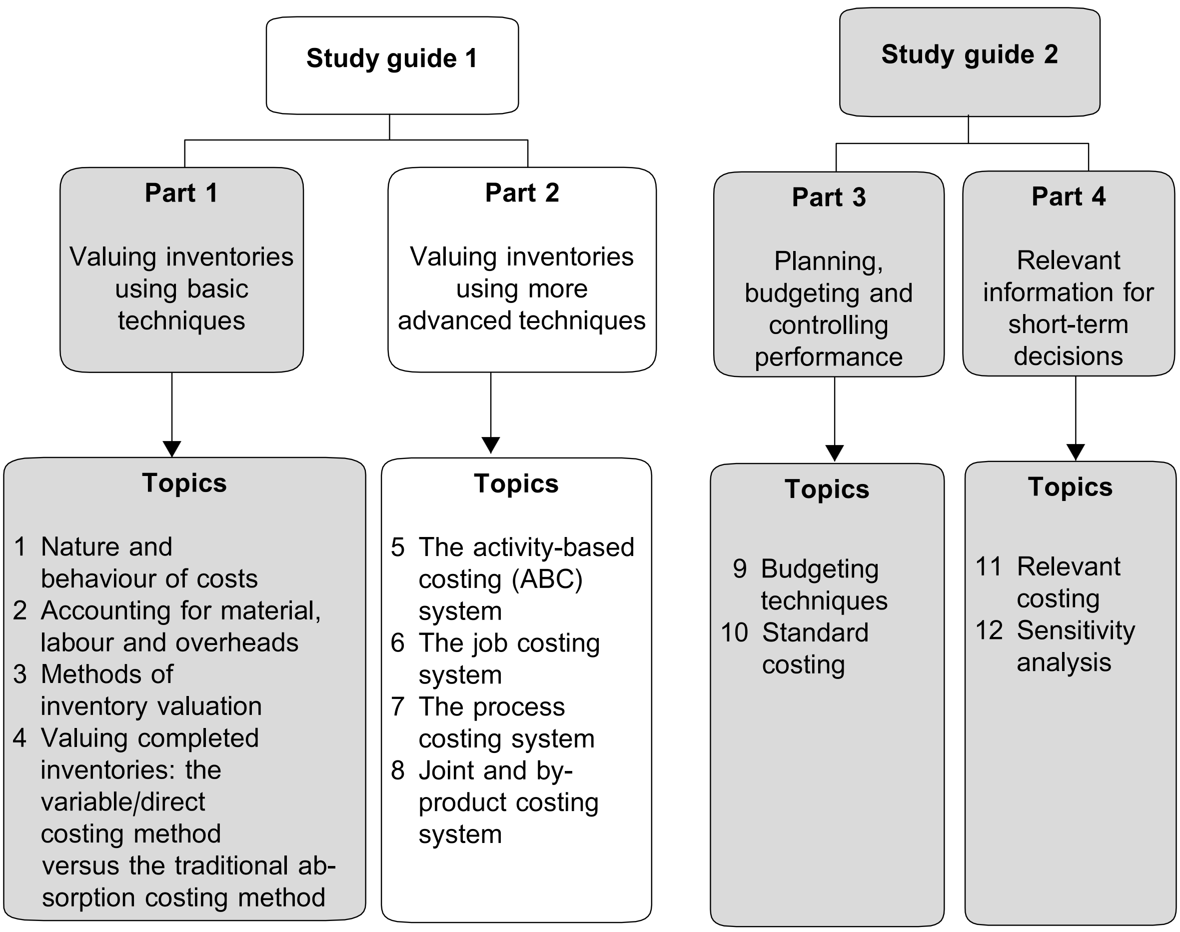
Closing inventory April (FIFO) = 22 500 / 89 100 x R2 030 850
= R512 841 rounded

② R2 171 500 + R405 515 = R2 577 015

Valuing inventories using more advanced techniques

PURPOSE

In part 2, we shall discuss other further issues concerning the treatment of manufacturing overheads in an activity-based costing (ABC) system. We shall also introduce you to different costing systems, the application of which depends on the particular manufacturing environment.



TOPIC 5

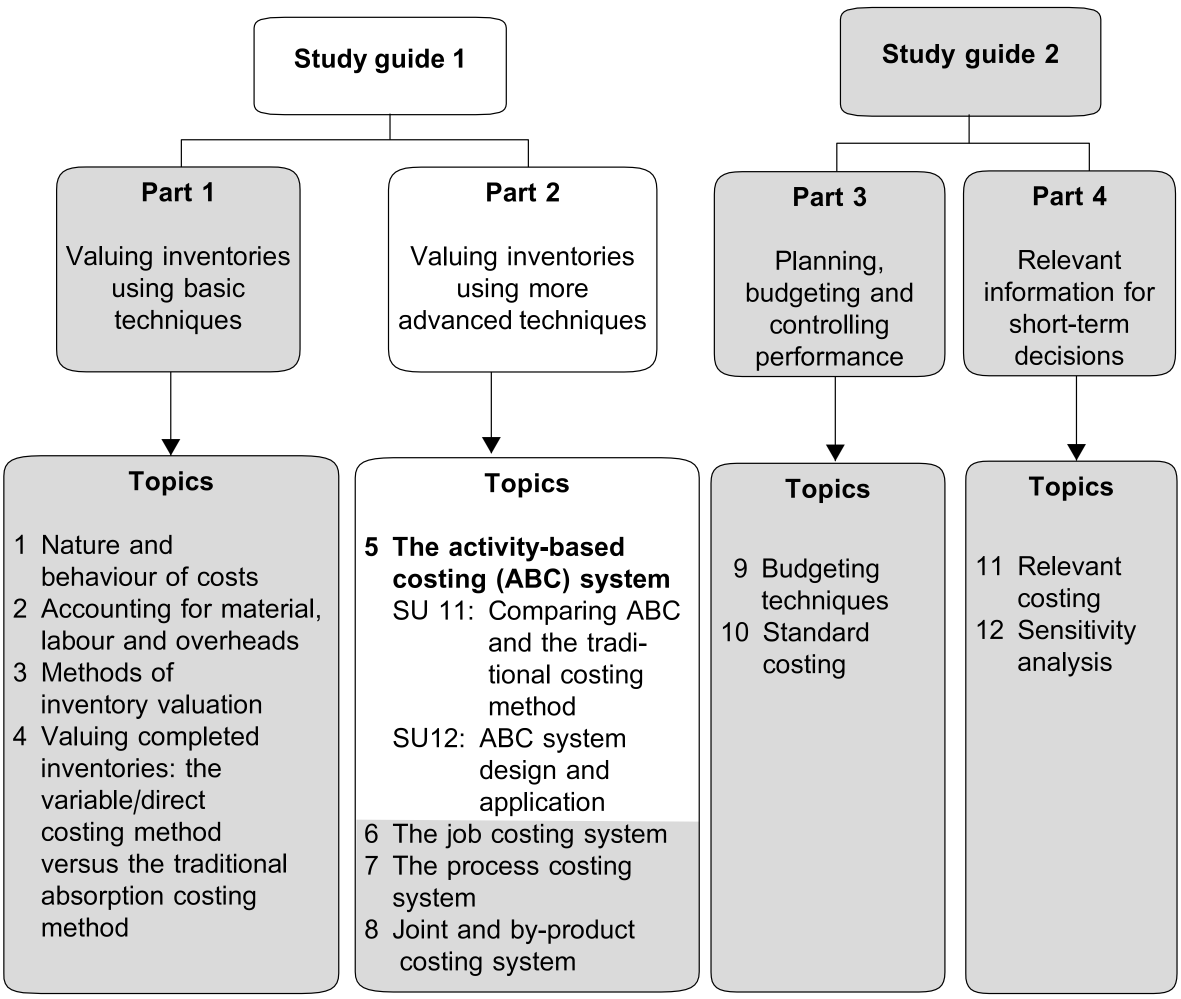
The activity-based costing (ABC) system

LEARNING OUTCOMES

After studying this topic, you should be able to:

– identify and describe the differences between activity-based costing (ABC) and the traditional costing method
– identify those environments which are suitable to the implementation of an ABC system
– design and implement an ABC system with a view to costing products

STUDY UNIT	TITLE
Study unit 11	Comparing ABC and the traditional costing method
Study unit 12	ABC system design and application



Introduction

In topic 2, you learnt about the three elements of product costs:

- material
- labour
- manufacturing overheads

You have also learnt how to allocate manufacturing overheads to cost objects by using volume-based allocation bases such as units manufactured, labour hours etcetera. ABC is an alternative method of allocating overhead costs in specific scenarios. In this topic, we are going to look at the differences between ABC and traditional costing methods, how to design an ABC system, and how to calculate product cost using ABC.

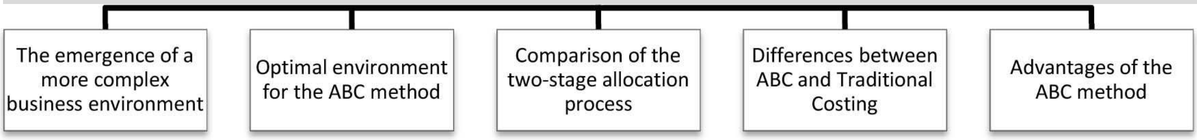
The word **SYSTEM** refers to the design and implementation of a specific method in a company. The word **METHOD** refers to the way in which that specific system works. For instance:

Eish (Pty) Ltd. started out manufacturing ice, but added a range of flavoured filtered water to their product range. Because they diversified the product range, the accountant decided to design and implement a different costing **system** in the company, using the **ABC method** instead of the traditional costing method previously used.

STUDY UNIT 11

Comparing ABC and the traditional costing method

In this study unit



1 Introduction

Activity-based costing (ABC) originated in the late 1980s in response to the increase in overhead costs, especially manufacturing support costs; this, in itself, was a result of the increasingly complex manufacturing environment. Volume-based measures of allocating production overheads were deemed to be a crude way of allocating overheads owing to their inadequate treatment of cause-effect relationships.

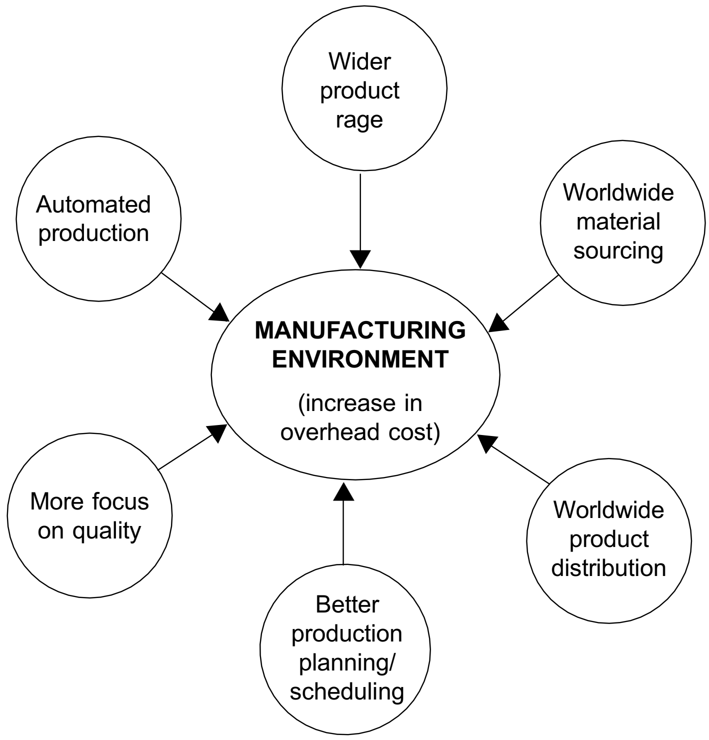
2 The emergence of a more complex business environment

Figure 11.1 on the next page illustrates some of the factors that emerged to complicate the business environment.

All these factors caused overhead costs to increase, irrespective of the volume of goods produced, and the more complex manufacturing environment made the traditional costing method ineffective. A greater emphasis on quality, lower inventory levels and technology, along with a more diverse range of products provided to companies and an increase in overheads all led to the emergence of ABC.

> **TRADITIONAL COSTING**
>
> In the traditional costing method, fixed production overhead cost is allocated to products by linking it to only one volume-driven allocation base (eg labour hours or machine hours). In this method, fixed production overhead cost is assumed to be the most significant cause for the production cost (refer to topic 2).

The traditional costing method, however, has certain shortcomings, the most significant being that it is a very crude way in which to allocate **support** overheads. The need for more accurate product costs in an increasingly competitive market has forced many organisations to re-evaluate their costing procedures.



Source: Author (2012)

FIGURE 11.1: Factors that contributed to the complex manufacturing environment.

ABC

ABC – a more accurate system – was designed to improve the allocation of overheads. ABC assumes that **activities cause or drive the cost and that products are created by activities**. The allocation of costs is therefore based on the utilisation of activities. The purpose of ABC is to allocate cost **based on the cause of the cost.**

3 Optimal environment for the ABC method

As you can see, ABC is very different from the traditional costing method, and certain situations are particularly appropriate for the use of ABC. The following are probable indicators:

- Organisations with larger amounts of overhead costs not driven by production volume
- Organisations with a diverse range of products
- Intense global competition, with pressure on prices and quality
- Low information costs that are already computerised

Activity 11.1

Company A manufactures two products of 80 000 and 60 000 units respectively. A combination of the two products is sold to four local customers. Orders are only accepted in thousands.

Company B manufactures 10 products, which are available in four variations each, resulting in 40 product codes. This is sold to 93 customers in quantities ranging from 200 units to 5 000 units, locally and abroad.

Both companies manufacture and sell approximately the same total volume of units.

REQUIRED

Which company do you think requires more support for its production activities and why?

Solution to Activity 11.1

Company B clearly has more support activities than Company A. Company B has more products that are different, more variations in products, more product codes etcetera.

NOTE

It is very important to remember that variable cost (ie direct materials, labour and direct expenses) is treated the same in both methods. The only difference is the allocation method for overheads.

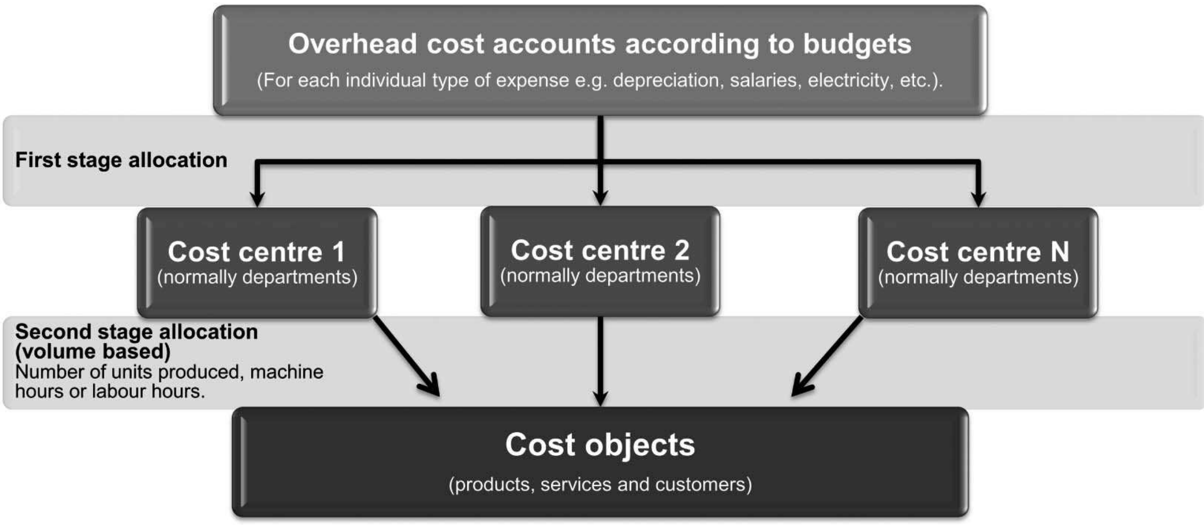
4 Comparison of the two-stage allocation process (between traditional and ABC)

Both methods (traditional and ABC) use a two-stage allocation process.

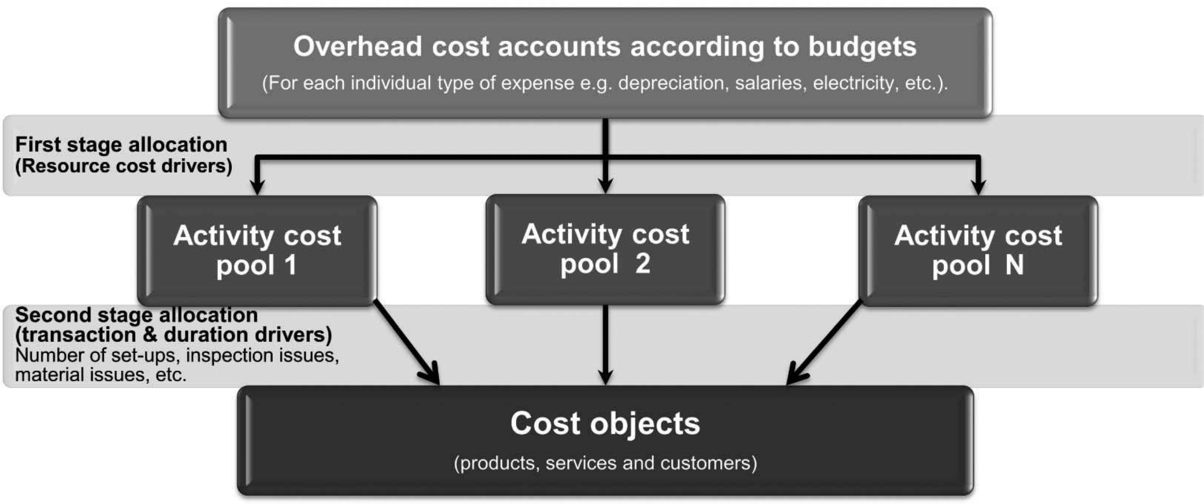
In the first stage, the traditional costing method allocates overheads to production and service departments and then re-allocates service department costs to the production departments (refer to topic 2). The ABC method pools overheads to each major activity (rather than departments).

The second stage of the two-stage allocation process allocates costs from production departments (traditional method) or cost pools (ABC) to products or other chosen cost objects. The traditional costing method allocates overheads to products based on a small number of second-stage allocation bases (ie units or hours), resulting in the overhead allocation rate. In ABC, the term "cost driver rate" is used rather than "overhead allocation rate". A much wider allocation base or drivers are used owing to technological development. For example, the number of times that material requisitions is processed and issued by stores or the number of logins on a computer system can easily be monitored.

Traditional costing method



Activity based costing method



Source: Author (2012)

FIGURE 11.2: Illustrates of the two-stage allocation process for the traditional and ABC methods.

5 Differences between ABC and traditional costing

With ABC:

- Non-manufacturing (ie customer support costs), as well as manufacturing costs, may be assigned to products for **decision-making purposes** *(not for GAAP inventory valuation)*.
- A number of overhead activity cost pools are used, each of which is allocated to products and other cost objects using ABC's own unique measure of activity or driver.
- The allocation bases differ from those used in the traditional costing method.
- The activity rates may be based on the level of activity at normal capacity rather than on the budgeted level of activity.

6 Advantages of the ABC method

- More accurate price decisions if costs are used to set prices.
- Cost cutting (eliminate activities which do not add value).
- Activity-based budgeting can be used in conjunction with ABC.
- Performance measurement can be carried out in more detail owing to the extensive research required to implement ABC.
- The business process can be redesigned if inadequacies are identified in ABC research.

7 Disadvantages of the ABC method

- Expensive to implement because it involves mapping all the business processes in the organisation.
- Expensive to maintain because it requires far more record-keeping and is only possible because of the advent of complex and extensive computer packages.
- Specialised knowledge needed to implement this costing method.
- ABC needs a greater deal of care; cost drivers can be identified incorrectly.
- If overhead cost is a low percentage of total cost, ABC may not differ significantly from traditional costing.
- The cost of implementation and running may exceed the benefits of improved costing information.

8 Summary

In this study unit, you learnt about ABC and the circumstances that lead to the development of this costing method. You also learnt to identify the differences between the ABC method and the traditional costing method. In the next study unit, we are going to design and implement an ABC system.

Self-assessment Activity

Say whether the following statements about ABC are true or false:

a. ABC is more suitable for companies with larger amounts of indirect costs.
b. ABC is less expensive than the traditional costing method.
c. In ABC, only manufacturing costs can be assigned to products.
d. Total overhead costs using the traditional costing method do not equal total overhead costs using the ABC costing method.
e. Overhead rate is the same irrespective of which method is used.

After studying the theory above, can you answer the following questions?

a. List the advantages of the ABC method.
b. List the disadvantages of the ABC method.
c. Describe the optimal environment for implementing the ABC method.

Solution to Self-assessment Activity

a. True
b. False (ABC is more expensive owing to the higher cost of implementation and maintenance.)
c. False (Non-manufacturing costs can also be assigned to products.)
d. False (The total overhead costs allocated to all cost objects are the same for both methods; it is only the allocation method that is different.) ABC may ultimately lead to a more effective cost structure by eliminating non-value adding activities (by applying activity-based management [ABM]).
e. False (Different overhead rates are calculated for each method.)

STUDY UNIT 12

ABC system design and application

In this study unit

- Designing an ABC system
- Product costing with ABC

1 Introduction

In the previous study unit, we discussed the advantages and disadvantages of the ABC method and the environment that is most suitable for its application. We learnt how ABC is used to allocate overheads more accurately, and we also identified the differences between the traditional costing and the ABC method.

In this study unit, we are going to design an ABC system. Since overheads are part of product cost, we are going to calculate product cost using ABC and compare the answer with that obtained using the traditional costing method.

2 Designing an ABC system

To design an ABC system, we follow four steps:

- Identify activities.
- Identify cost drivers.
- Create cost pools for each activity.
- Trace activities to cost object.

We will discuss each of these steps in turn.

2.1 Identifying activities

To identify an activity, the definition of "activity" will first be explained

> **ACTIVITY**
>
> An activity is a task, action, or unit of work that is carried out in the organisation.

For example, the purchasing of materials might be identified as a separate activity; completing a quality inspection of the finished product might also be identified as a separate activity.

Activities are identified by carrying out an extensive activity analysis. Identifying an activity for costing purposes should be done after all activities are pooled together or eliminated (on the basis of costs versus benefits). The final selection of activities should represent the operations of the organisation, from start of operations to product delivery to the customer. This choice involves a fair amount of judgement and it is important that the accountant have a thorough understanding of the processes involved in his/her employer's business.

The following factors must be taken into account when selecting the final list of activities that will be cost:

- Total cost of the activity, which should not be insignificant.
- Is there a driver that can provide a satisfactory explanation for the costing of this activity?

ABC classifies activities along a cost hierarchy that consists of the following:

1. *Unit-level activities (lowest level).* These are performed each time a unit of the product or service is produced (eg direct labour).
2. *Batch-related activities.* These are performed each time a batch of goods is produced (eg setting up machines for a specific production run of a product).
3. *Product-sustaining activities.* These are performed to enable the production and sale of a specific product (eg maintenance of machines used to manufacture this product).
4. *Facility-sustaining activities.* These are performed to support the facility's general manufacturing process (eg verifying orders, issuing material requisitions).

2.2 Identifying activity cost drivers

Factors that cause different activity costs are known as "cost drivers". The cost drivers used at this stage are also called "activity cost drivers".

The following factors should be considered when selecting suitable cost drivers:

- A cost driver should provide a good explanation of the activity costs.
- It should be easily measurable.
- Data must be easily obtainable.
- Must relate to specific product, service or customer.
- Each unit of the cost driver should be homogenous (ie the same).

Cost drivers consist of two categories:

- Transaction drivers
- Duration drivers

TRANSACTION DRIVERS

Transaction drivers **count the number of times that an activity is performed.** They are the least expensive to determine, but they are also likely to be the least accurate.

Example: set-ups undertaken (getting a machine ready for production, ie adjusting the speed, loading materials), number of inspections performed, number of purchase orders processed or number of customer orders processed.

DURATION DRIVERS

Duration drivers represent the **length of time required** to perform an activity.

Example: set-up hours or inspection hours.

Some examples illustrating the link between the production activity, the cost driver and the activity level are as follows:

ACTIVITIES	COST DRIVERS	ACTIVITY LEVEL CLASSIFICATION
Direct labour hours	Direct labour hours	Unit level
Set-ups	Number of set-ups	Batch level
Maintenance	Maintenance hours	Product-sustaining

NOTE

For the purposes of MAC2601, the focus is on matching appropriate cost-drivers to appropriate cost pools rather than on identifying the activity level. You will learn more about classifying activity levels in your later MAC modules.

2.3 Cost pool creation and resource cost drivers (first-stage allocation)

After the activities are identified, the cost of resources consumed (eg salaries, electricity, etc) over a period is allocated to a cost pool for each activity. Some resources of costs will be directly attributable to specific cost pools, and others not. Those that are **not directly attributable (shared resources)** should be assigned to pools based on **cause-and-effect resource drivers** (eg decide how to allocate electricity to different cost pools based on kilowatts used by machines in each cost pool). Arbitrary allocations should **not** be used.

2.4 Tracing activity costs to a cost object (second-stage allocation)

The rates used to allocate costs from cost pools to cost objects are calculated as follows:

$$\text{Activity cost rate} = \frac{\text{activity cost \ \ cost pool cost}}{\text{cost driver \ \ volume}}$$

For example: if the total budgeted costs in the cost pool for set-ups is R300 000 for the period and the budgeted number of set-ups for all products that the organisation manufactures is 300, then the cost is as follows:

$$\text{Activity cost rate} = \frac{\text{R300 000}}{300}$$

$$= \text{R1 000 per set-up}$$

If a *specific* product is budgeted to require 21 set-ups during the budget period, 21 x R1 000 = R21 000 would be allocated to this product's (cost object's) budgeted manufacturing overhead for product costing purposes.

In the following activity, you will learn how to allocate overhead cost to a cost object using ABC.

Activity 12.1

DESIGNING AN ABC SYSTEM

An analysis of the Materials Department of Melemi (Pty) Ltd's monthly records reveals the following:

	R
Salary: manager	24 000
Salaries: three purchasing clerks	48 000
Salaries: five receiving clerks	60 000
Miscellaneous expenses (rent, electricity, telephone)	50 000

A time-event study indicated that time and costs are incurred as follows:

Manager's time allocation:	
– Purchasing orders	40%
– Verifying orders	15%
– Receiving materials	45%
Receiving clerk's time allocation:	
– Verifying order requirements	30%
– Receiving materials	70%
Miscellaneous cost allocation	
– Purchasing section	20%
– Receiving section	80%

The following major activities were identified in the Materials Department:

Activity	Cost drivers	Cost driver monthly quantities
Purchasing orders	Number of orders	200 orders
Verifying orders	Number of orders	200 orders
Materials receiving	Monetary value of materials	R 600 000

REQUIRED

Assume that a specific job (job A) requires two purchase orders for direct materials, for the amounts of R20 000 and R12 000 respectively.

Determine the amount of overhead support cost in respect of materials management that would be allocated to job A in each of the following circumstances:

a. Apply the traditional costing method. (Assume the allocation base is the value of materials ordered in a month.)
b. Set up and apply the ABC method

Solution to Activity 12.1

a. Traditional costing method allocation

	R
Salaries:	
Purchasing clerks	48 000
Receiving clerks	60 000
Purchasing manager	24 000
Miscellaneous expenses	50 000
	182 000
Value of materials received	600 000
Allocation rate	**R0,303**

Allocate to job A = (20 000 + 12 000) x R0,303 = R9 696

b. ABC method allocation

i. Allocating resource cost to activity cost pools (first-stage allocation)

	Purchasing orders	Verifying orders	Materials receiving
	R	**R**	**R**
Salaries:			
Purchasing clerks	48 000		
Receiving clerks			
(60 000 x 30%)		18 000	
(60 000 x 70%)			42 000
Purchasing manager			
(24 000 x 40%)	9 600		
(24 000 x 15%)		3 600	
(24 000 x 45%)			10 800
Miscellaneous expenses			
(50 000 x 20%)	10 000		
(50 000 x 80%)			40 000
	67 600	**21 600**	**92 800**

NOTE

① Taking into consideration the additional information given, three activities were identified. The total cost per activity must first be calculated. Ideally, the cost of each activity would be the actual cost recorded per activity. If that is not available, costs have to be allocated to cost pools based on resource cost drivers.

② The resources consumed by the Materials Department were the employees' salaries and certain other overheads (eg rent and electricity).

③ Resource cost drivers were identified in the time-event study to allocate costs from the general ledger accounts to the activity cost pool accounts.

④ Since no further information was given relating to the purchasing clerks, you may assume they spend 100% of their time on purchasing activities.

⑤ Now you can see why setting up an ABC system can be very time-consuming and expensive. In the ABC system, the cost per activity within the Materials Department has to be calculated.

⑥ In an ABC question, it is important to look for the activity, and whether the cost was given, or if it should first be allocated to the cost pool.

ii. **Determining activity rate**

Now we have the total cost per activity cost pool. The next step would be to calculate the cost per activity. This is done by using cost drivers. In this question, the cost drivers were given, but this may not always be the case. If the cost drivers are not given, apply the theory explained in study unit 2.

	Purchasing orders	Verifying orders	Materials receiving
Total activity cost	R67 600	R21 600	R92 800
Cost driver quantities	200	200	R600 000
Cost per activity	**R 338**	**R 108**	**R 0,155**

iii. **Allocating costs to cost object (job A in this case)**

We can now move on to the next step, since we have the cost per activity. The overhead cost per purchase order is now calculated using the unit cost per activity, thus implementing ABC.

	Purchase order 1	Purchase order 2
Activity costs:		
Purchase orders x 1	R338	R338
Verifying orders x 1	R108	R108
Materials receiving		
(R20 000 x 0,155)	R3 100	
(R12 000 x 0,155)		R1 860
Total	**R3 546**	**R2 306**

Summary of material management cost allocated to job A:

Traditional	**ABC**
R9 696	R5 852 (R3 546 + R2 306)

NOTE

① Can you see that the ABC method allocated fewer support overhead costs to job A? However, be careful. The total cost incurred by the Materials Department was still R182 000, as calculated in a. This means that the traditional costing method under costed the other jobs.

② ABC is an allocation method. Implementing ABC on its own does not reduce overhead costs (thus leading to higher profits). In both methods, the total cost is still

R182 000. To achieve a reduction in cost, ABC must be combined with a process called activity-based management (ABM), which you will learn about in MAC3701, which deals with the application of management accounting techniques.

③ ABC on its own (in the appropriate environment) can lead to more accurate costing; this, in turn, can be used to achieve better pricing across the range of the company's products/services, resulting in higher profits.

3 Product costing with ABC

In the previous activity, we have only allocated one overhead support cost by means of ABC. In the next activity, we are going to illustrate the application of ABC where there is disparate or differing use of support services between products, and where there is more than one type of support overhead cost.

Activity 12.2

PRODUCT COSTING WITH ABC

Dogs Ltd. manufactures two products (fluffy stuffed animals), namely "Old" and "Dirty", using an automated manufacturing process. The company manufactures 75 000 units of "Old" and 525 000 units of "Dirty" per year.

Economic order quantity calculations determined that the most economical option would be 1 000 and 3 000 units per production run (batch) for "Old" and "Dirty" respectively. Set-ups are done for every batch and each set-up takes 24 minutes for "Old" and 15 minutes for "Dirty".

Total direct manufacturing costs for the coming financial year are as follows:

	R
Direct Material	
– Old	1 988 000
– Dirty	5 112 000

The budgeted manufacturing overheads for the coming financial year are as follows:

	R
Material purchase and storage	520 000
Setting up of machines	3 705 000
Processing	2 125 000
Maintenance	150 000
Total	6 500 000

The products are manufactured by machines only. It takes three machine hours to manufacture a batch of 1 000 "Old" units and two machine hours for every batch of 3 000 "Dirty" units. An analysis of the manufacturing process revealed the following:

Activity	Cost driver
Material purchase and storage	**Number** of orders placed: 50 orders for "Old" and 75 orders for "Dirty" per year: (transaction driver)
Setting up of machines	Setting up **hours** (duration driver)
Processing	Machine **hours** (duration driver)
Maintenance (routine inspection of machines)	Inspection **hours (**Inspection is done after every 25 hours of machine time and takes 36 minutes for "Old" and 12 minutes for "Dirty".) (duration driver)

Dogs Ltd. currently allocates all manufacturing overheads according to machine hours.

REQUIRED

a. Allocate the total overheads using the traditional costing method.
b. Set up an ABC system and allocate total overheads.
c. Calculate the product cost per unit for "Dirty" and "Old" by applying both methods and then compare the results.

NOTE

In this activity, manufacturing overheads first need to be allocated to the two products, "Old" and "Dirty". The purpose of ABC is to allocate these overheads more accurately (ie based on activities). In the traditional costing method, overheads are still allocated to the two products, and are simply based on (in this case) machine hours

Solution to Activity 12.2

a. Allocating overheads using the traditional costing method

$$\frac{\text{total overhead cost}}{\text{budgeted production hours}} = \frac{\text{R6 500 000}}{75\ 000 \quad 3\ \ 1000 \quad 525\ 000 \quad 2\ \ 3000}$$

= R 11 304,35 / hour

(= 225 machine hours budgeted to manufacture "Old" and 350 hours budgeted for "Dirty")

Thus "Old" overhead	=	R11 304,35 x 225 hours	=	R2 543 478
Thus "Dirty" overhead	=	R11 304,35 x 350 hours	=	R3 956 522
Total overheads				**R6 500 000**

As you can see, the overhead per machine hour is calculated first, and then the overhead for the two products ("Old" and "Dirty"). Once again, the use of machine hours for allocating the manufacturing overheads was an in-house decision. Note that, in any examination question, this decision will be given to you.

b. Setting up an ABC system

COST DRIVER RATES

	Material purchase and storage	Setting up	Production	Maintenance
Amount	R520 000	R3 705 000	R2 125 000	R150 000
Orders (50 + 75)	125			
Set-up hours (75 000/1 000 x 24/60) + (525 000/3 000 x 15/60)		73,75		
Machine hours (75 x 3) + (175 x 2)			575	
Maintenance hours calc (1) (5,4 + 2,8)				8,2
Cost driver rate	**R4 160**	**R50 237,29**	**R3 695,65**	**R18 292,68**

Calc (1) Number of inspection hours

	``Old"	**``Dirty"**
Total machine hours	225	350
Inspections	25	25
Number of inspections	9 (225 / 25)	14 (320 / 25)
Inspection hours	5,4 (9 x 36 / 60)	2,8 (14 x 12 / 60)

NOTE

Can you see that we use the same machines hours as those used in the traditional costing method? Manufacturing activities and support activities, using machines hours as drivers, would use the same allocation base (ie machine hours) as that used in the traditional costing method.

ALLOCATION OF OVERHEADS

		R
``Old"		
Material purchase and storage	(50 x 4 160)	208 000
Setting up of machines	(30 x 50 237,29)	1 507 119
Production	(225 x 3 695,65)	831 522
Quality control	(5,4 x 18,292,69)	98 780
Total		**2 645 421**

		R
``Dirty"		
Material purchase and storage	(75 x 4 160)	312 000
Setting up of machines	(43,75 x 50 237,29)	2 197 881
Production	(350 x 3 695,65)	1 293 478
Quality control	(2,8 x 18 292,69)	51 220
Total		**3 854 579**
Grand total		**6 500 000**

We can see how the R6 500 000 is allocated differently, depending on the costing method used.

ABC:	"Old" R 2 645 421	and	"Dirty" R 3 854 579
Traditional costing:	"Old" R 2 543 478	and	"Dirty" R 3 956 522

``Old" consumes more of the support activities relative to its volume and should therefore carry more of the overhead support cost.

In this question, the total manufacturing overheads were given to you, and these were then broken down into activities. In some instances the **total overheads** will be given to you, as in this question – the R6 500 000 but not the breakdown of the activities. In other questions, **period and manufacturing costs** may be given, so you would need to be able to distinguish between the two. In this question, the **cost drivers** were also given so that, as in question b., the cost per activity could be calculated. (This was done in the table above.) Using the cost per activity, the overheads were then allocated based on usage of activities and not on an "in-house" decision (because this was deemed to be more accurate).

c. Calculating the product cost per unit for "Dirty" and "Old" using ABC

``Old"	**ABC**	**Traditional**
Direct material (1 988 000/75 000)	R26,51	R26,51
Manufacturing overheads (2 645 421/75 000)	R35,27	R33,91
Total product cost	R61,78	R60,42
``Dirty"		
Direct material (5 112 000 / 525 000)	R9,74	R9,74
Manufacturing overheads (3 854 579/ 525 000)	R7,34	R7,54
Total product cost	R17,08	R17,28

As you can see, the total product cost would differ, depending on the costing method used. However, note that the variable costs are not different; it is only the manufacturing overheads that are different.

NOTE

① Determining a product's cost is very important, because this may influence the product's price. ABC can therefore be very *helpful* in calculating the product cost more accurately.

② Do not forget: ABC is not useful in all scenarios. Before implementing ABC, there needs to be a large percentage of support costs which are not volume (unit) driven **AND** a difference in the way in which the range of products consumes the support activities.

4 Summary

In this study unit, you learnt how to design and implement an ABC system, even though this method requires more research and more resources. You also learnt how to apply the ABC method to cost products. As you can see, using ABC may make a big difference to overheads and thus product cost, which is why many organisations regard it as a worthwhile costing method.

QUESTION 1: OVERHEAD COST PER UNIT WITH ABC

Colourful Stuff (Pty) Ltd. manufactures three products and uses the ABC method. The names of the three products are Pink, Blue and Yellow. The company uses the same machinery to manufacture all three products. Pink and Blue tend to put a lot of pressure on the assembly machine and therefore the technician needs to inspect the machine frequently.

Manufacturing overheads for the month of October 2010 were as follows:

	R
Assembly	750 000
Compression	840 000
Indirect labour (technician salary)	12 000
Total	1 602 000

Additional information

The following information for October 2010 was obtained from the manufacturing department:

Machine	**Number of set-ups**	**Number of technician inspections**
Assembly	10	5
Compression	8	–
TOTAL	**18**	**5**

The following information also relates to October production:

Product	**Units manufactured**	**Number of set-ups required**		**Number of technician inspections required**
		Assembly	**Compression**	
Pink	8 000	3	3	2
Blue	5 000	5	4	2
Yellow	3 000	2	1	1
TOTAL	**16 000**	**10**	**8**	**5**

Management determined that the number of set-ups of the relevant machine is an appropriate cost driver for the activities of assembly and compression; management also determined that the number of technician inspections is an appropriate cost driver for the inspection activity. All activity costs were deemed substantial in size and justified separate treatment. The technician's only task is to inspect the assembly machine.

REQUIRED

Calculate the following (round off all amounts to two decimal places):

a. The activity cost rates to be used for:
   - Assembly

- Compression
- Inspection

b. The overhead costs per unit for each of the products.

QUESTION 2: ABC VERSUS TRADITIONAL

ABC Ltd. has a single manufacturing process of which the following overhead cost estimates are available for the period ending 31 December 20X2:

	R
Raw materials receiving and inspection cost	18 720
Electricity	23 400
Materials handling cost	16 380
	58 500

Three products, namely A, B and C, are manufactured by labourers. The raw material arrives in bundles and is then processed further using electrical drills, which are operated by hand. The labourers are paid a wage of R50 per hour.

The following estimates are applicable for the period ending 31 December 20X2:

	Product A	Product B	Product C
Units manufactured	2 200	1 650	880
Raw material received (total bundles)	11,00	6,00	18,00
Data per manufactured unit:			
Direct material (m^2)	4,00	6,00	3,00
Direct material (R)	6,50	3,90	7,80
Direct labour (minutes of drilling)	24,00	40,00	60,00
Number of electric drilling jobs	7,00	4,00	3,00

Overheads are currently allocated to products by means of a rate based on labour hours.

An activity-based investigation identified the following cost drivers:

Activity cost pool	**Cost drivers**
Material receiving and inspection	Number of material bundles
Electricity	Number of drilling jobs
Material handling	m^2 handled

REQUIRED

a. Prepare a summary for the budgeted product cost per unit for each product (A, B and C) for the period ending 31 December 20X2, where the unit cost for each of the cost elements is set out:

   i in terms of the current method of overhead allocation
   ii by using the identified cost drivers and on the basis of ABC principles

   Round off each figure to two decimal places.

b. Explain the process of an ABC costing system.

Solution to Self-assessment Activity

QUESTION 1

a. Calculating activity rates

Activity	Activity costs R	Cost driver volumes	Activity rates R
Assembly	750 000	10 set-ups	750 000 / 10 = R75 000 per set-up
Compressing	840 000	8 set-ups	840 000 / 8 = R105 000 per set-up
Inspection	12 000	5 inspections	12 000 / 5 = R2 400 per inspection

b. Calculating the overhead costs per unit manufactured for each product

Activity	Pink	Blue	Yellow
Assembly	3 set-ups x R75 000 per set-up = R225 000	5 set-ups x R75 000 per set-up = R375 000	2 set-ups x R75 000 per set-up = R150 000
Compressing	3 set-ups x R105 000 per set-up = R315 000	4 set-ups x R105 000 per set-up = R420 000	1 set-up x R105 000 per set-up = R105 000
Inspection	2 inspections x R2 400 per inspection = R4 800	2 inspections x R2 400 per inspection = R4 800	1 inspection x R2 400 per inspection = R2 400
Total	R544 800	R799 800	R257 400
Number of units manufactured	8 000	5 000	3 000
Overhead costs per unit	R68,10	R159,96	R85,80

NOTE

Did you notice the difference in the overhead costs per unit for each product?

QUESTION 2

a.

- **Current overhead allocation rate**

Labour hours	=	(2 200 x 24 / 60) + (1 650 x 40 / 60) + (880 x 60 / 60)
	=	2 860
Overheads	=	R 58 500 (given)
Rate	=	(58 500 / 2 860)
	=	R20,45 per hour

Product	A R	B R	C R
Direct material (given)	6,50	3,90	7,80
Direct labour ①	20,00	33,33	50,00
Overheads ②	8,18	13,63	20,45
Total product cost	34,68	50,86	78,25

①	A	=	24 / 60 x R50
		=	R20
	B	=	40 / 60 x R50
		=	R33,33
	C	=	60 / 60 x R50
		=	R50,00
②	A	=	24 / 60 x R20,45
		=	R8,18
	B	=	40 / 60 x R20,45
		=	R13,63
	C	=	60 / 60 x R20,45
		=	R20,45

- **ABC**

The first step is to calculate the overhead cost for the appropriate cost driver of each cost pool.

i.	Material receiving and inspection	= R18 720
	Bundles	= 35 (11 + 6 + 18)
	Cost per bundle	= R 534,86 (R18 720 / 35)
ii.	Electricity	= R23 400
	Number of drilling jobs	= 24 640 ((2 200 x 7) + (1 650 x 4) + (880 x 3))
	Cost per drill job	= R 0,95 (23 400 / 24 640)
iii.	Material handling	= R16 380
	Square meters	= 21 340 ((2 200 x 4) + (1 650 x 6) + (880 x 3)
	Cost per m^2	= R0,77 (R16 380 / 21 340)

Then calculate the overhead rates for each product for every cost pool.

i. Material receiving and inspection costs:

	A	B	C
	R	**R**	**R**
((R534,86 x 11) / 2 200))	2,67		
((R534,86 x 6) / 1 650))		1,95	
((R534,86 x 18) / 880))			10,94
ii. Electricity costs			
(0,95 x 7)	6,65		
(0,95 x 4)		3,80	
(0,95 x 3)			2,85
iii. Material handling cost			
(0,77 x 4)	3,08		
(0,77 x 6)		4,62	
(0,77 x 3)			2,31
iv. Primary cost (as per traditional costing method)			
Direct material	6,50	3,90	7,80
Labour cost	20,00	33,33	50,00
Total cost	38,90	47,60	73,90
Per traditional cost	34,68	50,86	78,25

b. ABC recognises that various *activities* rather than units *produced or machine hours* cause the variation in cost. Products absorb the cost caused by activities required by their production. Different products require different levels of production and support activities. Cost drivers are the activities or events which are the most material indicators of the cost of the activity. A cost pool is a cost group which is influenced by the communal cost driver. To calculate a product's cost with the help of ABC, an allocation rate is calculated for each cost pool, based on appropriate cost drivers. The allocation rate is then used to allocate overhead costs to products. This method of allocating overheads to products can influence the product cost substantially.

The job costing system

LEARNING OUTCOMES

After studying this topic, you should be able to:

- identify when a job costing system is appropriate
- record costs in a job costing system
- calculate the profit or loss per job

STUDY UNIT	TITLE
Study unit 13	The job costing system

Introduction

In the previous topics you learnt that direct manufacturing costs are traced to, and indirect manufacturing cost allocated to, cost objects. In this topic, specific jobs will be the cost objects. You will learn how to accumulate costs for each job and how to calculate the profit for each.

Study guide 1

Part 1
Valuing inventories using basic techniques

Topics
1 Nature and behaviour of costs
2 Accounting for material, labour and overheads
3 Methods of inventory valuation
4 Valuing completed inventories: the variable/direct costing method versus the traditional

Part 2
Valuing inventories using more advanced techniques

Topics
5 The activity-based costing (ABC) system
6 The job costing system
SU13: The job costing system
7 The process costing system
8 Joint and by-product costing system

Study guide 2

Part 3
Planning, budgeting and controlling performance

Topics
9 Budgeting techniques
10 Standard costing

Part 4
Relevant information for short-term decisions

Topics
11 Relevant costing
12 Sensitivity analysis

STUDY UNIT 13

The job costing system

In this study unit

Costing systems	Description of job costing	The flow of documents in a job costing system	Manufacturing cost flow through ledger accounts using job costing

1 Introduction

In this study unit, we will discuss how to select between the job and process/product costing systems.We will then illustrate the accounting entries and, finally, we will explain how to calculate the profit for each job.

2 Costing systems

PRODUCT COSTING SYSTEM

A product costing system represents a specific method according to which the manufacturing cost of a single product, job or group of products or jobs is accumulated, processed and recorded.

Product costing systems were primarily developed with the purpose of calculating the unit cost of a product or job. It is important to know the unit cost of a product because of the following reasons:

- If the unit cost of a product or products is known, the value of the inventory, the cost of sales and the net profit can be determined.
- We need to know the unit cost of a product when preparing a budget, because budgets are compiled using expected cost at various production levels.It is therefore important to calculate the unit cost of products accurately.
- Unit costs are also used to set selling prices or quotes in certain circumstances.

When unit costs are calculated, it is necessary to distinguish between the various costs which apply in specific situations. There are two groups of production costing systems which make this distinction easier: job-oriented systems and process-oriented systems.

The **product** and the manufacturing **process** determine the choice of the costing system.The costing system used in printing a batch of advertising posters designed to a client's specification (each poster design is unique and another print run might never be required again) will necessarily differ from the system used for the manufacture of a constant range of flavoured drinks (these are similar products that are manufactured year after year).

When posters are printed, the cost of each client's order (printing of these posters) is accumulated by means of a job system. In the manufacture of flavoured drinks, for example, the cost of each process (process cost) is accumulated, because all orders for the same product are batched together in a production run. You will learn about process costing in topic 7.

The decision whether to use a job or process costing system depends on the following questions regarding the market, the production process and the product:

		JOB	PROCESS
The market	Is this a special assignment or job for a particular client, or is it intended for the market in general?	Particular client	General market
The production	Is it a specialised or a continuous process?	Specialised (once off)	Continuous
The product	Is it a specialised product or unique product?	Unique	Homogeneous (all alike)

3 Description of job costing

JOB COSTING

This method of calculating the cost per unit (unit costing) is used where goods are manufactured according to a client's specifications, that is, where heterogeneous (different) products are manufactured using the same production facilities.

A common example of a business where job costing is applied is at a garage, where repairs are carried out on different vehicles and where the cost of the repairs to each vehicle (job) is calculated separately.

Job costing is not confined to manufacturing organisations; service organisations such as banks and consultants also use this system. In service organisations, costs are accumulated per activity; in consultancies, they are accumulated per project.

4 The flow of documents in a job costing system

- A ***requisition*** is prepared as the basis for the issue of a ***production order***.
- A production order (eg a job card is opened when a specific client's posters have to be printed) initiates the work that has to be done on a job. The resources utilised are recorded on three documents: a ***material requisition***, a ***direct labour time card*** and an ***overheads allocation statement.***
- The production costs are accumulated in the accounts department on the ***job card***.
- The job card forms the basis for calculating the unit costs, and for valuing the closing inventory and the cost of goods sold.

5 Manufacturing cost flow through ledger accounts using the job costing system

The costs (direct material, direct labour and manufacturing overheads) are accumulated separately for every job (which may be either a single product or a small group of identical products or a specific service).

When a job costing system is used, the accounting system must be adjusted to make provision for recording the cost per job. A separate ledger account must be opened for each job, against which the cost of that specific job is debited. This ensures that all the costs incurred for a specific job will be accumulated.

All the ledger accounts for all the different jobs are usually grouped in a subsidiary ledger, known as the cost ledger, and this is represented in the general ledger by means of a central control account (the work-in-process account [WIP]). The WIP control account is merely a summary of everything recorded in the separate job accounts in the cost ledger.

See figure 13.5 for a diagram of how the costs are accumulated.

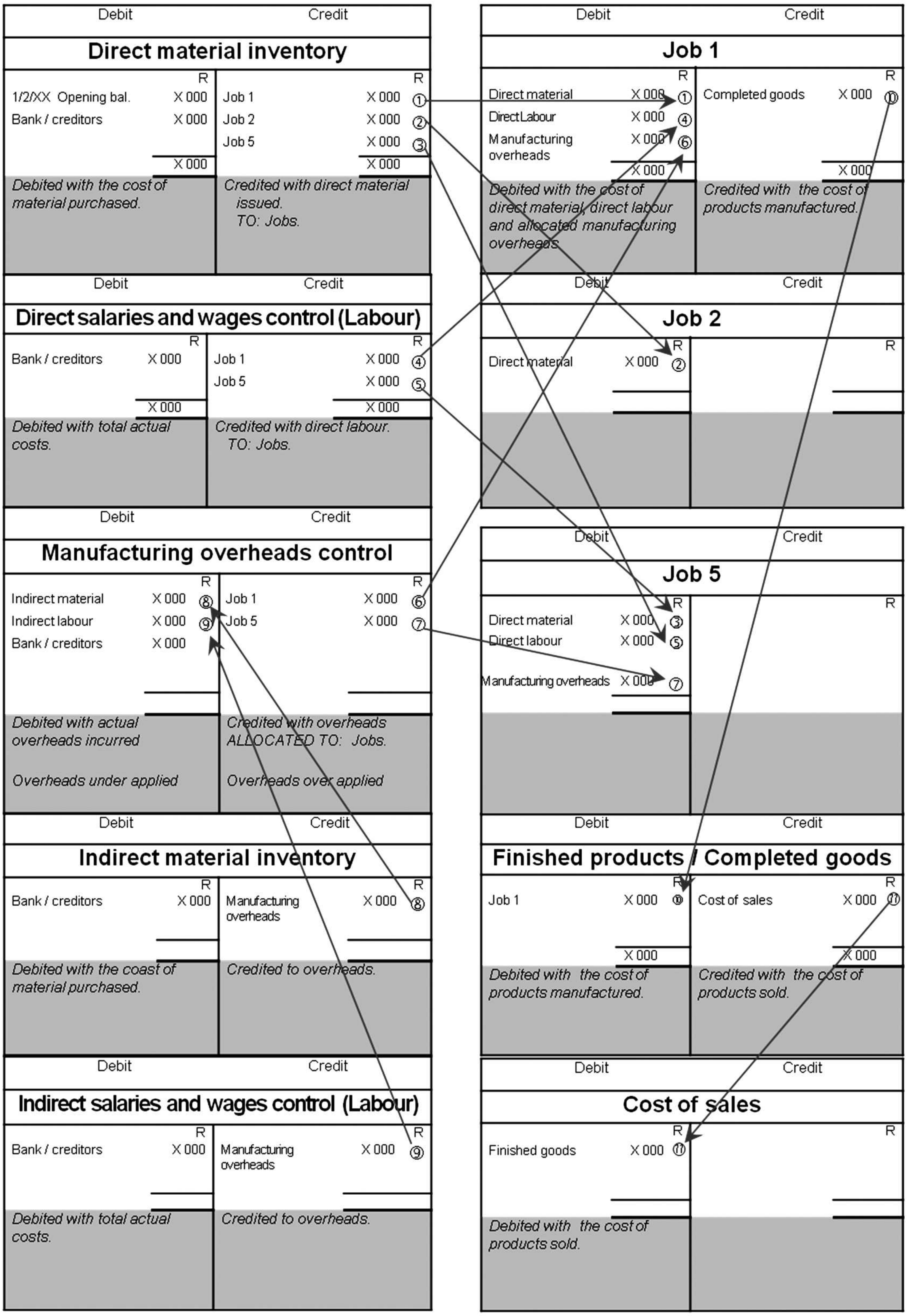


FIGURE 13.1: Flow of costs in a job costing system

Activity 13.1

Khetiwe Printers issued the following material:

	R
To job A	100
To job B	300
To job C	400

REQUIRED

Record the issuing of material in the general ledger (as well as the cost ledger) of Khetiwe Printers.

Solution to Activity 13.1

GENERAL LEDGER

Material control account

		R
		800

WIP control account

R	
800	

COST LEDGER

Job 1

	R	
Material	100	

Job 2

	R	
Material	300	

Job 3

	R	
Material	400	

NOTE

① The sum of the individual jobs in the cost ledger is equal to the balance in the general ledger WIP account.

② A similar process is followed for direct labour and overhead costs. A more comprehensive activity follows next.

Activity 13.2

Masenya Printers uses a job costing system. The following information is available for the first month of trading:

	R
• Material purchases	42 600
• Material was requested as follows:	
Direct material:	
Job 1	16 950
Job 2	17 360
Indirect material	4 360
• The following is an extract from the wages paid:	
Direct labour paid for:	
Job 1 (249 hours)	12 450
Job 2 (273 hours)	13 650
Indirect labour	2 800

- Overheads are allocated on the basis of direct labour hours. The budgeted average manufacturing overheads amount to R27 000 per month, and the estimated average normal capacity is 600 direct labour hours per month.
- Job 1 (300 units) was completed during the month, and 200 units were sold during the first month of trading for R130,00 per unit. Job 2 is still in process at the end of the month.
- The following actual expenses were debited to the overheads control account:

	R
Electricity and water	3 130
Depreciation – equipment	8 200
Factory rental	8 000

REQUIRED

a. Calculate the total cost of job 1 and the cost of WIP (incomplete work) on job 2 at the end of the first month of trading. T-accounts are not required.
b. Calculate the profit or loss on the sale of 200 units of job 1.
c. Calculate the over or under recovery of production overheads for the month.

Solution to Activity 13.2

a. **Total cost of jobs**

	Job 1	**Job 2**
	R	**R**
Direct material	16 950	17 360
Direct labour	12 450	13 650
Overheads	11 205 ①	12 285 ②
Cost of job 1 transferred to finished goods	40 605	
Cost of WIP job 2		43 295

Explanatory notes

① Overheads are allocated on the basis of direct labour hours. The budgeted manufacturing overheads amount to R27 000 per month and the estimated normal capacity is 600 labour hours per month.During June 249 labour hours were spent on job 1.

Budgeted rate per hour: R27 000/600 hours = R45 per direct hour
Thus: R45 per hour x 249 hours = R11 205

② During June 273 labour hours were spent on job 2.
Thus: R45 per hour x 273 hours = R12 285

b. **Profit or loss on job 1**

	R
Sales (200 units x R130)	26 000
Less: Cost of units sold	27 070 ①
Net loss on the sale of 200 units	(1 070)

① R40 605/300 units x 200 units = R27 070

c. **Over or under recovery of production overheads for the month**

	R
Actual overheads incurred (R4 360 + R2 800 + R3 130 + R8 200 + R8 000)	26 490
Allocated to WIP (R11 205 + R12 285)	23 490
Under recovery	3 000

6 Summary

In this study unit, you have learnt the following about the job costing system:

- ***When to use*** the job costing system – it depends on the market, the production and the product.
- ***Where to use*** job costing –job costing can be used in manufacturing enterprises, service enterprises and consultancies.
- ***The flow of the documents*** in a job-costing system – different documents are used in job costing systems.
- ***The flow of manufacturing costs through the ledger accounts*** when a job costing system is used – how costs are recorded and how profit is calculated.

Self-assessment Activity

a. Identify three factors you would consider when deciding whether to use a job or process costing system.
b. Describe briefly how the costing ledger is linked to the general ledger.
c. List two examples of products or services for which a job costing system could be used.

QUESTION 1

Elco Manufacturing Ltd. manufactures machinery according to client specifications. On 1 May the incomplete work consisted of one job, job 5. The recorded costs on this incomplete job amounted to R13 000.

The following information is available for May:

- Material amounting to R7 500 was in inventory at the beginning of the month. Additional material to the amount of R38 200 was purchased. A single material account is used for both direct and indirect material.
- Material was issued as follows:

	R
Job 5	15 800
Job 6	13 400
Job 7	9 100
Indirect material consumed	2 100

- Labour-related costs:

Job 5	16 000
Job 6	12 000
Job 7	9 000
Indirect labour and supervision	5 500

- Other manufacturing overheads for May:

Depreciation on machinery and equipment	6 000
Water and electricity	3 000
Sundry overheads	3 900

  Overheads are allocated to jobs on the basis of direct labour costs. The budgeted overheads recovery rate is R0,50 for every R1 of direct labour cost.
- Jobs 5 and 7 were completed during the month and invoiced to the clients concerned at R65 600 and R27 200 respectively.

REQUIRED

a. Calculate the profit and loss for May for each job and for Elco as a whole and indicate the inventory value of each at the end of the month.
b. Assume that there was an amount of R2 000 in under applied overheads at the end of May. Draft a journal entry showing how these under applied overheads would normally be dealt with in the company's books at the end of the period.

QUESTION 2

BMX Ltd. uses a job costing system to accumulate costs for their tailor-made range of products. The normal average capacity is 5 000 labour hours per month and the budgeted average manufacturing overheads are R175 000 per month. Overheads are allocated on the basis of labour hours.

In July an order was received (job 103) to manufacture 250 units of item X. The costing section carried out the following calculation of the estimated direct costs of completing this job:

Material per item X	R131,50
Labour per item X	7,5 hours @ R15 per hour

The following relevant actual information is available for July:

- **All** the material required to complete job 103 was issued at R140,00 per item X.
- However, only 200 units of item X were completed and transferred to completed goods.

- A total of 1 600 hours were worked on job 103 in order to complete the 200 units of item X.
- Manufacturing overheads for the month amounted to R192 000.
- In the course of the month, 5 600 labour hours were worked at R16 per hour.

The job costing system operates as follows:

- Units completed on any order are booked to completed inventory at **estimated** cost as and when they are completed.
- Inefficiencies (actual costs > estimated costs) in the production of the **completed** units are written off as period costs only when transfer to completed inventory has occurred.
- WIP for incomplete units is carried at actual cost.

REQUIRED

a. Calculate the estimated total absorption cost for job 103 and the cost per unit of item X.
b. Prepare the WIP account for job 103 in July.
c. Calculate the total over or under applied manufacturing overheads for BMX Ltd. in July.

QUESTION 1

a. Calculating the profit or loss for May for each job

	Job 5	Job 6	Job 7	Total
WIP 1 May	**R**	**R**	**R**	**R**
Direct material consumed:	13 000			13 000
	15 800	13 400	9 100	38 300
Opening inventory				7 500
Plus: Purchases				38 200
				45 700
Less: Indirect material				2 100
				43 600
Less: Closing inventory				5 300
Direct labour	16 000	12 000	9 000	37 000
Allocation of overheads @ R0,50	8 000	6 000	4 500	① (18 500)
Total overheads				① 20 500
Indirect material				2 100
Indirect labour				5 500
Depreciation				6 000
Water and electricity				3 000
Sundry overheads				3 900
	52 800	31 400	22 600	106 800
Less: Closing inventory of incomplete work		31 400		31 400
Cost of sales	52 800	–	22 600	75 400
Sales	65 600	–	27 200	92 800
Gross profit	12 800	–	4 600	17 400

Inventory value:

Raw material	R 5 300
WIP	R31 400

b. Journal entry

	Debit	Credit
Cost of sales (manufacturing overheads under applied)	2 000	
Manufacturing overheads		2 000

NOTE

① Actual overheads incurred of R20 500, less allocated to jobs of R18 500, leaves R2 000 under applied.

QUESTION 2

a. Estimated (quoted) total cost for job 103

		R
Material:	(250 units x R131,50)	32 875
Labour:	(250 units x 7,5 hours x R15)	28 125
Overheads:	(250 units x 7,5 hours x R35)	65 625
		126 625

Cost per item X = R126 625 ÷ 250 = R506,50

b. WIP account for job 103 in July

Actual costs incurred:			R
Material	:	(250 units x R140)	35 000
Labour	:	(1 600 hours x R16)	25 600
Overheads applied	:	(1 600 hours x R35)	56 000
			116 600

COST LEDGER

Job 103

Material	35 000	Completed goods	101 300
Labour	25 600	Production inefficiencies	8 300
Overheads	56 000	Closing inventory	7 000
	116 600		116 600
Opening inventory	7 000		

Calculations

① Budgeted overheads recovery rate = R175 000 ÷ 5 000 labour hours = R35

② Did you notice that all the material was issued from the stores for the whole order of 250 units of item X, even though only 200 units were completed? The closing WIP consists of the material component only at the actual cost = 50 x R140 = R7 000.

③ On average eight hours (1 600 200) was spent on each unit of item X instead of the budgeted 7,5 hours.

④ 200 completed units x R506,50 estimated cost = R101 300

⑤ Total actual cost R116 600, less closing inventory of R7 000, less allocated to completed goods R101 300 = R8 300. See note below!

⑥ Actual labour cost was R16 per hour, whilst the estimated cost was R15 per hour.

NOTE

Did you notice that the company paid more for the material and labour than was estimated? They also spent 1 600 hours finishing the 200 units instead of the 1 500 estimated (200 x 7,5). These made up the production inefficiencies that were calculated in . In Topic 10 – Standard costing, you will learn how to account for these inefficiencies or variances.

c. Total overheads over or under applied

Actual overheads – overheads applied

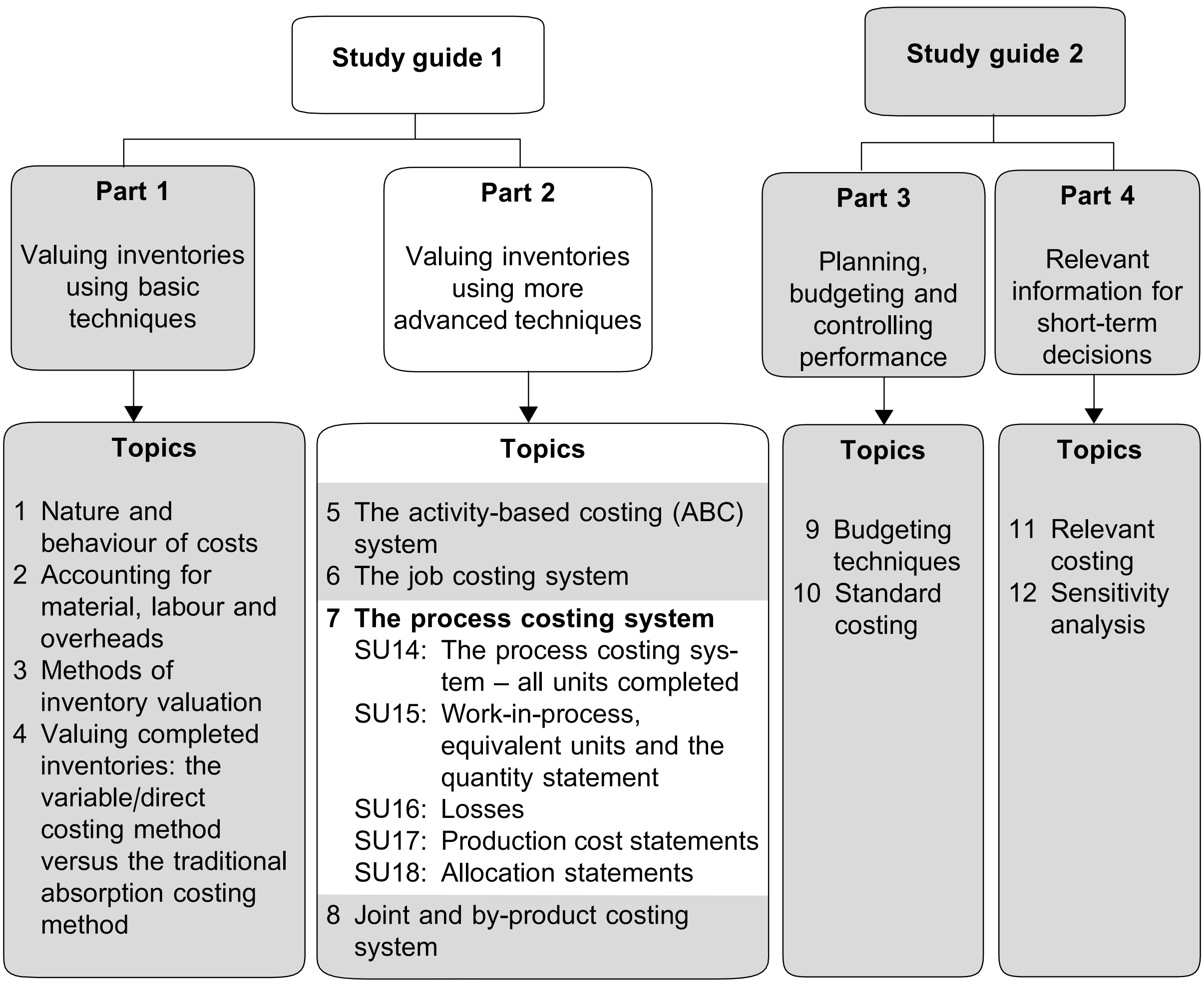
= R192 000 – [5 600 hours x R35]
= R192 000 – R196 000
= R4 000 over applied

The process costing system

LEARNING OUTCOMES

After studying this topic, you should be able to:

- describe the uses of a process costing system
- calculate unit costs in a system with a single manufacturing process and in a system with two or more consecutive manufacturing processes, assuming all units are completed
- calculate completed units and the equivalent units for work-in-process (WIP)
- calculate the normal and abnormal losses for a specific period, depending on the wastage point
- prepare a Quantity Statement, Production Cost Statement and Cost Allocation Statement, all of which include losses, based on the weighted average method and on the first-in-first-out (FIFO) method of inventory valuation
- record and allocate process costs in the general ledger



STUDY UNIT	TITLE
Study unit 14	The process costing system – all units completed
Study unit 15	Work-in-process, equivalent units and the quantity statement
Study unit 16	Losses
Study unit 17	Production cost statements
Study unit 18	Allocation statements

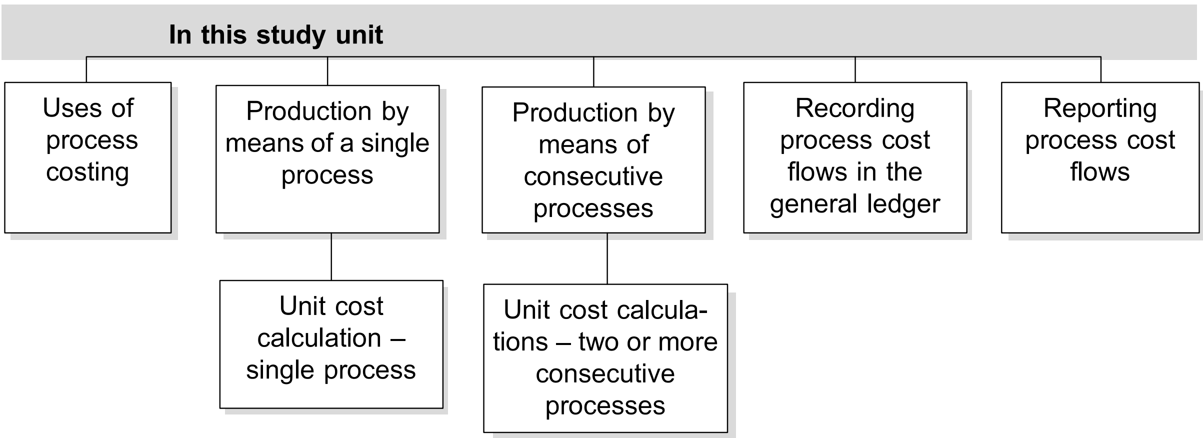
Introduction

In the previous topic (topic 6, dealing with the job costing system), you learnt that an organisation could make use of a job costing system or a process costing system to calculate and account for the unit cost of a product or group of products. You also learnt how to account for the cost of jobs and their profits. In this topic, we will look in detail at the other side of the scale: process costing. In this case, the accounting focus shifts from specialised or unique jobs or products (topic 6) to similar or identical products produced in large quantities.

The application of process costing techniques will be discussed within the contexts of completed and partially completed production output and you will learn how to account for material, labour and manufacturing overhead costs, and for different types of losses that could be incurred in a manufacturing process.

STUDY UNIT 14

The process costing system – all units completed



1 Introduction

The nature of certain products is such that these products must be manufactured in a **process**. A manufacturing process mainly consists of physical *inputs* (material or partially completed units), working on those inputs, ie *converting* them using labour and overheads (eg electricity and machine time) and the fully or partially completed units, or physical *output*. The conversion process takes place over time.

Examples of such products might include chemicals (eg household or vehicle cleaning agents), fuel, certain medicines, beverages and certain food products (eg flour or canned foods). Larger items, such as computers and motor vehicles, are assembled from individual components in a sequence of processes.

Consider the challenges the following organisation may experience in costing its product, this being a breakfast cereal measured in units of 1 kg each and produced in a single production process:

Material cost incurred in the period	
Oats	R100 000
Fruit	R230 000
Nuts	R340 000
Other	R200 000
Direct labour costs for the period	R 80 000
Manufacturing overheads	R120 000

Raw materials are added at the beginning of the process. Conversion of the raw materials into the cereal takes place evenly throughout the process.

At the end of the previous period, the organisation had a mixture of 15 000 kg of product that was still in the process of being converted into the final product. This mixture was 60% complete as far as its conversion was concerned, and information about the cost of material, labour and manufacturing overheads already incurred was available from the accountant.

In the current period, the organisation put 250 000 kg of ingredients into the process.

As the organisation dries the fruit used in production of the cereal, the mass of the fruit decreases, which results in the final output for 1 kg of input only being 900 g on average. In the current period, the organisation also experienced a power outage, which led to some of the product being spoilt.

In the current period, 180 000 kg of cereal was fully completed. However, by the end of this period, another 30 000 kg of product mix was still in the process of being converted into the final product. (The level of completion was 20%.)

Process costing will help us to obtain some of the answers that are needed in the above scenario. We will divide this topic into five study units in order to gradually lead you into the intricacies of process costing.

In this study unit, we will start off by discussing the following:

- when a process costing system is used and for which purposes
- how to calculate the cost per unit manufactured in:
  - a single process
  - consecutive processes (assuming all units are completed)
- how costs that accumulate in respect of a process should be recorded in the organisation's general ledger

For production in **consecutive** processes, we will confine our discussion to the following:

- basic concepts of production by means of consecutive processes
- basic unit cost calculations *for completed units only*
- basic general ledger entries

NOTE

In this topic, we will assume the following:

- All overheads incurred are *manufacturing* overheads.
- The conversion process takes place evenly (uniformly) over the production timespan.
- The actual overheads incurred agree to the allocated overheads (ie *there are no over applied or under applied manufacturing overheads*).
- The terms
  - finished goods, finished products or finished units and
  - completed goods, completed products or completed units

  are used interchangeably.

2 Uses of process costing

An organisation needs to know what the cost is to manufacture units in a process in order to

- determine appropriate selling prices for the units (where the organisation itself can set the price); and
- accurately report profits made as these units are sold.

Accurate determination of product cost is also required to enable an organisation to value WIP and unsold completed units at the end of the period in terms of International Financial Reporting Standards (IFRS) – specifically IAS 2.

> **PROCESS COSTING SYSTEM**
>
> A *process costing system* is a costing system used to **obtain, record and report cost data** in industries where large quantities of similar products pass through a single process or consecutive processes in the course of **production**.

A pure *process costing system* is different from other costing systems such as the job costing system (see topic 6), because the different units of the product (eg litres of chemicals) *cannot be distinguished* from each other in the process. This is because these units are

- *identical, and*
- produced in *bulk*.

For example, when different ingredients are properly mixed in a large container in order to manufacture dog shampoo, each one of the many litres of the dog shampoo will be exactly the same and we will not be able to single out a specific item (litre of dog shampoo) from the mixture.

In more complex manufacturing environments, where products such as computers and motor vehicles are manufactured, a costing system that combines process costing and job costing may be applicable.

Similar models (products) are manufactured in batches (or production runs). In different consecutive processes, material is added and conversion takes place that enables the models to be distinguished from each other. Each batch still consists of identical units produced in bulk. This is called batch or operation costing.

In the final instance, this could also be combined with **job costing** methods (eg right at the end of the motor vehicle assembly process when an individual motor vehicle is fitted with optional extras according to client specifications).

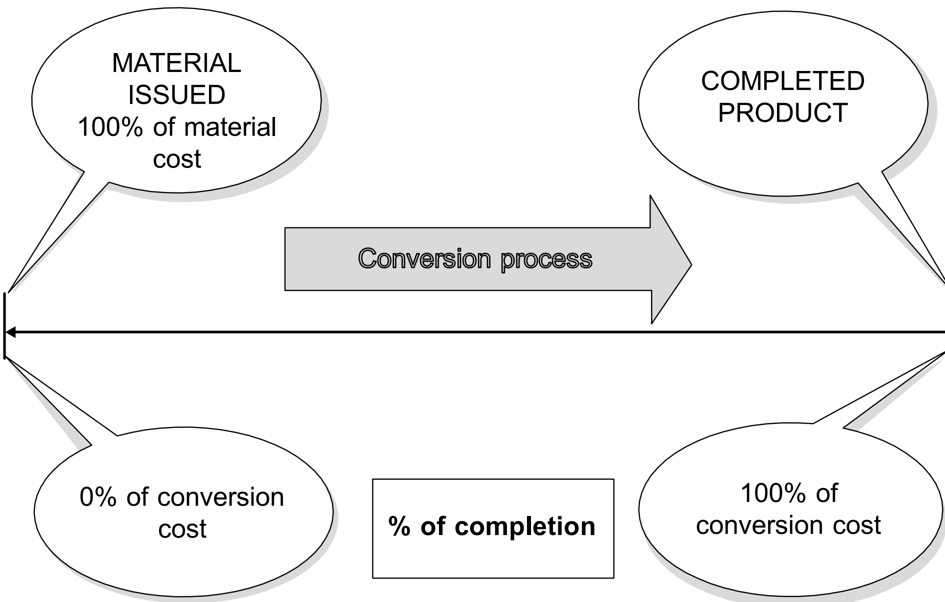
In MAC2601, we will only focus on simple production processes.

NOTE

In this topic, the term PRODUCTION is sometimes used to refer to the mass or mixture of completed or partially completed units in/from a manufacturing process (in addition to the use of the term for the physical activity of manufacturing). We can also refer to these units as ‘‘production output’’.

3 Production by means of a single process

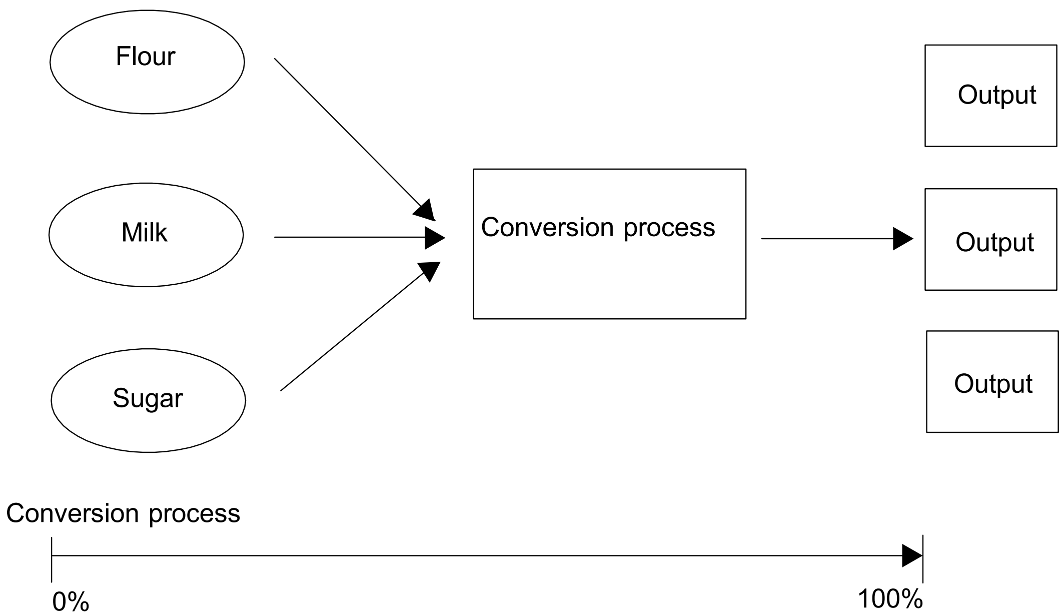
Figures 14.1a and 14.1b illustrate the conversion of inputs (material) into outputs in a single manufacturing process.



Source: Author, 2012

FIGURE 14.1a: Diagrammatic representation of a single manufacturing process for a specific product

Raw material



Source: Author, 2012

FIGURE 14.1b: Graphic representation of a single manufacturing process for a specific product

The correct quantity of material is **issued** from material stores to the plant when required for production. For costing purposes, we therefore say that the process is 100% **complete** for material as soon as the material is issued – the product carries 100% of the material cost.

NOTE

In practice, the material may be **added** at the plant or in the factory at any *specific point* in or *evenly* during the same process. This will have an impact on the valuation of *incomplete units*. However, for the purposes of this module, MAC2601, material will always be added at the starting point in the process.

Conversion begins once the material has been received. At this stage, the conversion process is 0% complete. We indicate the *end* of the conversion process as 100% because – at this point in time – the manufacturing process is complete. The final product (eg a liquid bathroom cleaner) is now ready to be sold to the customer.

3.1 Unit cost calculations in a system with a single process

In order to determine the value of inventory in a process costing system, the average cost per unit of the final product has to be calculated. The inventory may consist of both work-in-process (also called WIP or incomplete work) and finished products. This study unit assumes that all units started were completed, whereas study unit 15 will deal with WIP as well. Study units 14 and 15 assume that no losses occurred in the process. (We discuss losses in study unit 16.)

To calculate the average cost per unit (from now on referred to as the ''cost per unit'' or ''unit cost''), it is important to obtain the following data from the process costing system:

- total manufacturing cost for a specific period (accumulated cost at the end of the process)
- number of units produced in the specific period (units in existence at the end of the process)

In the absence of any incomplete units (WIP) at both the beginning and the end of the specific period, the cost per unit will be calculated by dividing the total manufacturing cost for the specific period by the number of units produced in this specific period.

Activity 14.1

Calculating unit cost in a system with a single manufacturing process

Fizzy Zoeler (Pty) Ltd. manufactures a popular fizzy drink in a single process and makes use of a process costing system.

Management obtained the following cost and unit data for March 20X5 (assume there was no opening or closing WIP):

	R
Material	150 000
Labour	60 000
Overheads	75 000
Total manufacturing cost	285 000
Number of units produced	57 000

REQUIRED

Calculate the cost per unit for March 20X5.

Solution to Activity 14.1

Using the method provided in the introduction above, the cost per unit will be calculated by dividing the total manufacturing cost for March 20X5 by the number of units produced in March 20X5, since there was no opening or closing WIP.

Step 1

Determine the total manufacturing cost for March 20X5.

R285 000 (given)

Step 2

Determine the number of units produced in March 20X5.

57 000 units (given)

Step 3

Apply the formula to calculate the cost per unit for the period.

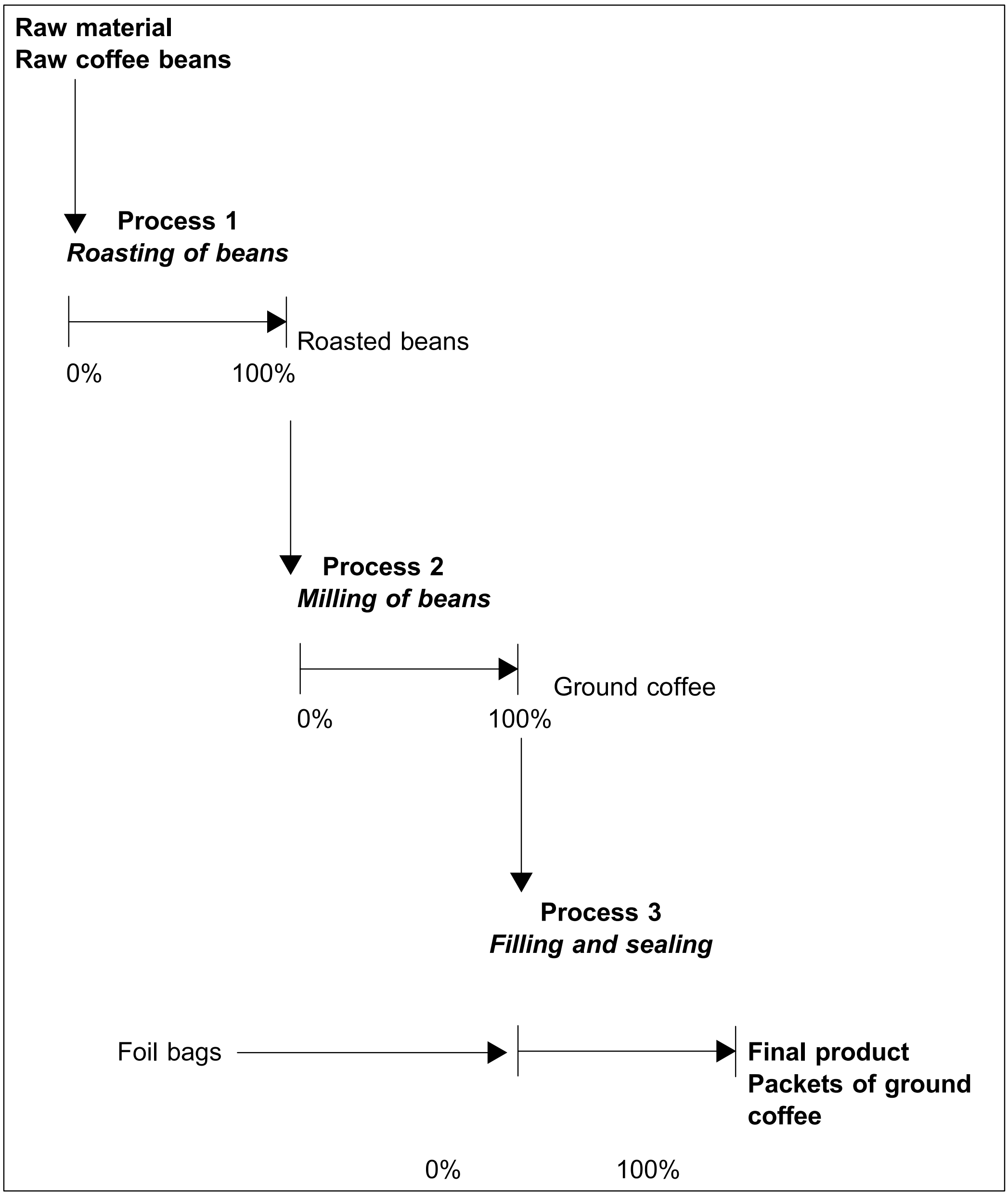
Cost per unit for the period	=	total manufacturing cost for the period/ number of units produced during the period
	=	R285 000 / 57 000 units
	=	R5 per unit

NOTE

We describe each of the above steps **only** to explain the calculation. If this was an assignment or examination question, the eventual calculation (highlighted in the solution above) would be sufficient and you would not have to provide a written description for each of the steps.

4 Production by means of consecutive processes

As we said earlier on, certain products may be manufactured in two or more consecutive processes. An example of such a product would be ground filter coffee, where process one is the roasting of the coffee beans, process two the milling (grinding) of the coffee beans and process three the packaging of the ground coffee (filling and sealing of the foil bags).



Source: Author, 2012

FIGURE 14.2: Diagrammatic representation of three consecutive manufacturing processes as applied in the production of packets of ground coffee.

Let us now consider a few important concepts relating to figure 14.2:

- In a process costing system, material, labour and overhead cost data has to be obtained, recorded and reported (as with other costing systems).
- Material has to be added at the beginning of process 1, otherwise the process cannot start.
- The **output of one process** automatically becomes **the input of the following process**.
- Additional material (eg foil bags, or even flavouring) could also be issued to production at specific intervals in, or continuously throughout, some of the processes.
- *Conversion* takes place evenly throughout each of the processes and conversion costs therefore accumulate as the product moves on through the processes.

- The unit costs accumulate as the product moves through the processes and, eventually, the unit costs of the final product can be calculated.

NOTE

In topic 2, you learnt that it is the *allocated* overheads that should be included in product costs, and therefore in the valuation of inventory. You have also learnt that the difference between actual and allocated overheads (ie over applied or under applied overheads) should be treated as a period cost, and therefore *excluded* from the value of inventory.

This principle also applies to process costing: it is the *allocated* overheads in the production account that will be allocated to products manufactured in the process/es and *not* the actual overheads incurred (paid in cash or accrued).

Conversion taking place ‘‘evenly throughout the process’’ refers to the *activity* of converting process inputs into outputs and *does not mean* that the cash outflows involved take place evenly throughout the process. For instance, salaries and wages are only paid at the end of the month or week, even though workers are continuously busy converting products (from 0%–100%). Similarly, overheads will accumulate in the process account (ie be allocated to products) independent of whether these costs are eventually under or over recovered.

Also note that, when we refer to labour costs and overheads being ‘‘incurred’’ in the same way, we are actually saying (for the purposes of this topic) that the labour and overhead *activities* take place in the same way (usually evenly throughout the process). Should you come across a MAC2601 question indicating that labour costs and overheads, or conversion costs, are ‘‘*incurred evenly throughout the process"*, this will also refer to the relevant *activities* taking place evenly throughout the process (and not the actual cash flows or accruals).

4.1 Unit cost calculations in a system with two or more consecutive processes

The next activity illustrates how to calculate unit cost in multiple processes.

Activity 14.2

Calculating unit cost in a system with two or more consecutive processes

Petrolco Ltd. manufactures aeroplane fuel in four consecutive processes and uses a process costing system.

The following cost and unit data has been obtained for June 20X6 (assume there was no opening or closing WIP):

	Process 1	**Process 2**	**Process 3**	**Process 4**
	R	**R**	**R**	**R**
Material added	12 000	–	–	14 000
Labour cost	29 000	16 000	15 000	2 000
Overheads allocated	9 000	20 000	6 000	7 000

Output at the end of each of the processes consisted of 250 kilolitres (kℓ) of production.

NOTE

Did you notice that we assume that no litres were spilled during the four processes? We will deal with spillage in study unit 16.

REQUIRED

Calculate the cost per kilolitre after completion of each of the processes.

Solution to Activity 14.2

	Process 1	**Process 2**	**Process 3**	**Process 4**	**Finished products – total**
	R	**R**	**R**	**R**	**R**
Cost of previous processes	–	50 000	86 000	107 000	
Material	12 000	–	–	14 000	26 000
Labour	29 000	16 000	15 000	2 000	62 000
Overheads	9 000	20 000	6 000	7 000	42 000
Total manufacturing cost	50 000	86 000	107 000	130 000	130 000
Kilolitres produced	250	250	250	250	250
Cost per kilolitre	R200	R344	R428	R520	R520

NOTE

Did you notice that, in processes 2 and 3, only conversion activities occurred? Material was not added in all the processes. This is quite common.

The cost per kilolitre was calculated by dividing the total manufacturing cost accumulated up to the end of a process by the **output** at the end of the specific process (''kilolitres produced''). You will note that the cost per kilolitre of the final product can be calculated as the total manufacturing cost up to the end of process 4 (because this is the final process), divided by the final output (output after process 4 has been completed). This renders the same cost per kilolitre as arrived at when calculating the cost per kilolitre at the end of process 4 (R520).

Also note from the example that cost per unit will increase as the product passes through the processes. If the reporting period ended just as the units have passed through process 2, the inventory would be valued at R344 per kilolitre (R344/kℓ). However, if the period ended just as the units have passed through process 3, the valuation would be done at R428 per kilolitre.

NOTE

Please note that in a MAC2601 exam you may write in an abbreviated form as used above. This might save valuable time. (R344/kℓ instead of R344 per kilolitre.)

5 Recording process cost flows in the general ledger

The following general ledger accounts can be used to record cost in a process costing system in the absence of any WIP at both the beginning and the end of the specific period and where no losses/spillage occurred:

- Material
- Labour
- Overheads
- A production account for each process
- Finished products

Activity 14.3

Recording cost in a process costing system

REQUIRED

a. With reference to the information provided in **Activity 14.2** (section 4) and the additional information below, illustrate how the cost flow will be recorded in Petrolco Ltd's general ledger:

	R
Opening balance – material	10 000
Material purchases	18 000

b. What is the value of inventory in the statement of financial position at 30 June 20X6?

c. Calculate the cost per unit of a completed kilolitre in terms of its cost components.

Solution to Activity 14.3

a. PETROLCO LIMITED

General ledger for the month ended 30 June 20X6

Material

Dr	R	Cr	R
	R		R
Opening balance	10 000	Process 1	12 000
Bank/Creditors*	18 000	Process 4	14 000
		Closing balance	2 000
	28 000		**28 000**
Opening balance (following period)	2 000		

Labour

Dr	R	Cr	R
	R		R
Bank/Creditors*	62 000	Process 1	29 000
		Process 2	16 000
		Process 3	15 000
		Process 4	2 000
	62 000		**62 000**

Overheads

Dr	R	Cr	R
	R		R
Bank/Creditors*	42 000	Process 1	9 000
		Process 2	20 000
		Process 3	6 000
		Process 4	7 000
	42 000		**42 000**

Process 1: production account

Dr	R	Cr	R
	R		R
Material	12 000	Process 2	50 000
Labour	29 000		
Overheads	9 000		
	50 000		**50 000**

Process 2: production account

Dr	R	Cr	R
	R		R
Process 1	50 000	Process 3	86 000
Labour	16 000		
Overheads	20 000		
	86 000		**86 000**

Process 3: production account

Dr	R	Cr	R
	R		R
Process 2	86 000	Process 4	107 000
Labour	15 000		
Overheads	6 000		
	107 000		**107 000**

Process 4: production account

Dr	R	Cr	R
	R		R
Process 3	107 000	Finished products	130 000
Material	14 000		
Labour	2 000		
Overheads	7 000		
	130 000		**130 000**

Finished products

Dr	R	Cr	R
	R		R
Process 4	130 000		

* This depends on whether the goods and/or services are acquired on a cash or credit basis.

b. Inventory

		R
Raw material		2 000
Finished products		130 000
		132 000

c. Cost components

		R
Material	(26 000 / 250)	104
Labour	(62 000 / 250)	248
Overheads	(42 000 / 250)	168
		520

6 Reporting process cost flows

There are three types of basic process cost reports:

- Quantity statement (also called the production statement)
- Production cost statement
- Cost allocation statement (also called the allocation statement)

Although different formats of the above process cost reports are in use, we use standard formats for the purposes of MAC2601. These formats and the information contained in the different statements are discussed in study units 15 to 18.

7 Summary

In this study unit, you learnt the following:

- A process costing system is used to obtain, record and report cost data where mass production of identical products is applicable.
- Products may be manufactured in a single process or in a number of consecutive processes.
- In a process costing system, the unit cost has to be calculated (refer to **Activity 14.1** and **Activity 14.2** in this study unit) after each process.
- Process costs are recorded in the general ledger and reported in a quantity statement, production cost statement and cost allocation statement.

In the next study unit, you are going to learn how to calculate equivalent units in a process costing system, and how to prepare quantity statements using different methods of inventory valuation.

NOTE

Although we introduced you to the basic concept of consecutive processes, we will only use one process for illustration purposes in the *remainder* of this topic. You will learn to apply the concepts covered in study units 15 to 18 to consecutive processes in **MAC3701,** which deals with the **application of management accounting techniques.**

For the purposes of MAC2601, you will only be expected to know the following regarding **consecutive** processes:

- basic concepts of production by means of consecutive processes (as discussed in this study unit)
- how to perform basic unit cost calculations in a system with two or more consecutive processes (as illustrated in this study unit) for completed units only
- how to record basic process cost flows regarding consecutive processes in the general ledger (as illustrated in this study unit)

Self-assessment Activity

Cleancor (Pty) Ltd. manufactures a household cleaning agent in two consecutive processes, namely mixing and heating the chemicals (process MH) and then packaging the cleaning liquid (process P).

The following data was obtained from the process costing system and relates to the year ended 31 May 20X4:

	Process MH	**Process P**
Material bought and issued	R35 600	R24 800
Conversion cost	R48 200	R18 600
Units completed (litres)	20 000	20 000

There was no opening or closing inventory of material or WIP. 15 000 litres of the finished product were sold during the year.

REQUIRED

a. Calculate the total manufacturing cost per litre of the final product.

b. Record the process cost flows for the year in the general ledger of Cleancor (Pty) Ltd.

c. Name the three process cost reports that Cleancor (Pty) Ltd. will use to report the process cost flows for the year.

Solution to Self-assessment Activity

a. Total manufacturing cost per litre

	Process MH	**Process P**	**Finished products – total**
	R	**R**	**R**
Costs of previous processes	–	83 800	
Material	35 600	24 800	60 400
Conversion costs	48 200	18 600	66 800
Total manufacturing costs	83 800	127 200	127 200
Number of litres produced	20 000	20 000	20 000
Cost per litre	R4,19	R6,36	R6,36

b. General ledger entries

CLEANCOR (PTY) LTD

General ledger for the year ended 31 May 20X4

Dr		Cr	
Material			
	R		R
Bank/Creditors (35 600 + 24 800)	60 400	Process MH	35 600
		Process P	24 800
	60 400		**60 400**

Dr		Cr	
Conversion costs			
	R		R
Bank/Creditors (48 200 + 18 600)	66 800	Process MH	48 200
		Process P	18 600
	66 800		**66 800**

Dr		Cr	
Process MH: Production account			
	R		R
Material	35 600	Process P	83 800
Conversion cost	48 200		
	83 800		**83 800**

Dr		Cr	
Process P: Production account			
	R		R
Process MH	83 800	Finished products	127 200
Material	24 800		
Conversion cost	18 600		
	127 200		**127 200**

Dr		Cr	
Finished products			
	R		R
Process P	127 200	Cost of sales (15 000 x 6,36)	95 400
		Closing balance	31 800
	127 200		**127 200**
Opening balance	31 800		

Dr		Cr	
Cost of sales			
	R		R
Finished products	95 400		

c. Process cost reports

- i Quantity statement
- ii Production cost statement
- iii Cost allocation statement

NOTE

- Do not forget to include the cost of previous processes in the total manufacturing cost when two or more consecutive processes exist.
- If there was no opening and no closing inventory of material, the plant used all material purchased during the year in production.
- In process costing exercises or questions, it could save time to combine labour and overhead information into conversion cost for the purposes of calculating unit cost (if they are incurred in the same way). In the general ledger, labour and overheads will still be accounted for separately for control purposes, especially where a standard

costing system is employed – see topic 10. However, this question did not provide enough information to separate labour and overheads in the general ledger.

- Cost of sales is calculated as the cost per unit (as calculated in a.), multiplied by the number of units sold – in this activity R6,36 x 15 000 = R95 400.
- The closing inventory of finished products as at year-end automatically becomes the opening inventory of finished products for the next financial year.

Enrichment activity 14.4

If you want to learn more about real-life manufacturing processes, you can search the internet for videos about manufacturing processes. To do this search, we suggest you type in phrases such as the following:

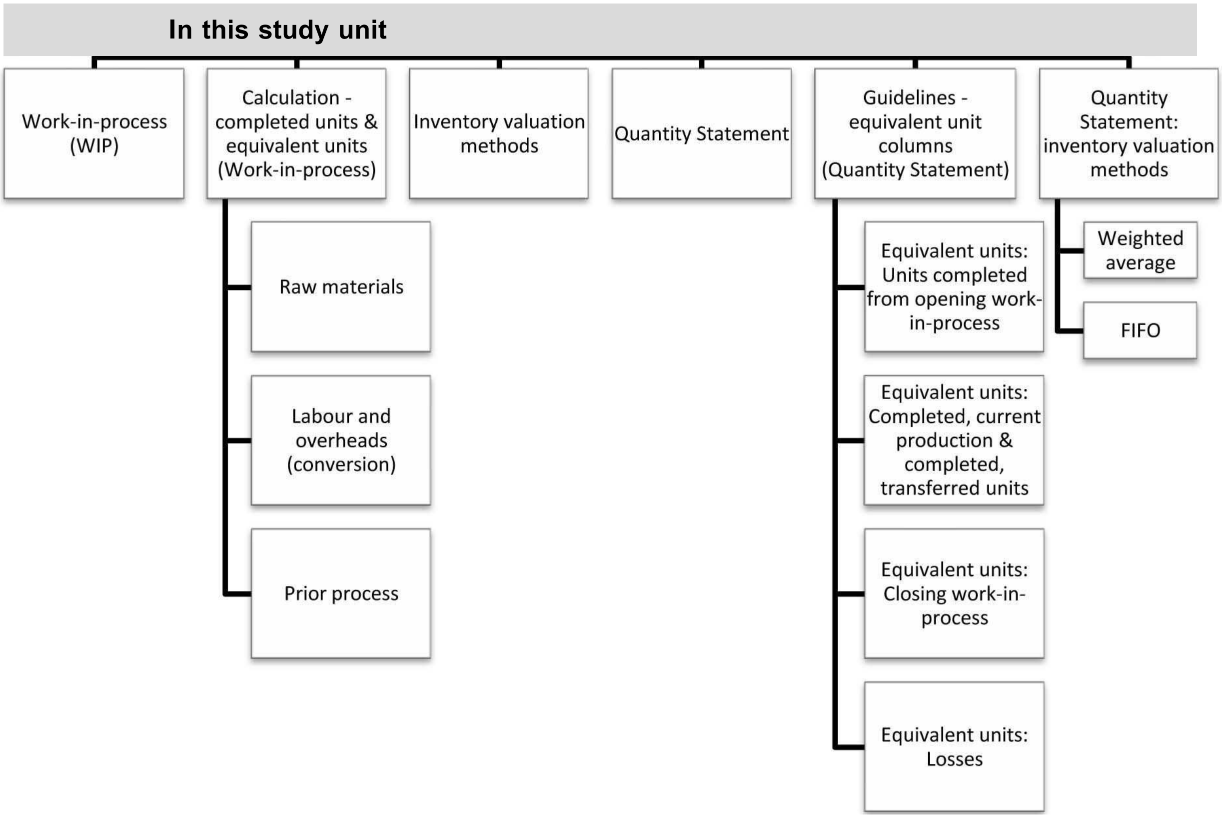
- "Video on how glass bottles are made"
- "Video on how pencils are made"

Additional reading

Please refer to the list of sources for additional reading at the end of study unit 18.

STUDY UNIT 15

Work-in-process, equivalent units and the quantity statement



1 Introduction

In study unit 14, we said that you need to know what the *total manufacturing cost* for and the *number of units manufactured* in a specific period are in order to calculate the average cost per unit. In study unit 14, we only focused on completed units.

In this study unit, you are going to learn how to calculate unit cost for work-in-process. You will also learn how to prepare quantity statements, with the focus on how to calculate the equivalent units that are to be included in a quantity statement. Note that we are going to demonstrate both the weighted average and the FIFO method of inventory valuation for goods manufactured in continuous processes.

2 Work-in-process (WIP)

A manufacturing process continues over different reporting periods (eg months or years). For example, the manufacturing process of wine often stretches over a number of years, as the wine ages to perfection in barrels. Other products usually have shorter processing times. However, it is possible that, at the end of a specific period, some of the units in the process will not be fully completed. As mentioned in study unit 14, these incomplete units at the end of a specific period are referred to as work-in-process (WIP).

To calculate the total manufacturing cost for a period is usually straightforward. The calculation of the number of units manufactured is somewhat more difficult for the following reasons:

- Processing of some units (WIP) may have already begun before the beginning of the current period. This means that only a portion of the work still has to be done in the current or a future period to fully complete these units.
- Some units (independent of the period in which the work on these units were started) may still be incomplete at the end of the current period, which means that some work will still have to be done on these units in the future.

We cannot simply take all the costs for the current period and apply these only to the fully completed units to calculate the average cost per unit, because this will overstate the average cost per unit. The incomplete units (WIP) will, to some extent, also have consumed resources (in the form of materials and conversion). We will therefore have to take into account the partially completed units.

Let us look at two simplified examples:

a. If I have a bottle completely filled with water and another that is filled up halfway with water, this is the same as having 1,5 bottles of water. This is straightforward, but if we think about which logical calculations we have automatically performed to arrive at the 1,5 bottles of water, we will arrive at the following:

1 bottle x 100%	=	1 bottle
1 bottle x 50%	=	0,5 bottles
Total:		1,5 bottles

The next example applies the same principle, and so does the rest of this topic.

b. If an organisation spends R1 000 000 and produces 50 000 units in a period, the cost per unit will be 1 000 000 / 50 000 = R20.

If, however, the organisation has only fully completed 40 000 units by the end of the current period, but did half of the work needed for completion of another 10 000 units, the following will apply:

- The total amount spent will be less than R1 000 000 (let us assume R900 000), because less work was done in the current period.
- The remaining 50% of the work on the 10 000 units will be performed in the following period and the costs of this remaining work (R1 000 000 – R900 000 = R100 000) will be incurred in the following period.
- The production of 10 000 units that are 50% complete are *equivalent* to 10 000 x 50% = 5 000 units being fully completed (based on the principle illustrated in the first example)!
- The calculation of cost per unit in the current period will now be 900 000 / (40 000 + 50% of 10 000). We will, therefore, arrive at 900 000 / 45 000 = R20 per unit. The cost to manufacture one unit of output remained the same as previously.

3 Calculation of equivalent units for WIP

We account for the partially completed units by converting them into **a comparable number of fully completed units called ``equivalent units"**. In order to do this, we have to assume that the cost for 100 units which are 60% complete are equivalent to the cost for 60 units which are 100% complete, and that the cost for 40 units which are 30% complete are equivalent to the cost for 12 units which are 100% complete, etcetera. The number of incomplete units (by physical counting) is thus multiplied by the stage (percentage) of completion to arrive at the equivalent units.

For example, if a unit costs R40 per unit to manufacture, it is 60% complete and there are 200 WIP units, the value of the WIP will be:

200 x (60% x R40) = R4 800,
or, in terms of equivalent units:
(200 x 60%) x R40 = R4 800.

NOTE

The incomplete units are *physical* units (you can count them!), while the equivalent units are a *concept* (to account for the cost)!

The **stage of completion** has to be **separately determined for each cost element** (raw material, labour and overheads – or raw material and conversion cost – as well as prior process cost).

3.1 Raw materials

As stated previously, for the purposes of this module, raw materials will always be added at the beginning of a process. In other words, the materials will always be added to a process when the process is 0% complete.

If material is added at the beginning of the process, any incomplete units will still be 100% complete in terms of the cost of material as soon as they have entered the process. Thus, the percentage of completion in terms of material cost will be 100%, independent of how far into the process these incomplete units are.

3.2 Labour and overheads (conversion)

As indicated before, it can often save time to combine labour and overhead information into conversion costs for the purposes of calculating unit cost in a process costing system. This will, however, only be possible if labour costs and overheads are incurred in the same way (usually evenly throughout the process). In addition, some questions do not provide enough information to treat labour and overheads separately. In the general ledger, labour and overheads would still be accounted for separately for control purposes (especially where a standard costing system is used).

For the purposes of this module, conversion will always take place evenly throughout the process.

On the one hand, this will mean that if 30% of the conversion work on the units in the process has been done, the process will be **30% complete** or, if 65% of the conversion work has been done, the process will be **65% complete**, etcetera.

On the other hand, if we know that the process is 20% complete and that conversion takes place evenly throughout the process, we should also know that:

- up to this point, a corresponding 20% of the conversion work would have been performed on the units involved, and
- these WIP units should each carry 20% of the relevant conversion cost per unit.

3.3 Prior process

In order to start moving through the next process in a set of sequential processes, a physical unit of production needs to be fully completed as far as all prior processes are concerned.

This implies that, when a unit reaches the second process of a set of processes, it should be 100% complete in terms of process 1 and 0% complete in terms of process 2. Similarly, when a unit reaches the third process of a set of processes, it should be 100% complete in terms of both process 1 and process 2 and 0% complete in terms of process 3.

Only in later modules will you be required to prepare quantity statements, production cost statements and cost allocation statements for scenarios involving **consecutive processes**.

NOTE

After studying this topic, you should be able to prepare quantity statements, production cost statements and cost allocation statements for *single-process* scenarios.

Activity 15.1

Calculating equivalent units

Jumpy Juice (Pty) Ltd. manufactures fruit juice in a single process and makes use of a process costing system.

The following information has been obtained for March 20X8:

Opening WIP	70 000 units
Conversion	75% complete
New units started/put into production	230 000 units
Closing WIP	50 000 units
Conversion	20% complete

Material is added at the beginning of the process and conversion takes place evenly throughout the process.

REQUIRED

Calculate the following:

a. the equivalent units included in opening WIP (separately for material and conversion cost)
b. the production work required to complete the opening inventory (in terms of equivalent units)
c. the units completed
d. the equivalent units included in the closing WIP

Solution to Activity 15.1

a. Material: 70 000 x 100% = 70 000 units
   Conversion cost: 70 000 x 75% = 52 500 units

b. Material: 70 000 x (100% – 100%) = 0 units
   Conversion cost: 70 000 x (100% – 75%) = 17 500 units

   or

   70 000 – 52 500 = 17 500 units

c. Units completed and transferred to the finished goods store
   = Opening WIP + units put into production – closing WIP
   = 70 000 + 230 000 – 50 000
   = 250 000 units
   These units have been completed and are thus fully completed in terms of both material and conversion cost.

d. Material: 50 000 x 100% = 50 000 units
   Conversion cost: 50 000 units x 20% = 10 000 units

NOTE

Did you see that WIP accounted for material at 100%, even though the stage of completion varied from 75% to 20%? That is because the material is added at the beginning of the process. All units would therefore be 100% complete as far as their material component is concerned.

4 Inventory valuation methods

Like other types of inventory, opening and closing WIP can be valued using different inventory valuation methods. For the purposes of MAC2601, the following two methods of inventory valuation may be used in determining the value of complete or incomplete units in a process costing system:

- Weighted average method – a "pool" of all units is created and each of these units is then valued at the same average amount per unit for that period.
- First-in-first-out (FIFO) method – units may have different values, depending on the production period that they come from. The oldest inventory is deemed to be completed first.

These two methods were explained in more detail in topic 3, study units 7 and 8. Please refer back to the relevant sections if you are unsure of the underlying principles.

The main difference between the weighted average method and the FIFO method lies in the treatment of units completed and transferred to finished goods and is as follows:

VALUATION OF INCOMPLETE UNITS

FIFO method: Units completed in the current period and transferred to the finished goods store **are split** between those completed from the opening WIP and those that were started (and completed) in the current period.

Weighted average method: Units completed in the current period and transferred to the finished goods store are **not split** between those completed from the opening WIP and those that were started (and completed) in the current period. In other words, all units that were completed in the current period are treated exactly the same, regardless of whether they come from the opening WIP or the units started in the current period.

NOTE

In this module process costs are calculated based on actual material and labour costs and allocated overheads for the current and prior period(s). In later modules, you will learn how to integrate a process costing system with a standard costing system. (Standard costing is covered later on in MAC2601.)

5 Quantity statement

QUANTITY STATEMENT

A quantity statement is a summary of the flow of physical units in a process costing system. A quantity statement will therefore include information about the number of units placed into the system and what happened to them, but *no* information about cost or rand values.

The typical quantity statement will include columns for the following:

Physical units			Equivalent units			
1 Input (units)	2 Details	3 Output (units)	4 Raw material		5 Conversion cost	
			Units	%	Units	%

We will now discuss the contents of each column:

1. ***Column 1: Input (physical units)***

   Input includes:

   - *opening WIP* that is already part of this process
   - *units entering this process in the current period*, either as new units started/put into production (first or only process) or units transferred in from a prior process

   The quantities of these two different types of input units are included in the input column of the quantity statement.

   The total of all the input units is also shown.

2. ***Column 2: Details (description of the type of input or output)***

   In MAC2601, the following descriptions are often used in a quantity statement:

   - **Opening WIP**
     The incomplete units in process at the beginning of a period.

- **Put into production (or new units started)**
  These are the new units that entered into the process in a specific period, that is, the units of which the production was only started in the current period.
- **Completed and transferred** (split further between *completed from opening inventory* and *completed from current production* when the FIFO method of inventory valuation is used)
  These are the units that went through a full production process and that can now be transferred to the finished goods store or to the next process, if applicable. (Remember: there can be more than one process!)
- **Losses**
  (Will be discussed and added to the quantity statement – in study unit 16.)
- **Closing WIP**
  The incomplete units in process at the end of a period.

3. ***Column 3: Output (physical units)***

   In this column, we account for what happened to all the inputs, that is, we indicate how many units were *completed* and how many are still in the process at the end of the current period (*closing WIP*: further processing of these units will continue in the following period).

   The total of all the output units is also shown.

NOTE

It is important to remember that this column's total should agree to the total of the input column.

4. ***Column 4: Equivalent units for material cost***

   This column is split into two sub-columns, of which one will indicate *equivalent* units for *material* for each of the quantities in the output column, and the other the percentages used to calculate each of these equivalent unit quantities.

5. ***Column 5: Equivalent units for conversion cost*** (*or separate equivalent unit columns for labour and overheads, as applicable*)

   The information provided in a question could make it necessary (or may allow for) labour and overheads to be combined into conversion cost **if they are incurred in the same way** (usually evenly throughout the process). If they are incurred at different stages, you should treat them separately.

   Just like the equivalent unit column for material, the equivalent unit column for conversion cost should be split into two sub-columns, one for the *equivalent* units for *conversion cost* (for each of the quantities in the output column) and the other for the percentages used to calculate these equivalent unit quantities.

   If labour and overheads need to be treated separately owing to the specific content of a question, two separate columns should be created for labour and overheads, and each of these columns should be split into two sub-columns to indicate the number of equivalent units and the associated percentages.

Below is an illustration of the layout based on the different valuation methods.

Framework of a quantity statement based on the <u>WEIGHTED AVERAGE</u> method of inventory valuation

JKL Limited

Quantity statement for the period ended... (weighted average method)

Physical units			Equivalent units			
1	**2**	**3**	**4**		**5**	
Input (units)	**Details**	**Output (units)**	**Raw material Units**	**%**	**Conversion cost Units**	**%**
	Input					
	Opening WIP					
	Put into production					
	Output					
	Completed and transferred					
	Closing WIP					

Framework of a quantity statement based on the <u>FIFO</u> method of inventory valuation

JKL Limited

Quantity statement for the period ended... (FIFO method)

Physical units			Equivalent units			
1	**2**	**3**	**4**		**5**	
Input (units)	**Details**	**Output (units)**	**Raw material Units**	**%**	**Conversion cost Units**	**%**
	Input					
	Opening WIP					
	Put into production					
	Output					
	Completed from:					
	Opening inventory					
	Current production					
	Completed and transferred					
	Closing WIP					

NOTE

- Did you notice the block in columns 3 to 5? This is to prevent you from double counting the output units. We will use this device initially to enforce the format of the quantity statement, but we will not be using it permanently.
- Did you see that, when the FIFO method is used, we identify separately the units completed from opening WIP and those completed from new units put into production in this period?

6 Guidelines for equivalent unit columns in the quantity statement

In this section, we discuss the ‘‘rules’’ that can be applied to arrive at appropriate percentages in the equivalent unit columns of a quantity statement.

NOTE

NB: Equivalent units are only calculated for **OUTPUT**, because this is what we want to cost.

To illustrate the rules, we will apply the following example:

Chuck's Car Air Fresheners (Pty) Ltd. has provided the following information for March 20X3:

WIP (cost: R2 300)	200 units
– 30% complete with regard to conversion cost	
New units put into process in the current month	860 units
Units completed in the current month	900 units
Closing WIP	160 units
– 25% complete with regard to conversion cost	
Material costs for March 20X3	R8 900
Conversion costs for March 20X3	R4 500

Raw material is added at the beginning of the process and conversion takes place evenly throughout the process. The organisation uses the FIFO method of inventory valuation.

NOTE

The wording "Units completed **IN** the current month" in the example above is not the same as "Units completed **FROM** current production"! Always read every question carefully. If you get this wrong, the rest of your calculations will be wrong!

6.1 Equivalent units: units completed from opening WIP

When the FIFO method of inventory valuation is used, we have to split units completed and transferred to finished goods between:

- units completed from opening WIP, and
- units that were put into production **and** completed in the current period (units completed from current production).

We therefore separate the units completed and transferred to the finished goods store according to **when** production of these units started – in a prior period (units completed from opening WIP) or the current period (units completed from current production).

The percentages to use in order to calculate equivalent units for "**Units completed from opening WIP**" is determined by calculating **how much work still had to be done on the opening WIP units in the current period to complete it**, that is, which part of the work has not yet been done in prior periods.

Since material is added at the beginning of the process, the material for the opening WIP would have already been added in a prior period, resulting in no material having to be added to these units in the current period. Consequently, equivalent units for material will be zero.

Since conversion takes place evenly throughout the process, we need to determine how far the process has been completed in the previous period and deduct this percentage from 100%.

> **Rule 15.1**
>
> **Percentages to use in the equivalent unit columns:**
>
> **Units completed from opening WIP (FIFO only): 100% less % of completion (opening WIP)**

Applying rule 15.1 to the example in section 6 above:

We will have 200 units of opening WIP in the output column of our quantity statement. Because these units are 100% complete in terms of material and 30% complete in terms of conversion cost, the equivalent units would be calculated as follows:

Material: (100% – **100%**) x 200 units = 0% x 200 units = 0 equivalent units
Conversion cost: (100% – **30%**) x 200 units = 70% x 200 units = 140 equivalent units

The above means that:

- no material was added to the 200 units in the current period (all relevant materials had already been added at the start of production of these units in a prior period); and
- 70% of the conversion work on these 200 units were done in the current period. (30% of the conversion work had already been done in a prior period.)

6.2 Equivalent units: completed, current production and completed, transferred units

When the FIFO method of inventory valuation is used, we will usually have a balancing figure in our quantity statement for the number of units completed from current production. These units should always be included in the equivalent unit columns at 100%, because they have been fully completed.

For FIFO, the number of units completed and transferred will thus be a subtotal of the equivalent units of units completed from opening WIP and the units completed from current production.

When the weighted average method of inventory valuation is used, we will not have a separate line in our quantity statement for the units completed from current production – all completed units will be combined into one line called "Units completed and transferred". These units should always be included in the equivalent unit columns at 100%, because they, too, have been fully completed.

> **Rule 15.2**
>
> **Percentages to use in the equivalent unit columns:**
>
> **``Current production" (FIFO) or ``Completed and transferred" (weighted average): material 100%; conversion cost 100%.**

Applying rule 15.2 to the example in section 6 above:

In the output column of our **FIFO** quantity statement, we will have 900 units for units completed and transferred.

The balancing figure between the units completed and transferred (900 units) and the units completed from opening stock (200 units) will be the units completed from current production (900 – 200 = 700).

These 700 units and their equivalent units can now be added to our quantity statement as follows:

Chuck's Car Air Fresheners (Pty) Ltd

Quantity statement for the period ended 31 March 20X3 (FIFO method)

Physical units			Equivalent units			
1	**2**	**3**	**4**		**5**	
Input (units)	**Details**	**Output (units)**	**Raw material Units**	**%**	**Conversion cost Units**	**%**
	Input					
200	Opening WIP					
860	Put into production					
	Output					
	Completed from:					
	Opening inventory	200	–	0	140	70
	Current production	**700**	**700**	**100**	**700**	**100**
	Completed and transferred	① 900	② 700		③ 840	
	Closing WIP	160				
1 060		1 060				

NOTE

- The totals of the equivalent columns (② and ③) are not equal to the total of the output column (①), because the equivalent column units are pro rated for costing purposes.
- The 900 subtotal in the output column has been given in the example; however, the subtotals of 700 equivalent units for material and 840 equivalent units for conversion cost should be calculated as the sum of the units completed from opening inventory and the units completed from current production:

  0 + 700 = 700 for material
  140 + 700 = 840 for conversion cost
- The sections of the quantity statement that we still have to complete are indicated in **dark** grey. We will only be able to complete these sections after applying rule 15.3 below.

If the organisation used the **weighted average method** instead of the FIFO method, we would have had 900 units in the output column for units completed and transferred, without any breakdown of these units into units completed from opening stock and units completed from current production.

These 900 completed units and their equivalent units for material and for conversion cost will appear as follows in a **weighted-average** method quantity statement:

Chuck's Car Air Fresheners (Pty) Ltd

Quantity statement for the period ended 31 March 20X3 (weighted average method)

Physical units			Equivalent units			
1	**2**	**3**	**4**		**5**	
Input (units)	**Details**	**Output (units)**	**Raw material Units**	**%**	**Conversion cost Units**	**%**
	Input					
200	Opening WIP					
860	Put into production					
	Output					
	Completed and transferred	① **900**	② **900**	**100**	③ **900**	**100**
	Closing WIP	160				
1 060		1 060				

When you use the **weighted average** method, the equivalent units (② and ③) will always agree to the output units on this line (①). As before, the sections in **dark** grey will still have to be completed before our quantity statement is complete.

NOTE

Regarding **FIFO**: in practice, most manufacturing processes are continuous. Machines are not stopped on the day of the month that the opening WIP has been completed. Also, it is stated in section 2 – Work-in-process – that there is no distinction between units. For these reasons, the weighted average method of inventory valuation is better; however, we teach the FIFO method as well for the following reasons:

- Because of the requirements of the South African Institute of Chartered Accountants (SAICA) and the requirements of the Chartered Institute of Management Accountants (CIMA).
- Because it might suit some products better (if the product is manufactured over a long period and the costs vary).

Also, companies nowadays try to keep inventory to a minimum. The difference between values determined according to the FIFO and weighted average methods should, therefore, be minimal simply because the bulk of the units will be from current production.

6.3 Equivalent units: closing WIP

The method of inventory valuation does not influence the equivalent units of closing WIP. These equivalent units are arrived at by simply multiplying the **percentage** of completion of the closing WIP by the relevant **number** in the output column.

> **Rule 15.3**
>
> **Percentages to use in the equivalent unit columns:**
>
> **Closing WIP: % of completion at end of period**

Applying rule 15.3 to the example in section 6 above:

We will have 160 units of closing WIP in the output column of our quantity statement. Since these units are 100% complete in terms of material and 25% complete in terms of conversion cost, the equivalent units will be calculated as follows:

Material: **100%** x 160 units = 160 equivalent units
Conversion cost: **25%** x 160 units = 40 equivalent units

NOTE

For completeness' sake, the FIFO and weighted average quantity statements for Chuck's Car Air Fresheners (Pty) Ltd, as fully completed, have been provided below. You will also see that there are **no rand amounts** in the quantity statements.

Chuck's Car Air Fresheners (Pty) Ltd

Quantity statement for the period ended 31 March 20X3 (FIFO method)

Physical units			Equivalent units			
1	**2**	**3**	**4**		**5**	
Input (units)	**Details**	**Output (units)**	**Raw material Units**	**%**	**Conversion cost Units**	**%**
	Input					
200	Opening WIP					
860	Put into production					
	Output					
	Completed from:					
	Opening inventory	200	–	0	140	70
	Current production	700	700	100	700	100
	Completed and transferred	900	700		840	
	Closing WIP	160	160	100	40	25
1 060		1 060	860		880	

Chuck's Car Air Fresheners (Pty) Ltd

Quantity statement for the period ended 31 March 20X3 (weighted average method)

Physical units			Equivalent units			
1	**2**	**3**	**4**		**5**	
Input (units)	**Details**	**Output (units)**	**Raw material Units**	**%**	**Conversion cost Units**	**%**
	Input					
200	Opening WIP					
860	Put into production					
	Output					
	Completed and transferred	900	900	100	900	100
	Closing WIP	160	160	100	40	25
1 060		1 060	1 060		940	

6.4 Equivalent units: losses

The guidelines for determining equivalent units for normal and abnormal losses are discussed in study unit 16.

7 Quantity statement – weighted average and FIFO methods of inventory valuation

The following activity illustrates the contents of the different columns of a quantity statement for the specific set of information given using different inventory valuation methods.

Activity 15.2

A basic quantity statement

Lunar Lotion (Pty) Ltd. manufactures shimmering body lotion in a single process and uses a process costing system. Raw material is added at the beginning of the process and conversion takes place evenly throughout the process.

Cost and production figures for January 20X8 are as follows:

	Units
WIP (1 January 20X8)	5 000
– 40% complete with regard to conversion cost	
New units put into process in the current month	15 000
Units completed in the current month	18 000
WIP (31 January 20X8)	2 000
– 30% complete with regard to conversion cost	

REQUIRED

Prepare a quantity statement for January 20X8 based on:

a. the **weighted average method** of inventory valuation; and
b. the **FIFO method** of inventory valuation.

Solution to Activity 15.2

a. Quantity statement for January 20X8 (weighted average method)

Physical units			Equivalent units			
Input (units)	**Details**	**Output (units)**	**Raw material Units**	**%**	**Conversion cost Units**	**%**
① 5 000	Opening WIP					
① 15 000	Put into production					
	Completed and transferred	① 18 000	18 000	100	18 000	100
	Closing WIP	① 2 000	2 000	100	④ 600	30
② 20 000		**② 20 000**	**20 000**		**18 600**	

b. Quantity statement for January 20X8 (FIFO method)

Physical units			Equivalent units			
Input (units)	**Details**	**Output (units)**	**Raw material Units**	**%**	**Conversion cost Units**	**%**
① 5 000	Opening WIP					
① 15 000	Put into production					
	Completed from:					
	Opening inventory	④ 5 000	–	0	⑤ 3 000	⑥ 60
	Current production	③ 13 000	13 000	100	13 000	100
	Completed and transferred	① 18 000	13 000		16 000	
	Closing WIP	① 2 000	2 000	100	④ 600	30
② 20 000		**② 20 000**	**15 000**		**16 600**	

Explanatory notes

① Given

② The total of the input column should always agree with the total of the output column.

③ Balancing figure. For part b. (FIFO), the units completed and transferred to the finished goods store were split between those completed from opening inventory and those completed from the units put into production in the current period. For part a. (weighted average method), all the units completed and transferred were pooled and treated identically, regardless of the period from which they originated.

④ 30% x 2 000 = 600 units

⑤ 60% x 5 000 = 3 000 units

⑥ 100% – 40% = 60% required to complete

NOTE

Did you notice the following?

Units completed from current production (output column)

+ closing WIP (output column)

= units put into production in the current month (input column)

This is because no losses occurred in the current period.

8 Summary

In this study unit, you learnt the following:

- In order to calculate the average cost per unit in process costing, the equivalent of fully completed units needs to be calculated for any partially completed units.

- Equivalent units are not the same thing as physical units.
- To calculate the equivalent units for every line in the quantity statement, an appropriate percentage has to be multiplied by the relevant number of units in the output column.
- The percentages to use are:

Quantity statement line	Material	Conversion cost
Units completed from opening WIP (FIFO)	100% less % of completion of opening WIP with regard to material, therefore for MAC2601 purposes always 100% – 100% = 0%	100% less % of completion of opening WIP with regard to conversion
Units completed from current production (FIFO)	100%	100%
Units completed and transferred (weighted average method)	100%	100%
Closing WIP (both methods)	100%	% of completion of closing WIP with regard to conversion

- In a quantity statement, the total of the input column should always agree to the total of the output column (input = output).

You also learnt how to compile a quantity statement based on the weighted average and the FIFO method of inventory valuation.

In the next study unit, we are going to determine the impact of losses on the calculation of equivalent units for the weighted average and for the FIFO method.

Additional reading

Please refer to the list of sources for additional reading at the end of study unit 18.

Self-assessment Activity

Tasteful Textile (Pty) Ltd. manufactures waterproof fabric in a single process and makes use of a process costing system. Material is added at the beginning of the process and conversion takes place evenly throughout the process.

The following information is available for the organisation's 20X7 financial year:

Opening WIP	30 000 units
Conversion	60% complete
New units started	500 000 units
Units completed in the current financial year	490 000 units
Closing WIP	40 000 units
Conversion	30% complete

REQUIRED

Prepare a quantity statement for the 20X7 financial year applying:

a. the FIFO method of inventory valuation; and
b. the weighted average method of inventory valuation.

Solution to Self-assessment Activity

a. FIFO method

Physical units			Equivalent units			
Input (units)	**Details**	**Output (units)**	**Raw material Units**	**%**	**Conversion cost Units**	**%**
30 000	Opening WIP					
500 000	Put into production					
	Completed from:					
	Opening inventory	30 000	–	0	12 000	② 40
	Current production	① 460 000	460 000	100	460 000	100
	Completed and transferred	490 000	460 000		472 000	
	Closing WIP	40 000	40 000	100	12 000	③ 30
530 000		530 000	500 000		484 000	

b. Weighted average method

Physical units			Equivalent units			
Input (units)	**Details**	**Output (units)**	**Raw material Units**	**%**	**Conversion cost Units**	**%**
30 000	Opening WIP					
500 000	Put into production					
	Completed and transferred	490 000	490 000	100	490 000	100
	Closing WIP	40 000	40 000	100	12 000	30
530 000		530 000	530 000		502 000	

Explanatory notes:

① Balancing figure (490 000 – 30 000)

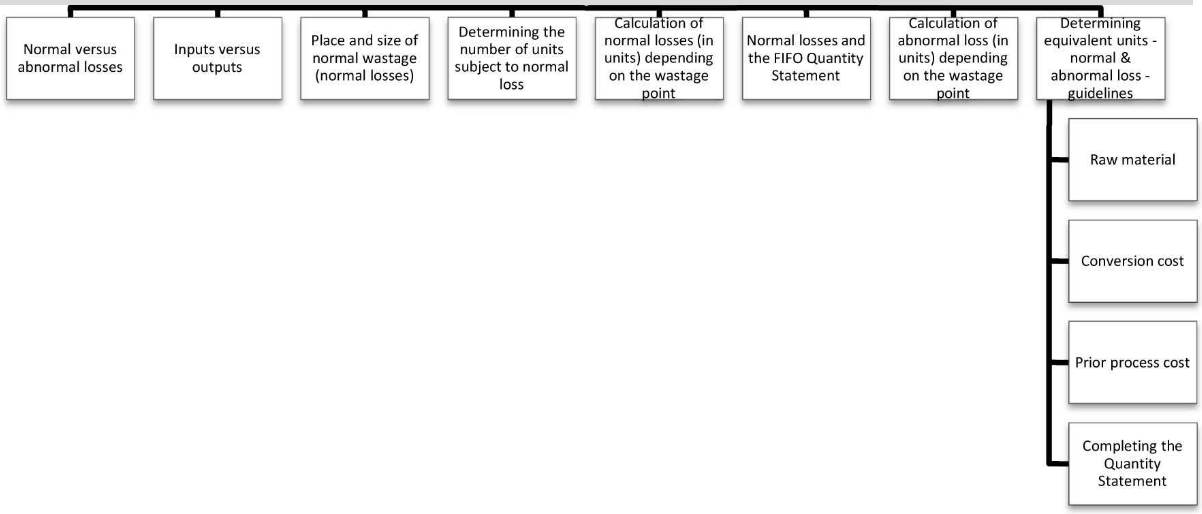
② 100% – 60% = 40%, where 60% is the percentage of completion of opening stock with regard to conversion (see rule 15.1 in 6.1)

③ 30%: percentage of completion of closing stock with regard to conversion (see rule 15.3 in 6.3)

STUDY UNIT 16

Losses

In this study unit



1 Introduction

In study unit 14, you learnt that the nature of certain products is such that these products must be manufactured in a *process*, and that this process mainly consists of input, conversion activities and output.

In a perfect world, all the inputs into the production process will be present in some or other processed form in the final product, or the *output* of completed units. However, in practice it is likely that some losses will occur in the manufacturing process. These losses can be split into two categories, both of which have distinctive characteristics and which differ with regard to accounting treatment: normal and abnormal losses.

In study unit 16, you are going to learn how to calculate these losses and how to treat them in the quantity statement.

2 Normal versus abnormal losses

The table below shows a comparison between normal and abnormal losses. You will note that the table includes alternative names for the two categories, refers to certain characteristics, and also gives examples of normal and abnormal losses.

TABLE 16.1: Normal losses compared with abnormal losses

Normal losses	Abnormal losses
Sometimes also referred to as unavoidable losses.	Sometimes also referred to as controllable losses.
Inherent in the manufacturing process (they will occur as a natural part of the process) – you cannot avoid them.	*Avoidable* in the manufacturing process (they will *not* occur as a natural part of the process) – you should control/inhibit their occurrence.
Do *not* indicate that a process is ineffective – therefore "normal".	Indicate that a part/parts of the process is/are ineffective – therefore "abnormal".
Examples: • Wastage due to evaporation in a chemical process (eg some inputs will "vanish" naturally when heating essential for binding takes place). • Waste materials where textiles are produced (off-cuts). • Units rejected at quality inspection (within acceptable (normal) range or tolerance).	Examples: • Wastage due to use of raw materials of inferior quality resulting in production output scrapped. • Wastage due to employee carelessness. • Spoilt output due to production interruption (eg electrical failure leading to units heating up/cooling down etc).

NOTE

In MAC2601, we sometimes refer to losses as wastage, spillage, spoilage or scrapped items. *Spillage*, for example, generally occurs when some of the product overflows or leaks, whereas *spoilage* could include losses caused by some products going rotten.

Although the appropriate term actually depends on the nature of the specific product and the specific manufacturing process, *we will use these terms interchangeably in this module*.

3 Inputs versus outputs

As explained in the introduction to this study unit, the total inputs into a process are likely to differ from the final completed units from the process due to normal and abnormal losses. We would therefore have to amend the quantity statement for the following:

Outputs could now include:

- Units completed and transferred (including units completed from the opening WIP and units both started and completed in the current period)
- Normal losses
- Abnormal losses
- Closing WIP

Total inputs into the process should still agree to total outputs from the process (including losses).

4 Place and size of normal wastage (normal losses)

In section 2 of this study unit, we indicated that it is likely (normal) that some losses (wastage) will occur in a production process. We will now have a look at how the normal loss is calculated for the purposes of the quantity statement (ie the number of units wasted by means of normal loss) when wastage occurs in the process of manufacturing a product.

These losses will be included in the output column of the quantity statement, with ‘‘Normal loss’’ in the *Details* column, as discussed in section 3.

It is important to note that there is a difference between *where* the normal loss occurs and *how much* (what the quantity/size of) normal wastage is. Both will influence the calculation of normal loss; however, it is important not to confuse the two concepts with each other.

Wastage could occur at any of the following stages of the production process:

- At the beginning of the process (when the process is 0% complete); for example, spillage when material is added.
- At the end of the process (when the process is 100% complete); for example, after quality inspections.
- During the process (anywhere between 0% and 100% completion); for example, when chemicals evaporate.

Wastage is identified at the *wastage point* or, in other words, *where* normal wastage occurs in the process.

The *how much* is usually **a percentage estimate** of the size of the normal loss and is, in most instances, expressed (for the purposes of this module) as a percentage of units that enter or pass/reach the wastage point in the current period. This is why it is important to determine how many of the units in the process have passed/reached the wastage point in the current period. We then apply the *how much* of the wastage to these units when calculating the normal loss to be included in the output column of the quantity statement.

NOTE

For the purposes of MAC2601, the calculation of the normal loss for insertion into the output and equivalent unit columns will not differ between the FIFO and weighted average methods of inventory valuation. In practice, we may decide to split the normal loss line in the quantity statement between opening WIP and the rest of the units for the purposes of calculating equivalent units using the FIFO method. It is debatable how much difference this will make to the final inventory valuations, especially if inventory levels are kept low.

5 Determining the number of units subject to normal loss

To determine the units subject to normal loss, we will always start with the total of the input column. We will then apply both of the following rules in order to determine the total number of units subject to normal loss in the current period:

Rule 16.1

If % of completion (opening WIP) is *greater than or equal to* the wastage point %, *deduct* the opening WIP units from the input column total.

Rule 16.2

If % of completion (closing WIP) is *smaller* than the wastage point %, *deduct* the closing WIP units from the input column total.

NOTE

- This calculation is based on physical units. It applies IRRESPECTIVE of which inventory valuation method is used.
- The following are the possible results of applying rules 16.1 and 16.2:
  - Only opening WIP units are deducted from the input column total.
  - Only closing WIP units are deducted from the input column total.
  - Neither opening nor closing WIP units are deducted from the input column total.
  - Both opening WIP units and closing WIP units are deducted from the input column total.

6 Calculation of normal loss in units, depending on the wastage point

To determine the *size* of the normal loss (which is ultimately included in the output column of the quantity statement), we will need to:

- determine how many units are subject to normal loss in the current period (refer to section 5 of this study unit); and
- apply the appropriate loss percentage, ratio, etcetera (the ''*how much''* of the loss, which depends on the information provided in a question) to the number of units subject to normal loss in the current period.

For example, if normal loss is estimated as 10% of units that have passed/reached the wastage point, we will have to multiply the total number of units subject to normal loss in the current period by 10% to arrive at normal loss in units. This normal loss will then be included in the output column of the quantity statement.

Activity 16.1

Normal loss calculations

The following information is available for Can-o'-Worms (Pty) Ltd, an organisation that prepares a mixture used for fishing bait (a single process applies and a process costing system is used):

	Units
Opening WIP – 40% completed	90 000
New units put into production in the current period	200 000
Closing WIP – 30% completed	40 000

Normal loss is estimated as 10% of the units that have passed the wastage point.

REQUIRED

Calculate the normal loss to be included in the output column of the quantity statement for each of the following scenarios:

a. Wastage occurs at the beginning of the process.

b. Wastage occurs at the end of the process.
c. Wastage occurs when the process is 50% complete.
d. Wastage occurs when the process is 35% complete.
e. Wastage occurs when the process is 20% complete.
f. Wastage occurs when the process is 30% complete.

Solution to Activity 16.1

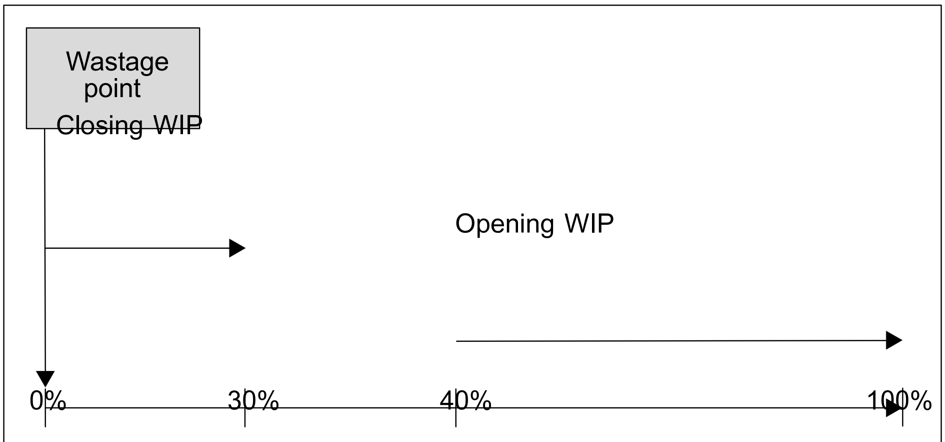
Firstly, calculate the physical input into the process (for purposes of a–f).

Input (units)	Details
90 000	Opening WIP
200 000	Put into production
290 000	

NOTE

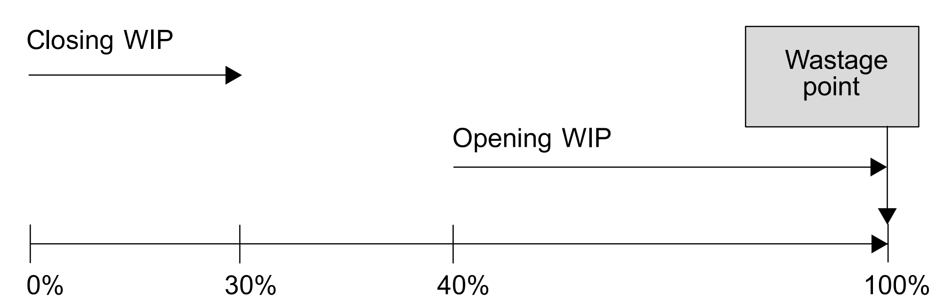
- The total of the input column will be the starting point for all calculations of units that are subject to loss.
- Over the next few pages, we will use figure 16.1 to illustrate the impact of the placement of the wastage point on the calculation of the units lost.
- We have used "WP" as the abbreviation for "wastage point".
- The arrows indicate the production activity that has taken place IN THIS PERIOD.

a. When wastage occurs at the beginning of the process:



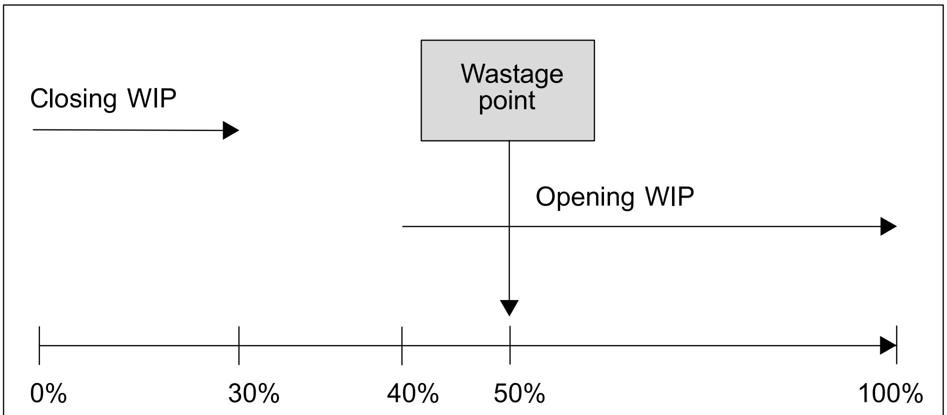
WP	Input	Opening WIP (40%) 90 000		Closing WIP (30%) 40 000		Subject to loss	Units lost (10%)
		>=WP?	Keep/Deduct	<WP?	Keep/Deduct		
0%	290 000	Yes	Deduct – 90 000	No	Keep	200 000	20 000

b. When wastage occurs at the end of the process:



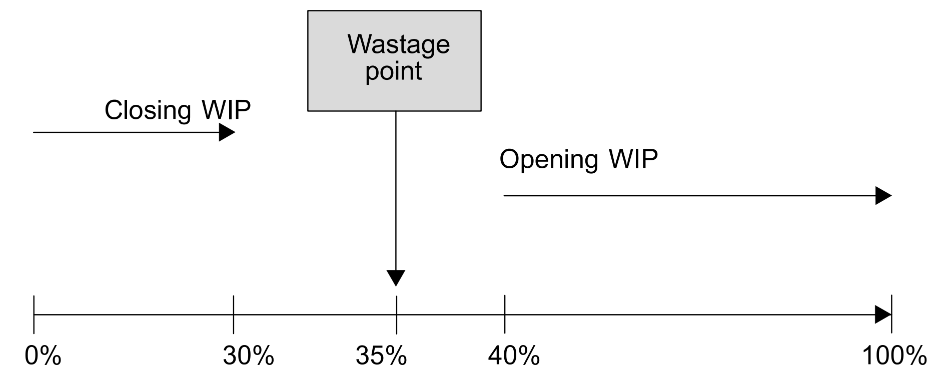
WP	**Input**	**Opening WIP (40%) 90 000**		**Closing WIP (30%) 40 000**		**Subject to loss**	**Units lost (10%)**
		>=WP?	**Keep/Deduct**	**<WP?**	**Keep/Deduct**		
100%	290 000	No	Keep	Yes	Deduct – 40 000	250 000	25 000

c. Wastage occurs when the process is 50% complete:



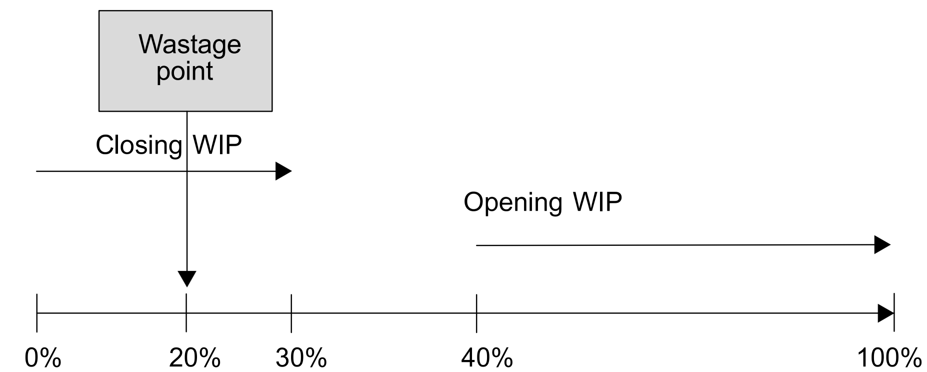
WP	**Input**	**Opening WIP (40%) 90 000**		**Closing WIP (30%) 40 000**		**Subject to loss**	**Units lost (10%)**
		>=WP?	**Keep/Deduct**	**<WP?**	**Keep/Deduct**		
50%	290 000	No	Keep	Yes	Deduct – 40 000	250 000	25 000

d. Wastage occurs when the process is 35% complete:



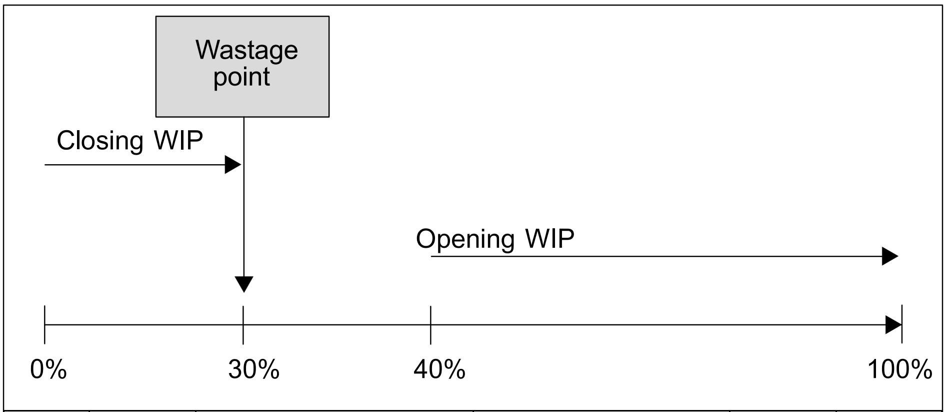
WP	Input	Opening WIP (40%) 90 000		Closing WIP (30%) 40 000		Subject to loss	Units lost (10%)
		>=WP?	**Keep/Deduct**	**<WP?**	**Keep/Deduct**		
35%	290 000	Yes	Deduct – 90 000	Yes	Deduct – 40 000	160 000	16 000

e. Wastage occurs when the process is 20% complete:



WP	Input	Opening WIP (40%) 90 000		Closing WIP (30%) 40 000		Subject to loss	Units lost (10%)
		>=WP?	**Keep/Deduct**	**<WP?**	**Keep/Deduct**		
20%	290 000	Yes	Deduct – 90 000	No	Keep	200 000	20 000

f. Wastage occurs when the process is 30% complete:



WP	Input	Opening WIP (40%) 90 000		Closing WIP (30%) 40 000		Subject to loss	Units lost (10%)
		>=WP?	Keep/Deduct	<WP?	Keep/Deduct		
30%	290 000	Yes	Deduct – 90 000	No	Keep	200 000	20 000

Source: Author, 2012.

FIGURE 16.1: Diagrammatic representation of a single manufacturing process with normal wastage

Explanatory notes

- In all instances, we started with the total of the input column.
- When we have to deduct opening and/or closing WIP in our normal loss calculation, we are effectively *excluding* the associated number of units from the total of the input column.
- When opening and/or closing inventory has to be kept or *included* in the normal loss calculation as per rules 16.1 and 16.2 of this study unit, we will *not* adjust the total of the input column for the inclusion(s). The reason for this is that the total of the input column already includes all the units involved in the process (including the units in opening and closing WIP): adding opening and/ or closing WIP units to the column total would therefore lead to double counting. Keeping the units included in the calculation is indicated as ``**keep**" and no action is taken.
- We applied rules 16.1 and 16.2 of this study unit to scenarios **a.** to **f.** to calculate the normal loss.
- Although the information in a question often specifies that the normal loss should be calculated on units that have passed the wastage point, this will include instances in which units have **reached** the wastage point (ie where the percentage of completion in terms of conversion cost is **equal** to the wastage point, as in scenario **f.** above). Similarly, when a question refers to the units that have reached the wastage point, you also need to include the units that have actually passed this point.

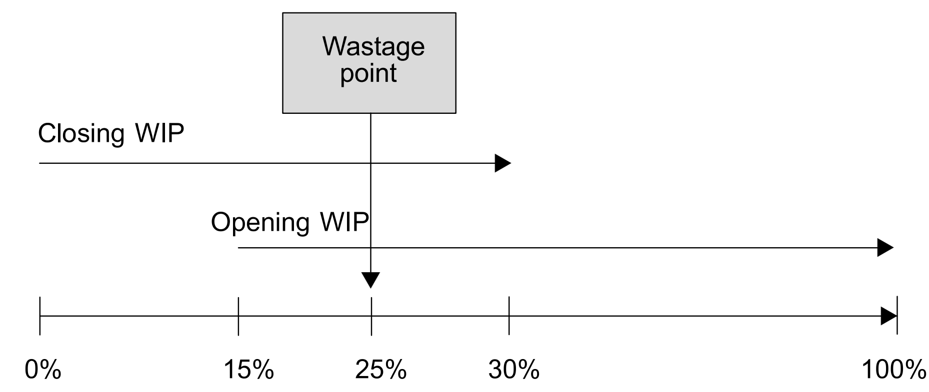
NOTE

The above diagrams and tables are only provided for the purposes of explaining the calculations. If this was an assignment or examination question, you could have left out the diagrams and the tables, but you should have shown your calculation of the normal loss (eg scenario f: *[290 000 – 90 000] x 10% = 20 000*). However, many students find that drawing a timeline or diagram helps them to understand the process.

Take note that the percentage of completion of opening WIP and of closing WIP can be anywhere in the process. The opening WIP percentage of completion will not necessarily be larger than the closing WIP percentage of completion – it could be smaller than or even equal to the closing WIP percentage of completion.

Assume, for example, that the opening WIP percentage of completion with regard to conversion cost now changed to 15%, with the closing WIP remaining as 30% complete and with wastage occurring when the process is 25% complete.

The diagram and normal loss would now look as follows:



WP	Input	Opening WIP (15%) 90 000		Closing WIP (30%) 40 000		Subject to loss	Units lost (10%)
		>=WP?	Keep/Deduct	<WP?	Keep/Deduct		
25%	290 000	No	Keep	No	Keep	290 000	29 000

Source: Author, 2012.

FIGURE 16.2: Diagrammatic representation of a single manufacturing process with normal wastage where both opening and closing WIP are subject to normal loss in the current period

Activity 16.2

Normal loss calculations – ratio of spoilt items

The following information is available for Cough-Less (Pty) Ltd, a pharmaceutical company that produces a cough syrup (a single process applies and a process costing system is used):

	Units
Opening WIP – 15% completed	10 000
New units put into production in the current period	22 000
Closing WIP – 30% completed	6 000

Normal loss information: Four out of every five units that reach the wastage point are unspoilt and of acceptable quality. Losses take place when the process is 25% complete.

REQUIRED

Calculate the normal loss to be included in the output column of the quantity statement for the specific scenario.

Solution to Activity 16.2

a. Calculate the physical input into the process

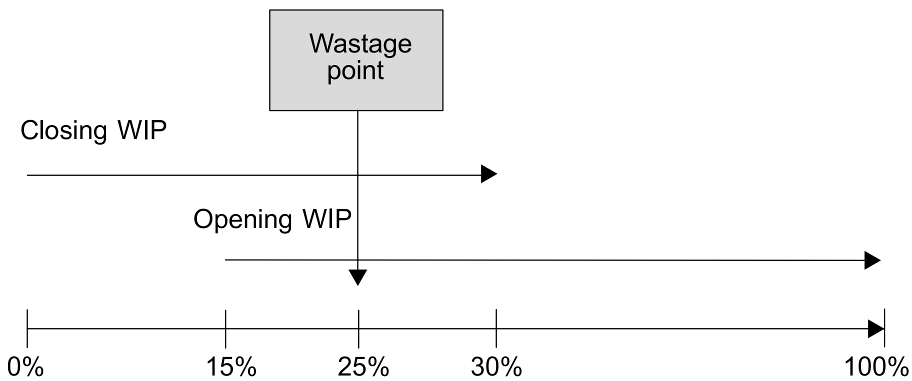
Input (units)	Details
10 000	Opening WIP
22 000	Put into production
32 000	

b. Calculate the normal loss percentage (size of the loss)

If four out of every five units are unspoilt, it means that 5 – 4 = 1 out of every 5 units will be lost due to normal wastage.

1 / 5 x 100 = 20%

Calculate the normal loss to be included in the output column



WP	Input	Opening WIP (15%) 10 000		Closing WIP (30%) 6 000		Subject to loss	Units lost (20%)
		>=WP?	Keep/Deduct	<WP?	Keep/Deduct		
25%	32 000	No	Keep	No	Keep	32 000	6 400

---

7 Normal losses and the FIFO quantity statement

Although the calculation of the normal loss **in units** will not differ regardless of whether we use the FIFO or weighted average method of inventory valuation, the normal loss could influence the FIFO quantity statement in terms of the units completed from opening WIP, based on the percentage of completion of the opening WIP.

If the opening WIP has already passed the wastage point in the previous period, this will mean that the normal loss on these units of opening inventory has already been accounted for in the past. The units in opening WIP that was included in our current period's input column, are therefore already *net* of the normal loss incurred on these units in the past. In the output column, the units completed from opening WIP will therefore be equal to the units carried forward in opening WIP.

However, if the opening WIP will only be passing/reaching the wastage point in the current period, the units *completed* from the opening inventory will be *less* than the opening WIP units of our current period's input column; this is because of the normal loss on the opening WIP being accounted for in the *current* period (as part of the normal loss to be included in the output column of the current period's quantity statement).

In other words, if we *include* (keep) our opening WIP in the calculation of the normal loss in units as per rule 16.1 of this study unit, we will have to *decrease our units completed from opening inventory* by the normal loss percentage/ratio, etcetera in order to avoid double counting.

If you think about this logically, normal losses on the incomplete units that we started the current period with (opening WIP) have not yet been brought into account in the past, because these units will only be passing/reaching the wastage point in the *current* period. When they pass/reach the wastage point in the current period, we will have to bring into account the normal losses on these units, together with normal losses on the units that were put into production in the current period and have passed/reached the wastage point.

The units that are eventually completed from this opening WIP will therefore be fewer than the incomplete units that we had at the beginning of the current period.

Therefore:

> **Rule 16.3 (FIFO only)**
>
> **If % of completion (opening WIP) is *smaller than* the wastage point, reduce the units completed from opening inventory by the normal loss on these units.**

For example:

	Scenario 1	**Scenario 2**
Opening WIP		
% of completion	60%	20%
Number of units	150 000	320 000
Wastage	• occurs when the process is 45% complete; and • is estimated as 15% of units that reach the wastage point.	• occurs when the process is 45% complete; and • is estimated as 8% of units that reach the wastage point.
Inventory valuation method	FIFO	FIFO

If we apply rule 16.3 above to the two scenarios, the calculation of the units completed from opening inventory to be included in the output column of the quantity statement will be as follows:

<u>Scenario 1</u>

Is 60% (% of completion: opening WIP) smaller than 45%? No. Therefore, do *not* reduce the units completed from opening inventory by the normal loss on these units. The reason for this is that these units will be deducted in our *current period* normal loss calculation (as per rule 16.1 of this study unit).

The units completed from opening inventory to be included in the output column of the quantity statement will thus be 150 000.

Scenario 2

Is 20% (% of completion: opening WIP) smaller than 45%? Yes. Therefore, *reduce* the units completed from opening inventory by the normal loss on these units. The reason for this is that these units will be kept included in our current period normal loss calculation (as per rule 16.1 of this study unit).

Normal loss on 320 000 units = 8/100 x 320 000
= 25 600 units

The units completed from opening inventory to be included in the output column of the quantity statement will thus be 320 000 – 25 600 = 294 400 units.

8 Calculation of abnormal loss in units, depending on the wastage point

The abnormal loss to be included in the output column of the quantity statement ("Abnormal loss" will appear in the *Details* column) is usually **a balancing figure** that can be calculated as follows from the *output column* (which you now know should agree to the input column total):

Output (= input) column total
Less: Units completed and transferred
Less: Normal loss in units
Less: Closing WIP
Equals: Abnormal loss in units

However, in some questions we might provide you with the number of units spoilt owing to abnormal circumstances and then the **units completed and transferred** might be the balancing figure.

Another scenario might also arise in which there are TWO types of abnormal losses:

- one type of abnormal loss caused by a specific event (eg a power failure resulting in a specific number of units spoiling) – this might be at any point in the process; **and**
- an abnormal loss occurring at the same wastage point as the normal loss (this will be the balancing figure in the calculation).

If the abnormal loss results in a negative number, there is actually an abnormal *gain* from the process. The treatment of this abnormal gain will be covered in later modules. Therefore, if you arrive at an abnormal gain in MAC2601, you should know that you have made an error somewhere!

9 Determining equivalent units of normal and abnormal loss – general guidelines

We are calculating equivalent units for losses because money and resources have been spent on these units up to the wastage point. The units will therefore have to carry **their share of cost** for the period.

9.1 Raw materials

For the purposes of MAC2601, raw materials will always be added at the beginning of a process. In other words, the materials will always be added to a process when the conversion process is 0% complete.

When material is added at the beginning of the process and any wastage of units occurs at any stage of the production process, this means that all the material added for purposes of these wasted units will effectively be wasted.

Therefore, for normal and abnormal losses, the equivalent unit percentage to use in MAC2601 will always be 100% for raw materials.

9.2 Conversion cost

In general, conversion cost will be "lost" due to wastage to the extent that conversion has taken place up to the point where the wastage occurred.

Therefore, for normal losses, the equivalent unit percentage to use in MAC2601 regarding conversion cost will be the percentage of the conversion work that has been done up to the point where wastage occurs (ie the wastage point percentage if conversion took place evenly).

For abnormal losses, we will also use the wastage point percentage if conversion took place evenly, unless the abnormal loss incident took place at a different time from the normal loss. In such a case, the percentage to use for the abnormal loss occurring at a different point in time from the normal loss will be the percentage of completion of the units (in terms of conversion cost) when this abnormal loss incident took place.

If the question does not state at what stage the abnormal loss occurred, you may assume the wastage point is the same as that for normal loss.

We can therefore deduce the following "rules" for abnormal losses:

> **Rule 16.4**
>
> **Percentage to use in the conversion cost equivalent unit column if conversion takes place evenly AND the normal and abnormal losses occur at the same wastage point:**
>
> **Wastage point % (ie % *where* the normal and abnormal losses takes place)**

> **Rule 16.5**
>
> **Percentage to use in the conversion cost equivalent unit column if conversion takes place evenly AND the abnormal loss takes place at a different wastage point from the normal loss:**
>
> **Specific (event) wastage point % (ie % *where* the specific loss takes place)**

9.3 Cost of prior processes

In order to start with a new process in a set of sequential processes, a physical unit of production needs to be fully completed as far as all prior processes are concerned (except when the new process is process 1).

However, in this module you will not be required to calculate the equivalent units of losses for scenarios with **consecutive processes**.

9.4 Completing the quantity statement

NOTE

Very important: as we explained earlier, the method of inventory valuation has no bearing on the *equivalent units* of normal or abnormal losses for the purposes of the MAC2601 quantity statement.

Activity 16.3

Losses in the output colum of the quantity statement

We shall now continue with our example of Lunar Lotion (Pty) Ltd.

To reiterate: Lunar Lotion (Pty) Ltd. manufactures shimmering body lotion in a single process and uses a process costing system. Raw materials are added at the beginning of the process, and conversion takes place evenly throughout the process.

Normal loss for February 20X8 is estimated as 15% of inputs that reach the wastage point.

Cost and production figures for February 20X8 are as follows:

	Units
WIP (1 February 20X8) – 30% complete	2 000
New units put into process in the current month	23 000
Units completed in the current month	16 000
WIP (28 February 20X8) – 60% complete	4 000

REQUIRED

a. Prepare the February 20X8 quantity statement according to the:
   i. weighted average method
   ii. FIFO method

   of inventory valuation, if all wastage occurs **at the beginning of the process**.

b. Prepare the February 20X8 quantity statement according to the:
   i. weighted average method
   ii. FIFO method

   of inventory valuation, if all wastage occurs **when the process is 70% complete**.

Solution to Activity 16.3

a. i Quantity statement for February 20X8 (weighted average method): WP = 0%

Physical units			Equivalent units			
Input (units)	**Details**	**Output (units)**	**Raw materials Units**	**%**	**Conversion cost Units**	**%**
① 2 000	Opening WIP					
① 23 000	Put into production					
	Completed and transferred ④	① 16 000	16 000	100	16 000	100
	Normal loss	② 3 450	3 450	100	–	0
	Abnormal loss ⑤	③ 1 550	1 550	100	–	0
	Closing WIP	① 4 000	4 000	100	⑥ 2 400	60
25 000		25 000	25 000		18 400	

Explanatory notes

① Given

② (25 000 – 2 000) x 15% = 3 450
[Opening WIP% ⩾ WP% → deduct; closing WIP% ⩾ WP% → keep]

③ Balancing figure (25 000 – 16 000 – 3 450 – 4 000)

④ Can you see that, because we are using the weighted average method, we are not concerned from which inventory the units are completed? Only one line: ''Completed and transferred'' is required.

⑤ The question indicated that *all* losses occur at the beginning of the process. Abnormal losses therefore occur at the same wastage point as that for normal losses (0%).

⑥ 4 000 x 60% = 2 400

⑦ The calculation of equivalent units for closing WIP is exactly the same, regardless of the inventory valuation method used.

a. ii Quantity statement for February 20X8 (FIFO method): WP = 0%

Physical units			Equivalent units			
Input (units)	**Details**	**Output (units)**	**Raw materials Units**	**%**	**Conversion cost Units**	**%**
① 2 000	Opening WIP					
① 23 000	Put into production					
	Completed from:					
	Opening inventory	② 2 000	–	0	⑥ 1 400	70
	Current production	③ 14 000	14 000	100	14 000	100
	Completed and transferred	① 16 000	14 000		15 400	
	Normal loss	④ 3 450	3 450	100	–	0
	Abnormal loss ⑤	③ 1 550	1 550	100	–	0
	Closing WIP	① 4 000	4 000	100	2 400	⑦ 60
25 000		25 000	23 000		17 800	

Explanatory notes

① Given

② Because the percentage of conversion of opening WIP (30%) is *larger* than the wastage point (0%), we *do not* reduce the units completed from opening inventory by 15%. The opening inventory has already been reduced by the losses in the previous period.

③ Balancing figures:
16 000 – 2 000 = 14 000
25 000 – 16 000 – 3 450 – 4 000 = 1 550

④ (25 000 – 2 000) x 15% = 3 450

⑤ Note that the abnormal loss is exactly the same as for the weighted average method.

⑥ 2 000 x (100% – 30%) = 1 400

⑦ The calculation of equivalent units for the closing WIP is exactly the same, regardless of the inventory valuation method used.

b. i Quantity statement for February 20X8 (weighted average method): WP = 70%

Physical units			Equivalent units			
Input (units)	**Details**	**Output (units)**	**Raw materials Units**	**%**	**Conversion cost Units**	**%**
① 2 000	Opening WIP					
① 23 000	Put into production					
	Completed and transferred	① 16 000	16 000	100	16 000	100
	Normal loss	② 3 150	3 150	100	③ 2 205	70
	Abnormal loss	③ 1 850	1 850	100	④ 1 295	70
	Closing WIP	① 4 000	4 000	100	⑤ 2 400	60
25 000		25 000	25 000		21 900	

Explanatory notes

① Given

② (25 000 – 4 000) x 15% = 3 150
[Opening WIP% < WP% → keep; closing WIP% < WP% → deduct]

③ 3 150 x 70% = 2 205

④ 1 850 x 70% = 1 295. The question indicated that *all* losses occur when the process is 70% complete. Abnormal losses therefore occur at the same wastage point as that for normal losses (70%).

⑤ 4 000 x 60% = 2 400

b. ii Quantity statement for February 20X8 (FIFO method): WP = 70%

Physical units			Equivalent units			
Input (units)	**Details**	**Output (units)**	**Raw materials Units**	**%**	**Conversion cost Units**	**%**
① 2 000	Opening WIP					
① 23 000	Put into production					
	Completed from:					
	Opening inventory	② 1 700	–	0	⑦ 1 190	70
	Current production	③ 14 300	14 300	100	14 300	100
	Completed and transferred	16 000	14 300		15 490	
	Normal loss	④ 3 150	3 150	100	⑧ 2 205	70
	Abnormal loss	③ 1 850	1 850	100	⑨ 1 295	70
	Closing WIP	① 4 000	4 000	100	⑩ 2 400	60
25 000		25 000	23 300		21 390	

Explanatory notes

① Given

② 2 000 x (100% – 15%) = 1 700. Because the percentage of conversion of opening WIP (30%) is *smaller* than the wastage point (70%), we *have to* reduce the units completed from opening inventory by 15%. These losses are now included in normal loss for the period.

③ Balancing figures:
16 000 – 1 700 = 14 300
25 000 – 16 000 – 3 150 – 4 000 = 1 850

④ (25 000 – 4 000) x 15% = 3 150 *(note that this is exactly the same as for the weighted average method)*

⑤ Note that the abnormal loss is exactly the same as for the weighted average method.

⑥ Note that the closing WIP is exactly the same in all four quantity statements in this question.

⑦ 1 700 x (100% – 30%) = 1 190

⑧ 3 150 x 70% = 2 205

⑨ 1 850 x 70% = 1 295

⑩ 4 000 x 60% = 2 400

NOTE

- Let us say the question did not specify that *all* losses occurred at a specific point in the process (eg at the beginning of the process or when the process is 70% complete), but only indicated the point where the normal losses occur. If this was the case, you could have assumed *the same wastage point* for the abnormal losses as for the normal losses, **unless** the question specified that an abnormal loss occurred at a specific point in the process (due to a **specific event**). If, in fact, an abnormal loss occurred owing to a specific event, you would have had to do the following:
  – Determine whether this abnormal loss takes place earlier in the process than the normal losses, in which case you will have to **exclude** the abnormal loss arising from the specific event from your normal loss unit calculation.

- Treat any remaining input units that cannot be accounted for as an **additional** abnormal loss (balancing figure) occurring at the same point in the process as the normal loss.

- When FIFO is used, remember to include a separate line for units completed from opening inventory and make sure that you only reduce the units involved by a normal loss figure if opening WIP percentage of completion (with regard to conversion cost) is *smaller than* the wastage point.
- For the purposes of this module, the opening inventory equivalent units for *material* will always be zero for units completed from opening WIP when applying FIFO (applying rule 15.1). This is because of the assumption, in MAC2601, that material will always be added at the starting point in the process (100% – 100% = 0%).

Activity 16.4

Prepare quantity statements

The following information for March 20X8 was taken from Activity 15.1 of study unit 15:

"Jumpy Juice (Pty) Ltd. manufactures fruit juice in a single process and makes use of a process costing system.

Closing WIP – 20% complete	50 000 units

Material is added at the beginning of the process and conversion takes place evenly throughout the process."

Jumpy Juice (Pty) Ltd. now has the following additional process costing information available:

April 20X8	
Put into production	250 000 units
Units completed in the current month	200 000 units
Closing WIP – 90% complete	60 000 units
Normal loss	5% of units that reach wastage point
Wastage point	75%

REQUIRED

Prepare a quantity statement for April 20X8 by applying:

a. the weighted average method of inventory valuation
b. the FIFO method of inventory valuation

Solution to Activity 16.4

a. Quantity statement – weighted average method (WP = 75%)

Physical units			Equivalent units			
Input (units)	**Details**	**Output (units)**	**Raw materials Units**	**%**	**Conversion cost Units**	**%**
① 50 000	Opening WIP					
② 250 000	Put into production					
	Completed and transferred	② 200 000	200 000	100	200 000	100
	Normal loss	③ 15 000	15 000	⑤ 100	⑥ 11 250	75
	Abnormal loss	④ 25 000	25 000	⑤ 100	⑦ 18 750	75
	Closing WIP	② 60 000	60 000	100	⑧ 54 000	90
300 000		300 000	300 000		284 000	

Explanatory notes

① Closing WIP from March 20X8 automatically becomes opening WIP for April 20X8.

② Given

③ 300 000 x 5% = 15 000
[Opening WIP% < WP% → keep; closing WIP% < WP% → keep]

④ Balancing figure (300 000 – 200 000 – 15 000 – 60 000). Assume the same wastage point as for the normal loss.

⑤ Equivalent units with regard to material for both the normal and the abnormal loss will be the units of the relevant loss in the output column multiplied by 100%, because material is added at the beginning of the process.

⑥ 15 000 (output column) x 75% = 11 250

⑦ 25 000 (output column) x 75% = 18 750

⑧ 60 000 (output column) x 90% = 54 000

b. **Quantity statement – FIFO method (WP = 75%)**

Physical units			Equivalent units			
Input (units)	**Details**	**Output (units)**	**Raw materials Units**	**%**	**Conversion cost Units**	**%**
① 50 000	Opening WIP					
② 250 000	Put into production					
	Completed from:					
	Opening inventory	④ 47 500	–	0	38 000	80
	Current production	⑤ 152 500	152 500	100	152 500	100
	Completed and transferred	② 200 000	152 500		190 500	
	Normal loss	③ 15 000	③15 000	③ 100	③ 11 250	③ 75
	Abnormal loss	③ 25 000	③ 25 000	③ 100	③ 18 750	③ 75
	Closing WIP	③ 60 000	③ 60 000	③ 100	③ 54 000	③ 90
300 000		300 000	252 500		274 500	

Explanatory notes

① Closing WIP from March 20X8 automatically becomes opening WIP for April 20X8.

② Given

③ These numbers could be taken directly from the weighted average method quantity statement prepared in a.

④ Opening inventory was kept included in the normal loss calculation, therefore units completed from opening inventory have to be reduced by 5%: 50 000 x 95% = 47 500.

⑥ Balancing figure (200 000 – 47 500)

---

10 Summary

In this study unit, you learnt the following:

- The *how much* of the normal loss should not be confused with the *where* of the normal loss (wastage point).
- In the output column of the quantity statement, the units completed from current production (FIFO only) and the abnormal loss are usually balancing figures. However, in some questions, one/both of these figures can be given, in which case other figures in the output column may have to be calculated as a balancing figure.
- If the percentage of completion (opening WIP) is *greater than or equal to* the wastage point, *deduct* the opening WIP in the normal loss calculation.
- If the percentage of completion (closing WIP) is *smaller* than the wastage point, *deduct* the closing WIP in the normal loss calculation.
- If the percentage of completion (opening WIP) is *smaller than* the wastage point, reduce the units completed from opening inventory by the normal loss on these units (FIFO only).
- The percentages to use when calculating equivalent units for the losses for purposes of the quantity statement are:

Quantity statement line (both methods)	Material	Conversion cost (if conversion takes place evenly)
Normal loss	100%	% at wastage point (% of completion *where* wastage occurs)
Abnormal loss	100%	% at wastage point (% of completion *where* wastage occurs)

In the next study unit, you are going to learn how to prepare production cost statements for the different methods of inventory valuation (FIFO and weighted average). In the process, you will learn how these statements differ in some areas and agree in other areas when the two methods of inventory valuation are applied.

References and additional reading

Please refer to the list of references and sources for additional reading at the end of study unit 18.

Self-assessment Activity

QUESTION 1

Brake Away Ltd. produces brake fluid for vehicles using a single process. The company uses a process costing system.

The following cost and production figures are available for the year ended 31 December 20X3:

	Units	Completion: raw materials	Completion: conversion cost
WIP (1 Jan 20X3)	40 000	100%	45%
Finished products	160 000	100%	100%
Units started in current year	195 000		
WIP (31 Dec 20X3)	30 000	100%	25%

Additional information

– Raw materials are added at the beginning of the process.
– Conversion takes place evenly throughout the process.
– Normal losses are estimated as 12% of units that reach the wastage point.
– The organisation uses the FIFO method of inventory valuation.

REQUIRED

Prepare the quantity statement if wastage occurs:

a. at the end of the process
b. when the process is 30% complete.

QUESTION 2

The following partially completed quantity statement is available for Purposeful Plastics (Pty) Ltd:

Physical units			Equivalent units			
Input (units)	**Details**	**Output (units)**	**Raw materials Units**	**%**	**Conversion cost Units**	**%**
10 000	Opening WIP					
200 000	Put into production					
	Completed from:					
	Opening inventory	10 000	–	0	?	25
	Current production	170 000	?	100	?	100
	Completed and transferred	180 000	?		?	
	Normal loss	?	?	100	?	30
	Abnormal loss	8 200	8 200	100	2 460	30
	Closing WIP	20 000	20 000	100	5 000	25
210 000		210 000	?		?	

Raw materials are added at the beginning of the process, and conversion takes place uniformly.

REQUIRED

a. Determine which inventory valuation method is used by Purposeful Plastics (Pty) Ltd.
b. What was the stage of completion for the opening and for the closing WIP?
c. At what stage of completion is the wastage point?
d. What is the waste percentage (percentage of units that are wasted when they reach the wastage point)?

QUESTION 3

The following quantity statement is available for Soweto Sweeteners (Pty) Ltd:

Physical units			Equivalent units			
Input (units)	**Details**	**Output (units)**	**Raw materials Units**	**%**	**Conversion cost Units**	**%**
70 000	Opening WIP					
560 000	Put into production					
	Completed and transferred	580 000	580 000	100	580 000	100
	Normal loss	8 000	8 000	100	3 600	45
	Abnormal loss	12 000	12 000	100	5 400	45
	Closing WIP	30 000	30 000	100	18 000	60
630 000		630 000	630 000		607 000	

REQUIRED

a. Determine what inventory valuation method is used by Soweto Sweeteners (Pty) Ltd.
b. What was the stage of completion for the closing WIP?
c. At what stage of completion is the wastage point?
d. Assume the stage of completion for opening WIP was 45%. Complete the sentence: One out of every ________ units is lost due to normal wastage.

QUESTION 4

The following information is available for Amazing Antidotes (Pty) Ltd, an organisation that uses a single process to manufacture an anti-venom for a specific type of snake bite. The organisation uses a process costing system, with material added at the beginning of the process and conversion taking place evenly throughout the process.

<u>October 20X9</u>	
Opening WIP – 30% complete	4 000 litres
New units put into production	15 000 litres
Units completed in the current month	12 000 litres
Closing WIP – 80% complete	3 000 litres
Normal loss	10% of litres that reach the wastage point
Wastage point	80%
Inventory valuation method	Weighted average

On 5 October 20X9, the cooling system in the factory broke down and this resulted in Amazing Antidotes (Pty) Ltd. having to discard 300 litres of anti-venom that heated up

and was thus rendered ineffective against the snake venom. These litres were 60% complete in terms of conversion cost.

REQUIRED

Prepare a quantity statement for Amazing Antidotes (Pty) Ltd. for October 20X9.

Solution to Self-assessment Activity

QUESTION 1

a. Wastage point of 100% (end of process)

Physical units			Equivalent units			
Input (units)	**Details**	**Output (units)**	**Raw materials Units**	**%**	**Conversion cost Units**	**%**
40 000	Opening WIP					
195 000	Put into production					
	Completed from:					
	Opening inventory	① 35 200	–	0	19 360	55
	Current production	② 124 800	124 800	100	124 800	100
	Completed and transferred	160 000	124 800		144 160	
	Normal loss	③ 24 600	24 600	100	24 600	100
	Abnormal loss	② 20 400	20 400	100	20 400	100
	Closing WIP	30 000	30 000	100	7 500	25
235 000		235 000	199 800		196 660	

b. Wastage point of 30%

Physical units			Equivalent units			
Input (units)	**Details**	**Output (units)**	**Raw materials Units**	**%**	**Conversion cost Units**	**%**
40 000	Opening WIP					
195 000	Put into production					
	Completed from:					
	Opening inventory	40 000	–	0	22 000	55
	Current production	② 120 000	120 000	100	120 000	100
	Completed and transferred	160 000	120 000		142 000	
	Normal loss	④ 19 800	19 800	100	5 940	30
	Abnormal loss	② 25 200	25 200	100	7 560	30
	Closing WIP	30 000	30 000	100	7 500	25
235 000		235 000	195 000		163 000	

Explanatory notes

① 40 000 x (100% – 12%) = 35 200

② Balancing figures:
160 000 – 40 000 = 120 000
235 000 – 160 000 – 19 800 – 30 000 = 25 200

③ (235 000 – 30 000) x 12% = 24 600

④ 235 000 – 40 000 – 30 000) x 12% = 19 800

NOTE

Opening WIP (45%) < wastage point (100%)

- When the opening WIP is kept included in the calculation of normal loss, the normal loss *on these units* will effectively be included in the quantity statement as part of the normal loss line. The loss on these units cannot, therefore, also be kept included in the units completed from opening inventory, because this would amount to double counting. Each input should only be accounted for *once* in the output column.
- Normal loss on the input units of 40 000 would be 40 000 x 12% = 4 800. These 4 800 units that were lost are effectively included in the total normal loss of 24 600 units in the quantity statement, because opening WIP was included in the normal loss calculation as per rule 16.1 of this study unit.

Opening WIP (45%) > wastage point (30%)

- The opening WIP has already passed the wastage point in the previous year and therefore the 40 000 input units are already net of any normal losses incurred on the opening WIP.
- When normal loss is calculated, opening WIP will be deducted in (excluded from) the calculation as per rule 16.2 of this study unit.

QUESTION 2

a. The completed output is split between units completed from opening inventory and units completed from current production. We therefore know that the FIFO method is being used.

b. Opening WIP: these units required a further 25% of conversion work to be completed and therefore had to be 75% complete when the period started.
Closing WIP: 25% as per the conversion column.

c. 30% as per the conversion column.

d. Calculate waste percentage

- Percentage of completion (opening WIP) of 75% is *greater than* the wastage point of 30%, therefore opening WIP would have been deducted in the normal loss calculation.
- Percentage of completion (closing WIP) of 25% is *smaller* than the wastage point of 30%, therefore the closing WIP would have been deducted in the normal loss calculation.
- Normal loss would therefore have been calculated based on (210 000 – 20 000 – 10 000) = 180 000 units.
- The normal loss in the output column can be calculated as a balancing figure of (210 000 – 180 000 – 8 200 – 20 000) = 1 800 units.
- 1 800 / 180 000 = 1%

NOTE

If the percentage of completion of opening WIP was smaller than the wastage point of 30%, our units completed from opening inventory would have been reduced by the percentage of the normal loss. We would then also be able to calculate the waste percentage based on the difference between opening WIP in the input column and units completed from opening inventory in the output column, divided by the opening WIP in the input column.

QUESTION 3

a. The completed output is **not** split between units completed from opening inventory and units completed from current production. We therefore know that the weighted average method is being used.

b. **60%** as per the conversion column.

c. **45%** as per the conversion column.

d. Calculate the waste ratio:
   Percentage of completion (opening WIP) of 45% is *equal to* the wastage point of 45%; therefore opening WIP would have been deducted in the normal loss calculation.

   Percentage of completion (closing WIP) of 60% is *larger* than the wastage point of 45%; therefore the closing WIP would have been kept included in the normal loss calculation.

   Normal loss would therefore have been calculated based on (630 000 – 70 000) = 560 000 units.

   Normal loss in the output column is 8 000 units (given).
   8 000 / 560 000 = 1 / 70 if simplified.
   Answer: **70**

QUESTION 4

AMAZING ANTIDOTES (PTY) LTD
Quantity statement for the month ended 31 October 20X9

	Physical units		Equivalent units			
Input (units)	**Details**	**Output (units)**	**Raw materials Units**	**%**	**Conversion cost Units**	**%**
4 000	Opening WIP					
15 000	Put into production					
	Completed and transferred	12 000	12 000	100	12 000	100
	Normal loss	①1 870	1 870	100	1 496	80
	Abnormal loss (at normal loss wastage point)	②1 830	1 830	100	1 464	80
	Abnormal loss (due to power failure)	300	300	100	180	③60
	Closing WIP	3 000	3 000	100	2 400	80
19 000		19 000	19 000		17 540	

Explanatory notes

① Calculation of normal loss:

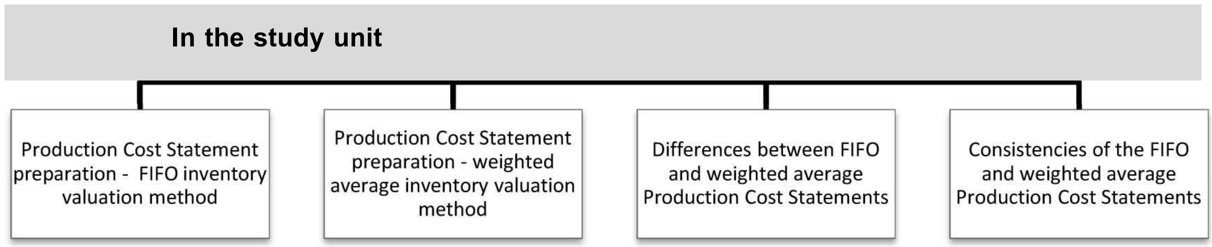
- Percentage of completion (opening WIP) of 30% is *smaller than* the wastage point of 80%, therefore opening WIP will have to be kept included in the normal loss calculation.
- Percentage of completion (closing WIP) of 80% is *equal to* the wastage point of 80%, therefore the closing WIP will have to be kept included in the normal loss calculation.
- The abnormal loss due to the power failure occurred when the relevant units were 60% complete, that is, before they could reach the 80% wastage point. These 300 units were thus never subject to a normal loss and will have to be deducted in the normal loss calculation.
- Normal loss should therefore be calculated based on 19 000 – 300 = 18 700 units.
- Normal loss in the output column should therefore be 10% x 18 700 = 1 870 units.

② In addition to the abnormal loss that resulted from the power failure, the balancing figure of 19 000 – 3 000 – 300 – 1 870 – 12 000 = 1 830 also represents an abnormal loss.

③ The conversion cost equivalent units for the abnormal loss that occurred owing to the power failure are based on the stage of completion when the loss occurred.

STUDY UNIT 17

Production cost statements



1 Introduction

In previous study units, you learnt how to determine the equivalent units of output for the quantity statement. In this study unit, you will learn how cost is allocated to these equivalent units in a production cost statement and what the differences and consistencies between production cost statements are when the weighted average and FIFO methods of inventory valuation are used.

The average cost per unit in a process costing system (see previous study units) is calculated in a *production cost statement*.

PRODUCTION COST STATEMENT

The production cost statement is a summary of the following:

- Total manufacturing cost for a specific period
- Number of units produced in the specific period – equivalent units from the quantity statement
- Resultant average cost per unit for each category of input

As with the quantity statement, conversion cost may have to be split into labour and overhead costs (if the information given in a question necessitates this).

It is important to note which *method of inventory valuation* is being used, since there is a significant difference between the calculations in the production cost statement for the FIFO method and for the weighted average method.

NOTE

a. In this module (MAC2601), process cost will be calculated based on actual material and labour cost and allocated overheads for the current and prior period(s). In later modules, you will learn how to integrate a process costing system with a standard costing system. (Standard costing is covered later on in this module.)

b. In a MAC2601 process costing question, we generally round cost per unit to two decimals, unless the number of decimal places to use is specified otherwise.

2 Production cost statement preparation – FIFO method of inventory valuation

Where the FIFO method of inventory valuation is used, only the *current period* production cost should be taken into account in the calculation of the average cost per unit manufactured (because we are spreading it over *current period production activities* only).

The next activity will demonstrate how to complete the production cost statement on the FIFO basis.

Activity 17.1

FIFO production cost statement

The following quantity statement is available for Jumpy Juice (Pty) Ltd. for May 20X8:

Physical units			Equivalent units			
Input (units)	**Details**	**Output (units)**	**Raw materials Units**	**%**	**Conversion cost Units**	**%**
60 000	Opening WIP					
380 000	Put into production					
	Completed from:					
	Opening inventory	60 000	–	0	6 000	10
	Current production	300 000	300 000	100	300 000	100
	Completed and transferred	360 000	300 000		306 000	
	Normal loss	16 500	16 500	100	12 375	75
	Abnormal loss	13 500	13 500	100	10 125	75
	Closing WIP	50 000	50 000	100	30 000	60
440 000		440 000	380 000		358 500	

In addition, the following cost information is available for May 20X8:

	R
WIP: 1 May 20X8	
Material	180 000
Conversion cost	297 000
Material added during May 20X8	1 219 800
Labour for May 20X8	1 020 565
Overheads for May 20X8	1 091 000

REQUIRED

Prepare the production cost statement for May 20X8 under the assumption that Jumpy Juice (Pty) Ltd. uses the FIFO method of inventory valuation.

Solution to Activity 17.1

PRODUCTION COST STATEMENT – FIFO

	Total R		Material		Conversion cost
Opening WIP	① 477 000				
Current production cost	3 331 365		1 219 800		2 111 565
Total	3 808 365				
Equivalent units – per quantity statement			② 380 000		② 358 500
Equivalent cost per unit	⑤ R9,10	=	③ R3,21	+	④ R5,89

Explanatory notes

① 180 000 + 297 000 = 477 000. Note that the R180 000 and the R297 000 from the opening inventory are *excluded from* the material and conversion cost columns respectively when the *FIFO method* of inventory valuation is used. (In the production cost statement above, the relevant section is blocked out to reinforce this principle.) The equivalent units exclude the percentage of completion from the previous period, and therefore we should exclude the costs that have arisen in the previous period so that the units and the costs are matched.

② Equivalent unit column totals from the quantity statement

③ Average material cost per equivalent unit manufactured
= current period material cost / equivalent units
= R1 219 800 / 380 000 units
= R3,21 per unit

④ Average conversion cost per equivalent unit manufactured
= current period conversion cost / equivalent units
= R2 111 565 / 358 500 units
= R5,89 per unit

⑤ R3,21 (material) + R5,89 (conversion cost) = R9,10. This is the total average cost per unit manufactured.

NOTE

- The TOTAL average cost per unit manufactured (⑤) is NEVER calculated by dividing the current production cost by any number of units. Instead, it is the sum of the input costs per equivalent unit!
- Although the R180 000 and R297 000 are not included in the equivalent cost per unit calculations for May 20X8, these costs relating to opening inventory will effectively be used in the valuation of our completed goods. This principle should become clearer to you when you work through study unit 18.

3 Production cost statement preparation – weighted average method of inventory valuation

Where the weighted average method of inventory valuation is used, both the current period production cost *and the cost included in the opening WIP* should be taken into account in the calculation of the average cost per unit manufactured. In calculating the average, we will include the opening WIP equivalent units in full, as included in the "Completed and transferred" line in the quantity statement.

Activity 17.2

Weighted average production cost statement

Refer to the information in activity 17.1 in this study unit.

REQUIRED

Prepare the production cost statement for May 20X8 under the assumption that Jumpy Juice (Pty) Ltd. uses the weighted average method of inventory valuation.

Solution to Activity 17.2

In this case, we were only provided with the FIFO quantity statement. From previous examples, we could see that the equivalent unit column totals differed between the FIFO and weighted average methods of inventory valuation because units completed from the opening inventory and from current production have to be split where FIFO is used. We cannot, therefore, simply just take the totals from our FIFO quantity statement for use in our weighted average production cost statement. We will therefore have to prepare the weighted average quantity statement for May 20X8 before we can prepare the weighted average production cost statement for May 20X8.

QUANTITY STATEMENT – Weighted average method

Physical units			Equivalent units			
Input (units)	**Details**	**Output (units)**	**Raw materials Units**	**%**	**Conversion cost Units**	**%**
① 60 000	Opening WIP					
① 380 000	Put into production					
	Completed and transferred	360 000	360 000	100	360 000	100
	Normal loss	① 16 500	① 16 500	① 100	① 12 375	① 75
	Abnormal loss	① 13 500	① 13 500	① 100	① 10 125	① 75
	Closing WIP	① 50 000	① 50 000	① 100	① 30 000	① 60
① 440 000		① 440 000	440 000		412 500	

Explanatory notes

① These items will be exactly the same as in the FIFO quantity statement.

NOTE

Can you see that the calculation of the total normal loss in units is in no way dependent on the valuation method used? This is because the calculation of the units lost is based on the PHYSICAL units that reached the wastage point.

PRODUCTION COST STATEMENT – Weighted average method

	Total R		Material		Conversion cost
Opening WIP	① 477 000		① 180 000		① 297 000
Current production cost	3 331 365		1 219 800		2 111 565
Total	3 808 365		1 399 800		2 408 565
Equivalent units – per quantity statement			② 440 000		② 412 500
Equivalent cost per unit	⑤ R9,02	=	③ R3,18	+	④ R5,84

Explanatory notes

① 180 000 + 297 000 = 477 000. Note that the R180 000 and the R297 000 *are* included in the material and conversion cost columns respectively when the *weighted average method* of inventory valuation is used. The equivalent units completed included those completed from the opening inventory in full and we should therefore include the costs related to the opening inventory so that the units and costs are matched.

② Equivalent unit column totals from the quantity statement

③ Average material cost per equivalent unit manufactured
= total material cost / equivalent units
= R1 399 800 / 440 000 units
= R3,18 per unit (rounded to two decimals)

④ Average conversion cost per equivalent unit manufactured
= total conversion cost / equivalent units
= R2 408 565 / 412 500 units
= R5,84 per unit (rounded to two decimals)

⑤ R3,18 (material) + R5,84 (conversion cost) = R9,02. This is the total average cost per unit manufactured.

NOTE

The above explanatory notes, as well as the explanatory notes in the solution to Activity 17.1 in this study unit, were included in the solution simply to show you how some of the figures in the production cost statements were arrived at. As long as it is clear that you have applied the correct principles in the production cost statement (ie used cost of the current period for FIFO/total cost for the weighted average method, and divided this cost by the column totals from the quantity statement) you do not have to explain the figures (as done here).

4 Differences between FIFO and weighted average production cost statements

By carefully looking at Activity 17.1 and Activity 17.2 in this study unit, you will notice the following significant differences between the FIFO and weighted average production cost statements:

- For FIFO, the cost included in opening WIP is only included in the total column whereas, for the weighted average method, the costs included in the opening WIP are also shown separately for material and for conversion in the relevant columns.

- For FIFO, only the production cost of the *current* period is used in the calculation of an average cost per unit for material and for conversion. For the weighted average method, the sum of the value of the opening WIP and the current period production cost need to be determined and then the respective *totals* are used to calculate the average cost per unit for material and conversion.
- The number of units used in the calculation of average cost per unit will also differ between FIFO and weighted average, because the quantity statements for these two methods will differ in terms of the equivalent unit column totals for material and conversion cost.

If we list the cost per unit from Activity 17.1 and Activity 17.2 in this study unit according to the method of inventory valuation, we will arrive at the following:

	Total **R**	**Material** **R**	**Conversion** **R**
Equivalent cost per unit (FIFO)	9,10	3,21	5,89
Equivalent cost per unit (weighted average method)	9,02	3,18	5,84

The differences between the two methods in terms of the equivalent cost per unit are due to the fact that the two methods account for different costs and for a different number of equivalent units when the cost per equivalent unit is calculated, as summarised in the following table:

Inventory valuation method	**Costs to account for**	**Units**
FIFO	Costs of the current period	Equivalent output of current period as per **FIFO** quantity statement
Weighted average	Costs of the current period + costs included in opening inventory	Equivalent output of current period as per **weighted average** quantity statement

In inflationary conditions, production costs may increase from period to period. It therefore follows that the FIFO method will result in higher unit costs, because this method only 'uses' costs for the latest period (which are higher than the costs for the previous period). If opening inventory (valued at the previous period's costs) is small compared with current period production, the weighted average method will achieve equivalent unit costs very close to that of FIFO.

NOTE

In very specific scenarios, the equivalent unit column totals of the FIFO and weighted average quantity statements may agree for material and/or conversion, which will result in the same number of units being used in the cost per equivalent unit calculations according to the two methods. However, the costs to be accounted for in the calculations will generally still differ between the methods, resulting in different costs per equivalent unit for the two methods.

5 Consistencies of FIFO and weighted average production cost statements

If you study Activity 17.1 and Activity 17.2 in this study unit carefully, you will notice the following main consistencies between the FIFO and weighted average production cost statements:

- Both statements summarise cost and equivalent unit information for material and conversion cost, and in total.
- Both statements kept the R477 000 value of opening WIP included in the total column. We always need to keep this amount in the *total column* in order to arrive at the total cost associated with all the units that were in the production process at some stage during the current period (R3 808 365 in these examples). Eventually the total cost in the production cost statement has to balance with the total cost as per the cost allocation statement (refer to study unit 18).
- The total average cost per unit is arrived at by adding the average material cost per unit to the average conversion cost per unit.

6 Summary

In this study unit, you learnt the following:

- A production cost statement summarises the cost and equivalent unit information for a specific period and indicates the resultant average cost per equivalent unit manufactured – for materials, conversion costs and in total.
- If the FIFO method of inventory valuation is used, only the *current* period production cost is used in the calculation of the average material and conversion cost per equivalent unit.
- If the weighted average method of inventory valuation is used, both the current period production cost *and the value of the opening WIP* are used in the calculation of the average material and conversion cost per equivalent unit.

In the next study unit, you are going to learn how to prepare cost allocation statements for the different methods of inventory valuation (FIFO and weighted average). You are also going to learn how to calculate and allocate the rand value of the normal loss for the cost allocation statement.

Additional reading

Please refer to the list of sources for additional reading at the end of study unit 18.

Self-assessment Activity

Refer to Activity 16.3 in study unit 16 and the cost information below. Now that you have learnt how to prepare production cost statements, draft these statements for the four different scenarios in Activity 16.3 and see whether your answer corresponds with the suggested solution below. Make sure that you understand how each of the numbers in the production cost statements was arrived at and which numbers differ between the different scenarios.

Cost information	
WIP (1 February 20X8)	R30 000
(including raw materials and conversion cost in the ratio 2:1)	
Material added during February	R253 000
Conversion cost for February	R363 165

Solution to Self-assessment Activity

a.i and b.i Production cost statement – weighted average method

	Total R	Material	Conversion costs
Opening WIP	30 000	① 20 000	① 10 000
Current production cost	616 165	253 000	363 165
Total	646 165	273 000	373 165
Equivalent units			
– per quantity statement (0%)		② 25 000	② 18 400
Equivalent cost per unit	R31,20	= R10,92	+ R20,28
Equivalent units		③ 25 000	③ 21 900
– per quantity statement (70%)			
Equivalent cost per unit	R27,96	= R10,92	+ R17,04

Explanatory notes

① Material: 2/3 x R30 000 = R20 000
Conversion costs: 1/3 x R30 000 = R10 000

② From quantity statement in Activity 16.3 in study unit 16, part a.i.

③ From quantity statement in Activity 16.3 in study unit 16, part b.i.

NOTE

- The above difference in equivalent cost per unit for **conversion** is a result of the *same amount of R373 165* being divided by different numbers of equivalent units (18 400 and 21 900 respectively). The equivalent unit numbers for conversion differ because different wastage points are applicable.
- In practice, the actual amount of *conversion costs would have differed* between the two wastage points, because the organisation would stop spending money (incurring conversion costs) on the units that have been identified as wasted. The two costs per unit would therefore tend to be very close to each other in optimal manufacturing conditions, irrespective of where the wastage point is.
- Since MAC2601 assumes that all **materials** are being added at the beginning of the process and the **weighted average** method is being applied, 100% of all the different types of output units will be accounted for in the material equivalent units column, independent of where in the process wastage occurs. This is why there was no difference between a.i. and b.i. in the equivalent cost per unit for material.

a.ii and b.ii Production cost statement – FIFO method

	Total R	Material	Conversion Cost
Opening WIP	30 000		
Current production cost	616 165	253 000	363 165
Total	646 165		
Equivalent units			
– per quantity statement (0%)		① 23 000	① 17 800
Equivalent cost per unit	R31,40	= R11,00	+ R20,40
Equivalent units		② 23 300	② 21 390
– per quantity statement (70%)			
Equivalent cost per unit	R27,84	= R10,86	+ R16,98

Explanatory notes

① From quantity statement in Activity 16.3 of study unit 16, part a.ii.

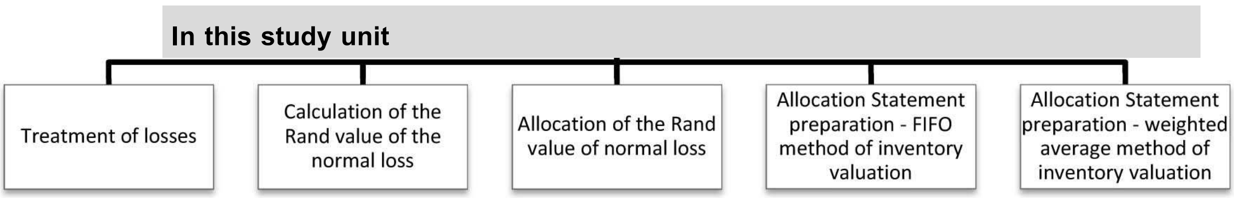
② From quantity statement in Activity 16.3 of study unit 16, part b.ii.

NOTE

- Refer to the notes on conversion cost differences below the solution to a.i. and b.i.
- ADVANCED NOTE: One would expect the material cost per unit to be the same, because the material is added at the beginning and the spillage percentage is always 100% irrespective of where the spillage take place. However, we have indicated that, in MAC2601, we will apply a measure of inaccuracy in determining the normal loss equivalent units when applying the FIFO method in order to simplify the calculations. If, in Activity 16.3 b.ii., we had split the normal loss between that generated by the opening inventory and that from the new units started, we would have excluded from the raw materials equivalent column 2 000 units x 15% = 300 units BECAUSE THESE COSTS WERE NOT INCURRED IN THE CURRENT PERIOD! In the solution above, this would have achieved the same equivalent material cost per unit. However, there is no need to worry if you do not understand this concept, because you will not be examined on it.

STUDY UNIT 18

Allocation statements



1 Introduction

In the previous study unit, you learnt how to prepare production cost statements using the FIFO and weighted average methods of inventory valuation.

In this study unit, you are going to learn how to prepare cost allocation statements using the FIFO and weighted average methods of inventory valuation. You will also learn how to determine the value of losses and how to perform the allocation of the normal loss.

ALLOCATION STATEMENT

An allocation statement, also called a *cost allocation statement*, is a statement that links the equivalent unit input costs in the production cost statement to the output from the quantity statement in order to value inventory, abnormal losses and production for the period, including any normal losses for the period.

All units included in the equivalent unit columns of the quantity statement should be accounted for under appropriate headings or parts in the cost allocation statement. Each equivalent unit is multiplied by the appropriate average cost per unit (average material or conversion cost per unit as applicable).

NOTE

The total production cost allocated in the cost allocation statement should agree to the total production cost as per the production cost statement.

Allocation statement

The cost allocation statement could include the following parts (headings):

TABLE 18.1: Sections/parts of the cost allocation statement per inventory valuation method

	Part (heading)	Weighted average method	FIFO method
1	Opening WIP	No	Yes
2	Current period equivalent production activities	No	Yes
3	Completed production transferred (to finished goods or the next process)	Yes	Yes (total of parts 1 and 2)
4	Abnormal loss	Yes	Yes
5	Closing WIP	Yes	Yes

NOTE

There is no separate heading for normal losses. The allocation of normal loss is dealt with next.

2 Treatment of losses

Knowing the differences between normal and abnormal loss is crucial to your understanding of the accounting treatment of each. Because it is so important to know the differences, we include the information contained in Table 16.1 of study unit 16 once more in Table 18.2 below. Please note that we have added an extra row at the end of the table (this applies to allocation statements).

TABLE 18.2: Normal losses compared with abnormal losses

Normal losses	Abnormal losses
Sometimes also referred to as unavoidable losses.	Sometimes also referred to as controllable losses.
Inherent in the manufacturing process (they will occur as a natural part of the process) – you cannot avoid them.	*Avoidable* in the manufacturing process (they will *not* occur as a natural part of the process) – you should control/inhibit their occurrence.
Do *not* indicate that a process is ineffective – therefore "normal".	Indicate that a part/parts of the process is/are ineffective – therefore "abnormal".
Examples: • Wastage due to evaporation in a chemical process (eg some inputs will "vanish" naturally when heating essential for binding takes place). • Waste materials where textiles are produced (off-cuts). • Units rejected at quality inspection (within acceptable (normal) range or tolerance).	Examples: • Wastage due to use of raw materials of inferior quality resulting in production output scrapped. • Wastage due to employee carelessness. • Spoilt output due to production interruption (eg electrical failure leading to units heating up/cooling down etc).

Normal losses	Abnormal losses
Product cost (included in the cost of inventory) Note: also allocated to abnormal units (if they have shared in the loss).	Period cost (not included in the cost of inventory). Note, however, that the abnormal loss will include its share of the normal loss (if the abnormal loss has indeed shared in the normal loss).

In terms of International Financial Reporting Standards (IFRS), normal losses should be included in the cost of inventory (thus it will be included in product cost) (IFRS Foundation 2010). This is logical, because this cost is unavoidable and is an inextricable part of the production process.

We can illustrate the inclusion of normal losses in the cost of inventory with a simple example:

Let us say an organisation spends R10 in total for the material and conversion work that go into a single litre (1 000 mℓ) of output. If no normal wastage takes place, the output per litre of input will also be one litre, resulting in a cost per unit of output of R10/1 litre = R10 per litre.

If 10% (or 100 mℓ) of each litre is lost due to normal wastage, the output will only be 900 mℓ for each litre of input. The same cost per litre of input (R10) still needs to be accounted for, but we will allocate it to only 900 mℓ of output, resulting in a cost per unit of output of R10/0,9 litre = R11,11 per litre (rounded).

Another way of putting it:
If the normal loss percentage is 10%, how many litres should we put into the process at the beginning to arrive at one litre of output?

1ℓ / 90% = 1,1111 ℓ (rounded)
[Proof: If 1,1111ℓ goes into the process and 10% of that is lost, then 1,1111ℓ x 10% = 0,1111ℓ is wasted, leaving one litre of final output.]

Therefore, 1,1111ℓ at R10/ℓ = R11,11 is the normal cost incurred to generate one litre. This is why normal losses are included in the valuation of ``good'' output.

This principle is taken further in this study unit and can be translated into a rule as follows:

Rule 18.1

All units of production that have reached/passed the (normal) wastage point in the current period are subject to the normal loss of this period and therefore each of these units needs to be allocated a portion of the rand value of the normal loss.

At the end of a period when financial reporting needs to take place, the rand value of the normal loss will therefore have to be allocated to the following:

- Completed units transferred to the finished goods store or to the following process (equivalent units) – to the extent that these units passed the wastage point in the **current** period **(the only exception to this rule is when the weighted average method is used and opening inventory has already passed the wastage point in the previous period [opening WIP % $\geqslant$ wastage point %], in which case we will use all units completed and transferred in the allocation calculation)**.
- Closing WIP (equivalent units) – only if closing WIP has already reached/passed the wastage point.

- Abnormal losses (equivalent units) – only if the abnormal loss occurs at **the same** wastage point as the normal loss **or after** the wastage point where the normal loss occurred.

The only part of the rand value of the normal loss that will eventually not be included in the inventory valuation or cost of sales is the portion that is allocated to the abnormal loss.

> **Rule 18.2**
>
> The rand value of abnormal losses (including their allocated portion of the normal loss) will not form part of the inventory cost, but should be written off as a period cost in the statement of profit or loss and other comprehensive income.

3 Calculation of the rand value of normal loss

The rand value of the normal loss is calculated as follows:

NLR = NLM + NLC

where:

NLR = Normal loss in rand

NLM = Equivalent cost per unit for material (from production cost statement) x normal loss in terms of equivalent units for material (from quantity statement)

NLC = Equivalent cost per unit for conversion cost (from production cost statement) x normal loss in terms of equivalent units for conversion cost (from quantity statement)

For example, assume the following information:

Quantity statement for September 20X8 – FIFO; closing WIP 90% complete

Physical units			**Equivalent units**			
Input (units)	**Details**	**Output (units)**	**Raw materials Units**	**%**	**Conversion cost Units**	**%**
40 000	Opening WIP					
260 000	Put into production					
	Completed from:					
	Opening inventory	36 800	–	- 0	23 920	65
	Current production	183 200	183 200	100	183 200	100
	Completed and transferred	220 000	183 200		207 120	
	Normal loss	24 000	24 000	100	21 600	90
	Abnormal loss	6 000	6 000	100	5 400	90
	Closing WIP	50 000	50 000	100	45 000	90
300 000		300 000	263 200		279 120	

Production cost statement for September 20X8 – FIFO; closing WIP 90% complete

	Total R	Material	Conversion Cost
Opening WIP	855 000*		
Current production cost	7 273 432	4 621 792	2 651 640
Total	8 128 432		
Equivalent units – per quantity statement		263 200	279 120
Equivalent cost per unit	R27,06	= R17,56	+ R9,50

* Consisting of material cost of R700 000 and conversion cost of R155 000.

From the above quantity statement and production cost statement, we can calculate the rand value of the normal loss as follows:

NLR = NLM + NLC
= (24 000 x 17,56) + (21 600 x 9,50)
= 421 440 + 205 200
= R626 640

Activity 18.1

Normal loss calculation: weighted average method of inventory valuation

Refer to the information in the Self-assessment Activity of study unit 17. You will notice that the FIFO method of inventory valuation has been used. We know this because:

- in the quantity statement, the units completed and transferred were split between units completed from opening inventory and units started *and* completed in the current period (''current production''); and
- in the production cost statement, only the production cost for the current period (''current production cost'') was used to calculate the equivalent cost per unit.

REQUIRED

Now assume that the organisation should actually have used the weighted average method of inventory valuation, and:

a. prepare the quantity statement and the production cost statement
b. calculate the rand value of the normal loss

Solution to Activity 18.1

a. LUNAR LOTION (PTY) LTD
Quantity statement for September 20X8: weighted average method

Physical units			Equivalent units			
Input (units)	**Details**	**Output (units)**	**Raw materials Units**	**%**	**Conversion cost Units**	**%**
40 000	Opening WIP					
260 000	Put into production					
	Completed and transferred	220 000	220 000	100	220 000	100
	Normal loss	24 000	24 000	100	21 600	90
	Abnormal loss	6 000	6 000	100	5 400	90
	Closing WIP	50 000	50 000	100	45 000	90
300 000		300 000	300 000		292 000	

Production cost statement for September 20X8: weighted average method

	Total R	Material	Conversion Cost
Opening WIP	855 000	700 000	155 000
Current production cost	7 273 432	4 621 792	2 651 640
Total	8 128 432	5 321 792	2 806 640
Equivalent units – per quantity statement		300 000	292 000
Equivalent cost per unit	R27,35	= R17,74	+ R9,61

b. NLR = NLM + NLC
= (24 000 x 17,74) + (21 600 x 9,61)
= 425 760 + 207 576
= R633 336

NOTE

As you will notice, the *method* of calculation of the rand value of normal loss will be the same for the weighted average and the FIFO methods; however, the equivalent cost per unit will differ between the two methods and the result of the calculation will therefore differ between the methods.

4 Allocation of the rand value of normal loss

The allocation of the rand value of the normal loss consists of two parts: material and conversion cost. The values of normal losses in terms of material and conversion cost for a specific period (R421 440 and R205 200 respectively in the FIFO example in section 3) are allocated to all the units that reached/passed the wastage point in the specific period (subject to the weighted average method exception as mentioned in section 2). We base the allocation on the number of equivalent units of each relevant item as per the quantity statement.

For example, if we use the FIFO quantity statement and production cost statement provided in section 3 above, we will allocate the normal loss as follows:

Material

	Units	Calculation	R
Completed and transferred	183 200	183 200 / 239 200 x R421 440	322 775
Abnormal loss	6 000	6 000 / 239 200 x R421 440	10 571
Closing WIP	50 000	50 000 / 239 200 x R421 440	88 094
TOTAL	239 200		**421 440**

Conversion

	Units	Calculation	R
Completed and transferred	207 120	207 120 / 257 520 x R205 200	165 040
Abnormal loss	5 400	5 400 / 257 520 x R205 200	4 303
Closing WIP	45 000	45 000 / 257 520 x R205 200	35 857
TOTAL	257 520		**205 200**

NOTE

We can summarise the allocation of the normal loss of R626 640 as follows:

Allocated to	**Calculation**	**R**
Completed goods	322 775 + 165 040	487 815
Abnormal loss	10 571 + 4 303	14 874
Closing WIP	88 094 + 35 857	123 951
Total cost of normal loss		**626 640**

Activity 18.2

Allocation of normal loss

Refer to the information in section 4 above (including the weighted average quantity statement and production cost statement prepared in Activity 18.1).

REQUIRED

Allocate the rand value of the normal loss for purposes of preparing the cost allocation statement based on the following:

a. weighted average method
b. FIFO method (assume closing inventory is now only 40% complete at 30 September 20X8)
c. weighted average method (assume closing inventory is now only 40% complete at 30 September 20X8).

NOTE

In practice, the total production cost for the month would be less if closing WIP were now only 40% complete (compared with 90% complete). However, for the purposes of simplicity, we have kept the amounts the same.

Solution to Activity 18.2

a. Material

	Units	Calculation	R
Completed and transferred	220 000	220 000 / 276 000 x R425 760	339 374
Abnormal loss	6 000	6 000 / 276 000 x R425 760	9 256
Closing WIP	50 000	50 000 / 276 000 x R425 760	77 130
TOTAL	276 000		425 760

Conversion

	Units	Calculation	R
Completed and transferred	220 000	220 000 / 270 400 x R207 576	168 886
Abnormal loss	5 400	5 400 / 270 400 x R207 576	4 145
Closing WIP	45 000	45 000 / 270 400 x R207 576	34 545
TOTAL	270 400		207 576

NOTE

We can summarise the allocation of the normal loss of R633 336 (refer to Activity 18.1) as follows:

Allocated to	**Calculation**	**R**
Completed goods	339 374 + 168 886	508 260
Abnormal loss	9 256 + 4 145	13 401
Closing WIP	77 130 + 34 545	111 675
Total cost of normal loss		**633 336**

b. The fact that closing inventory is now only 40% complete at the end of the period will result in the following having to be adjusted (**changes are highlighted**):

- FIFO quantity statement
- FIFO production cost statement (equivalent unit costs)
- Calculation of normal loss rand value

Quantity statement for September 20X8 – FIFO; closing WIP 40% complete

Physical units			Equivalent units			
Input (units)	**Details**	**Output (units)**	**Raw materials Units**	**%**	**Conversion cost Units**	**%**
40 000	Opening WIP					
260 000	Put into production					
	Completed from:					
	Opening inventory	36 800	–	0	23 920	65
	Current production	183 200	183 200	100	183 200	100
	Completed and transferred	220 000	183 200		207 120	
	Normal loss	①-③ 20 000	20 000	100	18 000	90
	Abnormal loss	④ 10 000	10 000	100	9 000	90
	Closing WIP	50 000	50 000	100	20 000	40
300 000		300 000	263 200		254 120	

Production cost statement for September 20X8 – FIFO; closing WIP 40% complete

	Total R	Material	Conversion Cost
Opening WIP	855 000		
Current production cost	7 273 432	4 621 792	2 651 640
Total	8 128 432		
Equivalent units – per quantity statement		263 200	254 120
Equivalent cost per unit	R27,99	= R17,56	+ R10,43

NLR = NLM + NLC
= (**20 000** x 17,56) + (**18 000** x 10,43)
= 351 200 + 187 740
= R538 940

Explanatory notes

① From the quantity statement given in section 3, the normal loss percentage can be calculated as (40 000 – 36 800) / 40 000 = 8% or alternatively, 24 000 / 300 000② = 8%.

② The full 300 000 was used, as:

- opening inventory percentage of completion (100% – 65% = 35%) was not larger than or equal to the wastage point (90%), therefore opening inventory would have been included in the normal loss calculation.
- closing inventory percentage of completion (90%) was not smaller than the wastage point (90%), therefore closing inventory would have been included in the normal loss calculation.

③ The normal loss calculation for the adjusted quantity statement will be as follows:

8% x (300 000 – 50 000) = 20 000
(Closing inventory percentage of completion (now 40%) is now smaller than the wastage point (90%), therefore closing inventory will have to be deducted in the normal loss calculation.)

④ Balancing figure

The allocation of the normal loss of R538 940 will be as follows:

<u>Material</u>

	Units	Calculation	R
Completed and transferred	183 200	183 200 / 193 200 x R351 200	333 022
Abnormal loss	10 000	10 000 / 193 200 x R351 200	18 178
Closing WIP	–	–	0
TOTAL	193 200		351 200

<u>Conversion</u>

	Units	Calculation	R
Completed and transferred	207 120	207 120 / 216 120 x R187 740	179 922
Abnormal loss	9 000	9 000 / 216 120 x R187 740	7 818
Closing WIP	–	–	0
TOTAL	216 120		187 740

NOTE

- At the end of the period, closing inventory had not yet reached/passed the wastage point (40% < 90%) and we cannot, therefore, allocate a portion of the normal loss to these units.
- We can summarise the allocation of the normal loss of R538 940 as follows:

Allocated to	Calculation	R
Completed goods	333 022 + 179 922	512 944
Abnormal loss	18 178 + 7 818	25 996
Closing WIP	0 + 0	0
Total cost of normal loss		**538 940**

c. The fact that closing inventory is now only 40% complete at the end of the period will result in the following having to be adjusted:

- Weighted average method quantity statement
- Weighted average method production cost statement (equivalent unit costs)
- Calculation of normal loss rand value

Quantity statement for September 20X8 – weighted average method; closing WIP 40% complete

Physical units			Equivalent units			
Input (units)	**Details**	**Output (units)**	**Raw materials Units**	**%**	**Conversion cost Units**	**%**
40 000	Opening WIP					
260 000	Put into production					
	Completed and transferred	220 000	220 000	100	220 000	100
	Normal loss	① 20 000	20 000	100	18 000	90
	Abnormal loss	② 10 000	10 000	100	9 000	90
	Closing WIP	50 000	50 000	100	20 000	40
300 000		300 000	300 000		267 000	

Production cost statement for September 20X8 – weighted average method; closing WIP 40% complete

	Total R	**Material**	**Conversion cost**
Opening WIP	855 000	700 000	155 000
Current production cost	7 273 432	4 621 792	2 651 640
Total	8 128 432	5 321 792	2 806 640
Equivalent units – per quantity statement		300 000	267 000
Equivalent cost per unit	R28,25	= R17,74	+ R10,51

NLR = NLM + NLC
= (20 000 x 17,74) + (18 000 x 10,51)
= 354 800 + 189 180
= R543 980

Explanatory notes

① As in part b.

② Balancing figure (as in part b.)

Material

	Units	Calculation	R
Completed and transferred	220 000	220 000 / 230 000 x R354 800	339 374
Abnormal loss	10 000	10 000 / 230 000 x R354 800	15 426
Closing WIP	–	–	0
TOTAL	230 000		354 800

Conversion

	Units	Calculation	R
Completed and transferred	220 000	220 000 / 229 000 x R189 180	181 745
Abnormal loss	9 000	9 000 / 229 000 x R189 180	7 435
Closing WIP	–	–	0
TOTAL	229 000		189 180

NOTE

At the end of the period, closing inventory has not yet reached/passed the wastage point (40% < 90%) and we cannot, therefore, allocate a portion of the normal loss to these units.

5 Allocation statement preparation – FIFO method of inventory valuation

The example below shows the format of the allocation statement as used with the **FIFO** method of inventory valuation. This example is based on the FIFO statements and related information in sections 3 and 4 above.

NOTE

In an assignment or examination question, you will not have to show the explanatory notes for the calculation and allocation of the normal loss rand value/the cost allocation statement. [The purpose of the explanatory notes in sections 5 and 6 is simply to explain the calculations to you.] The only exception is *if these figures do not come directly from a quantity statement or production cost statement provided in the question or prepared as part of your answer to the question*.

Cost allocation statements for September 20X8 – FIFO method

	Where closing inventory is 90% complete R	Where closing inventory is 40% complete R
Opening WIP	855 000	855 000
Material	700 000	700 000
Conversion cost	155 000	155 000
Current period equivalent production activities	5 672 447	5 890 198
Material	3 216 992	
(17,56① x 183 200②, ⑤)		3 216 992
(17,56① x 183 200②, ⑤)		
Conversion cost		
(9,50① x 207 120②, ⑤)	1 967 640	
(10,43① x 207 120②, ⑤)		2 160 262
Normal loss		
(322 775 + 165 040)	487 815	
(333 022 + 179 922)		512 944
Completed and transferred	6 527 447	6 745 198
Abnormal loss	171 534	295 466
Material		
(17,56① x 6 000③)	105 360	
(17,56① x 10 000③)		175 600
Conversion cost		
(9,50① x 5 400③)	51 300	
(10,43① x 9 000③)		93 870
Normal loss		
(10 571 + 4 303)	14 874	
(18 178 + 7 818)		25 996
Closing WIP	1 429 451	1 086 600
Material		
(17,56① x 50 000④)	878 000	
(17,56① x 50 000④)		878 000
Conversion cost		
(9,50 ① x 45 000④)	427 500	
(10,43 ① x 20 000④)		208 600
Normal loss		
(88 094 + 35 857)	123 951	
(0 + 0)		0
Total cost allocated	8 128 432	8 127 264
Rounding difference	–	1 168
Total cost per production cost statement	8 128 432	8 128 432

Explanatory notes

① From the relevant production cost statement

② From the equivalent unit columns in the relevant quantity statement

③ Abnormal losses as per the equivalent unit columns in the relevant quantity statement

④ Closing WIP as per the equivalent unit columns in the relevant quantity statement

⑤ Although the heading used is *Current period equivalent production activities*, this refers to the equivalent units in the quantity statement for completing the opening WIP in this period and new units started and completed.

NOTE

- In the example above, we have combined two cost allocation statements (one for where closing inventory is 90% complete and one for where closing inventory is 40% complete) so that you can compare the two scenarios.
- A balancing figure may exist in your cost allocation statement (eg see the R1 168 in the cost allocation statements above). If all your workings are correct, this will only be due to rounding.

In MAC2601 questions, you can show the rounding difference as a balancing figure between the total of the cost allocation statement and the total cost per production cost statement. You will not be required to show where the rounding difference comes from. However, if your rounding difference amounts to a large portion of the total cost allocated, your answer probably contains mistakes.

Enrichment Activity

Indicate where the rounding difference of R1 168 in the above example comes from.

Solution to enrichment activity

From the rounding of R10,4345 ... (equivalent conversion cost per unit as per activity 17.5, part b.) to R10,43, because:

(10,4345 ... – 10,43) x 254 120 = R1 168,40 (rounded to R1 168).

6 Allocation statement preparation – weighted average method of inventory valuation

The example below shows the format of the allocation statement if the **weighted average** method of inventory valuation is used. This example is based on the weighted average method statements and related information in sections 3 and 4 above.

Cost allocation statements for September 20X8 – weighted average method

	Where closing inventory is 90% complete	Where closing inventory is 40% complete
	R	R
Completed and transferred	6 525 260	6 736 119
Material		
(17,74① x 220 000②)	3 902 800	
(17,74① x 220 000②)		3 902 800
Conversion cost		
(9,61① x 220 000②)	2 114 200	
(10,51① x 220 000②)		2 312 200
Normal loss		
(339 374 + 168 886)	508 260	
(339 374 + 181 745)		521 119
Abnormal loss	171 735	294 851
Material		
(17,74① x 6 000③)	106 440	
(17,74① x 10 000③)		177 400
Conversion cost		
(9,61① x 5 400③)	51 894	
(10,51① x 9 000③)		94 590
Normal loss		
(9 256 + 4 145)	13 401	
(15 426 + 7 435)		22 861
Closing WIP	1 431 125	1 097 200
Material		
(17,74① x 50 000④)	887 000	
(17,74① x 50 000④)		887 000
Conversion cost		
(9,61① x 45 000④)	432 450	
(10,51① x 20 000④)		210 200
Normal loss		
(77 130 + 34 545)	111 675	
(0 + 0)		0
Total cost allocated	8 128 120	8 128 170
Rounding difference	312	262
Total cost per production cost statement	8 128 432	8 128 432

Explanatory notes

① From the relevant production cost statement

② From the equivalent unit columns in the relevant quantity statement

③ Abnormal losses as per the equivalent unit columns in the relevant quantity statement

④ Closing WIP as per the equivalent unit columns in the relevant quantity statement

Activity 18.3

Weighted average cost allocation statement

Refer to the information in Activity 16.3 of study unit 16 and the Self-assessment Activity of study unit 17. Below, we have duplicated the **weighted average** quantity statements and production cost statements from these activities for ease of reference:

Quantity statement for February 20X8 (weighted average method; wastage at beginning of process)

			Equivalent units			
Physical units			Raw materials		Conversion cost	
Input (units)	Details	Output (units)	Units	%	Units	%
2 000	Opening WIP					
23 000	Put into production					
	Completed and transferred	16 000	16 000	100	16 000	100
	Normal loss	3 450	3 450	100	–	0
	Abnormal loss	1 550	1 550	100	–	0
	Closing WIP	4 000	4 000	100	2 400	60
25 000		25 000	25 000		18 400	

Quantity statement for February 20X8 (weighted average method; wastage at 70%)

			Equivalent units			
Physical units			Raw materials		Conversion cost	
Input (units)	Details	Output (units)	Units	%	Units	%
2 000	Opening WIP					
23 000	Put into production					
	Completed and transferred	16 000	16 000	100	16 000	100
	Normal loss	3 150	3 150	100	2 205	70
	Abnormal loss	1 850	1 850	100	1 295	70
	Closing WIP	4 000	4 000	100	2 400	60
25 000		25 000	25 000		21 900	

Production cost statement – weighted average method

	Total R	Material	Conversion cost
Opening WIP	30 000	20 000	10 000
Current production cost	616 165	253 000	363 165
Total	646 165	273 000	373 165
Equivalent units – per quantity statement (0%)		25 000	18 400
Equivalent cost per unit	R31,20	= R10,92	+ R20,28
Equivalent units – per quantity statement (70%)		25 000	21 900
Equivalent cost per unit	R27,96	= R10,92	+ R17,04

REQUIRED

a. Prepare the cost allocation statement for February 20X8 under the assumptions that Lunar Lotion (Pty) Ltd. uses the **weighted average** method of inventory valuation and that wastage occurs at the **beginning** of the process.

b. Prepare the following general ledger accounts for the scenario in a. above:

   i. WIP
   ii. Production account
   iii. Completed goods
   iv. Abnormal loss

c. Prepare the cost allocation statement for February 20X8 under the assumptions that Lunar Lotion (Pty) Ltd. uses the **weighted average** method of inventory valuation and that wastage occurs when the process is **70% complete**.

d. Prepare the following general ledger accounts for the scenario in c. above:

   i. WIP
   ii. Production account
   iii. Completed goods
   iv. Abnormal loss

Solution to Activity 18.3

a.

- **Calculate the rand value of the normal loss**

NLR = NLM + NLC
= (3 450② x 10,92①) + (0② x 20,28①)
= 37 674 + 0
= R37 674

- **Allocate the rand value of the normal loss**

Material

	Units	Calculation	R
Completed and transferred	②, ⑦16 000	16 000 / 21 550 x R37 674	27 971
Abnormal loss	④1 550	1 550 / 21 550 x R37 674	2 710
Closing WIP	⑤4 000	4 000 / 21 550 x R37 674	6 993
TOTAL	21 550		37 674

Conversion: The rand value of the normal loss in terms of conversion cost is zero.

- **Prepare the cost allocation statement**

LUNAR LOTION (PTY) LTD
Cost allocation statement for February 20X8
(Weighted average; wastage at 0%)

	R
Completed and transferred	527 171
Material (10,92① x 16 000②)	③ 174 720
Conversion cost (20,28① x 16 000②)	③ 324 480
Normal loss	27 971
Abnormal loss	19 636
Material (10,92① x 1 550④)	16 926
Conversion cost (20,28① x 0④)	0
Normal loss	2 710
Closing WIP	99 345
Material (10,92① x 4 000⑤)	43 680
Conversion cost (20,28① x 2 400⑤)	48 672
Normal loss	6 993
Total cost allocated	646 152
Rounding difference	13
Total cost per production cost statement	⑥ 646 165

Explanatory notes

① From the relevant production cost statement

② From the equivalent unit columns in the relevant quantity statement

③ Note that the combined cost of material and conversion cost could have been calculated immediately as R31,20① (total equivalent cost per unit) x 16 000 = R499 200, because the number of equivalent units for material and conversion cost agree for the units completed and transferred.

④ Abnormal losses as per the equivalent unit columns in the relevant quantity statement

⑤ Closing WIP as per the equivalent unit columns in the relevant quantity statement

⑥ The total cost per the production cost statement is R646 165. However, because the average cost per unit for material and for conversion cost used in the cost allocation statement is rounded off, we will not arrive at the exact same total and will have a rounding difference of R13.

⑦ Although the opening WIP % of completion is larger than the wastage point % (which means that the opening WIP has already passed the wastage point in the previous month), the exception referred to in section 2 above applies, because the weighted average method of inventory valuation is being used. We therefore include all the units completed and transferred in the allocation of the rand value of the normal loss.

b. General ledger – wastage at 0%

Dr			Cr
WIP			
	R		R
1/2 Opening balance	30 000	28/2 Production account	30 000
28/2 Production account	99 435	Closing balance	99 435
	129 435		**129 435**
1/3 Opening balance	99 435		

Dr			Cr
Production account			
	R		R
28/2 WIP	30 000	28/2 Completed goods	527 171
Material	253 000	WIP	99 345
Conversion cost	363 165	Abnormal loss	19 636
		Rounding difference	13
	646 165		**646 165**

Dr			Cr
Abnormal loss			
	R		R
28/2 Production account	19 636		

Dr			Cr
Completed goods			
	R		R
28/2 Production account	527 171		

c.

- **Calculate the rand value of the normal loss**

NLR = NLM + NLC
= (3 150① x 10,92④) + (2 205① x 17,04④)
= 34 398 + 37 573②
= R71 971

- **Allocate the rand value of the normal loss**

Material

	Units	Calculation	R
Completed and transferred	① 16 000	16 000 / 17 850 x R34 398	30 833
Abnormal loss	① 1 850	1 850 / 17 850 x R34 398	3 565
Closing WIP	③ –	–	③ 0
TOTAL	17 850		34 398

Conversion

	Units	Calculation	R
Completed and transferred	① 16 000	16 000 / 17 295 x R37 573	34 760
Abnormal loss	① 1 295	1 295 / 17 295 x R37 573	2 813
Closing WIP	③ –	–	③ 0
TOTAL	17 295		37 573

- **Prepare the cost allocation statement**

LUNAR LOTION (PTY) LTD
Cost allocation statement for February 20X8
(weighted average; wastage at 70%)

	R
Completed and transferred	512 953
Material (10,92 ④ x 16 000 ①)	⑤ 174 720
Conversion cost (17,04 ④ x 16 000 ①)	⑤ 272 640
Normal loss (30 833 + 34 760)	65 593
Abnormal loss	48 647
Material (10,92 ④ x 1 850 ①)	20 202
Conversion cost (17,04 ④ x 1 295 ①)	② 22 067
Normal loss (3 565 + 2 813)	6 378
Closing WIP	84 576
Material (10,92 ④ x 4 000 ①)	43 680
Conversion cost (17,04 ④ x 2 400 ①)	40 896
Normal loss ③	0
Total cost allocated	646 176
Rounding difference	(11)
Total cost per production cost statement	646 165

Explanatory notes

① From the equivalent unit columns in the relevant quantity statement

② For the purposes of this module and topic, we generally round total cost to the nearest rand, unless the number of decimal places to use was specified otherwise.

③ Since the percentage of completion of the closing WIP with regard to conversion cost (60%) is smaller than the wastage point (70%), no portion of the normal loss would be allocated to closing WIP. (Closing WIP has not passed the wastage point yet and therefore the normal loss is only allocated to "Completed and transferred" and the abnormal loss.)

④ From the relevant production cost statement

⑤ Note that the combined cost of material and conversion cost could have been calculated immediately as R27,96 ④ (total equivalent cost per unit) x 16 000 = R447 360, because the number of equivalent units for material and conversion cost agree for the units completed and transferred.

d. General ledger – wastage at 70%

Dr					Cr
WIP					
		R			R
1/2	Opening balance	30 000	28/2	Production account	30 000
28/2	Production account	84 576		Closing balance	84 576
		114 576			**114 576**
1/3	Opening balance	84 576			

Dr					Cr
Production account					
		R			R
28/2	WIP	30 000	28/2	Completed goods	512 953
	Material	253 000		WIP	84 576
	Conversion cost	363 165		Abnormal loss	48 647
	Rounding difference	11			
		646 176			**646 176**

Dr					Cr
Abnormal loss					
		R			R
28/2	Production account	48 647			

Dr					Cr
Completed goods					
		R			R
28/2	Production account	512 953			

NOTE

- Separate accounts usually exist for labour and overheads, but the question does not provide sufficient information to enable us to split this cost.
- The completed goods account will be credited with the cost of sales for February.
- Closing balance for WIP and finished goods will reflect on the statement of financial position.
- The abnormal loss will be written off as period cost in the statement of profit or loss and other comprehensive income.

Activity 18.4

FIFO cost allocation statement

Refer to the information in Activity 16.3 of study unit 16 and the Self-assessment Activity of study unit 17.

Below, we have duplicated the **FIFO** quantity statements and production cost statements from these activities for ease of reference:

Quantity statement for February 20X8 (FIFO method; wastage at beginning of process)

Physical units			Equivalent units			
Input (units)	**Details**	**Output (units)**	**Raw materials Units**	**%**	**Conversion cost Units**	**%**
2 000	Opening WIP					
23 000	Put into production					
	Completed from:					
	Opening inventory	2 000	–	0	1 400	70
	Current production	14 000	14 000	100	14 000	100
	Completed and transferred	16 000	14 000		15 400	
	Normal loss	3 450	3 450	100	–	0
	Abnormal loss	1 550	1 550	100	–	0
	Closing WIP	4 000	4 000	100	2 400	60
25 000		25 000	23 000		17 800	

Quantity statement for February 20X8 (FIFO method; wastage at 70%)

Physical units			Equivalent units			
Input (units)	**Details**	**Output (units)**	**Raw materials Units**	**%**	**Conversion cost Units**	**%**
2 000	Opening WIP					
23 000	Put into production					
	Completed from:					
	Opening inventory	1 700	–	0	1 190	70
	Current production	14 300	14 300	100	14 300	100
	Completed and transferred	16 000	14 300		15 490	
	Normal loss	3 150	3 150	100	2 205	70
	Abnormal loss	1 850	1 850	100	1 295	70
	Closing WIP	4 000	4 000	100	2 400	60
25 000		25 000	23 300		21 390	

Production cost statements – FIFO method

	Total R	**Material**	**Conversion Cost**
Opening WIP	30 000		
Current production cost	616 165	253 000	363 165
Total	646 165		
Equivalent units – per quantity statement (0%)		23 000	17 800
Equivalent cost per unit	R31,40	= R11,00	+ R20,40
Equivalent units – per quantity statement (70%)		23 300	21 390
Equivalent cost per unit	R27,84	= R10,86	+ R16,98

REQUIRED

a. Prepare the cost allocation statement for February 20X8 under the assumptions that Lunar Lotion (Pty) Ltd. uses the **FIFO** method of inventory valuation and that wastage occurs at the **beginning** of the process.

b. Prepare the following general ledger accounts for the scenario in a. above:
   i. WIP
   ii. Production account
   iii. Completed goods
   iv. Abnormal loss

c. Prepare the cost allocation statement for February 20X8 under the assumptions that Lunar Lotion (Pty) Ltd. uses the **FIFO** method of inventory valuation and that wastage occurs when the process is **70% complete**.

d. Prepare the following general ledger accounts for the scenario in c. above:
   i. WIP
   ii. Production account
   iii. Completed goods
   iv. Abnormal loss

Solution to Activity 18.4

a.

- Calculate the rand value of the normal loss

NLR = NLM + NLC
= (3 450 ② x 11,00①) + (0② x 20,40①)
= 37 950 + 0
= R37 950

- Allocate the rand value of the normal loss

Material

	Units	Calculation	R
Completed and transferred (14 000 – 0⑥)	②, ⑥ 14 000	14 000 / 19 550 x R37 950	27 176
Abnormal loss	③ 1 550	1 550 / 19 550 x R37 950	3 009
Closing WIP	④ 4 000	4 000 / 19 550 x R37 950	7 765
TOTAL	19 550		37 950

Conversion: The rand value of the normal loss for conversion cost is zero.

- Prepare the cost allocation statement

LUNAR LOTION (PTY) LTD
Cost allocation statement for February 20X8 (FIFO; wastage at 0%)

	R
Opening WIP	30 000
Material	20 000
Conversion cost	10 000
Current period equivalent production activities	495 336
Material	154 000
(11,00① x 14 000②, ⑤)	
Conversion cost	314 160
(20,40① x 15 400②, ⑤)	
Normal loss	③ 27 176
Completed and transferred	525 336
Abnormal loss	20 059
Material	17 050
(11,00① x 1 550③)	
Conversion cost	–
(20,40① x 0③)	
Normal loss	3 009
Closing WIP	100 725
Material	44 000
(11,00① x 4 000④)	
Conversion cost	48 960
(20,40① x 2 400④)	
Normal loss	7 765
Total cost allocated	646 120
Rounding difference	45
Total cost per production cost statement	646 165

Explanatory notes

① From the relevant production cost statement

② From the equivalent unit columns in the relevant quantity statement

③ Abnormal losses as per the equivalent unit columns in the relevant quantity statement

④ Closing WIP as per the equivalent unit columns in the relevant quantity statement

⑤ Although the heading used is *Current period equivalent production activities*, this refers to the equivalent units in the quantity statement for completing the opening WIP in this period and new units started and completed.

⑥ The opening WIP % of completion is larger than the wastage point % (which means that the opening WIP has already passed the wastage point in the previous month). We therefore need to deduct/exclude units completed from opening WIP from the units completed and transferred in the allocation of the rand value of normal loss.

b. General ledger – wastage at 0%

Dr					Cr
WIP					
		R			R
1/2	Opening balance	30 000	28/2	Production account	30 000
28/2	Production account	100 725		Closing balance	100 725
		130 725			**130 725**
1/3	Opening balance	100 725			

Dr					Cr
Production account					
		R			R
28/2	WIP	30 000	28/2	Completed goods (495 336 + 30 000)	525 336
	Material	253 000		WIP	100 725
	Conversion cost	363 165		Abnormal loss	20 059
				Rouding difference	45
		646 165			**646 165**
1/3	Opening balance	84 576			

Dr					Cr
Abnormal loss					
		R			R
28/2	Production account	20 059			

Dr					Cr
Completed goods					
		R			R
28/2	Production account	525 336			

c.

- Calculate the rand value of normal loss

NLR = NLM + NLC
= (3 150① x 10,86⑤) + (2 205① x 16,98⑤)
= 34 209 + 37 441
= R71 650

- Allocate the rand value of normal loss

Material

	Units	Calculation	R
Completed and transferred	14 300	14 300 / 16 150 x R34 209	30 290
Abnormal loss	③ 1 850	1 850 / 16 150 x R34 209	3 919
Closing WIP	② –	–	0
TOTAL	16 150		34 209

Conversion

	Units	Calculation	R
Completed and transferred	15 490	15 490 / 16 785 x R37 441	34 552
Abnormal loss	③ 1 295	1 295 / 16 785 x R37 441	2 889
Closing WIP	② –	–	–
TOTAL	16 785		37 441

- Prepare the cost allocation statement

LUNAR LOTION (PTY) LTD
Cost allocation statement for February 20X8 (FIFO; wastage at 70%)

	R
Opening WIP	30 000
Material	20 000
Conversion cost	10 000
Current period equivalent production activities	483 160
Material (10,86⑤ x 14 300)	155 298
Conversion cost (16,98⑤ x 15 490)	263 020
Normal loss (30 290 + 34 552)	64 842
Completed and transferred	513 160
Abnormal loss	48 888
Material (10,86⑤ x 1 850③)	20 091
Conversion cost (16,98⑤ x 1 295③)	21 989
Normal loss (3 919 + 2 889)	6 808
Closing WIP	84 192
Material (10,86⑤ x 4 000④)	43 440
Conversion cost (16,98⑤ x 2 400④)	40 752
Normal loss (0 + 0)	0
Total cost allocated	646 240
Rounding difference	(75)
Total cost per production cost statement	646 165

Explanatory notes

① Normal losses as per the equivalent unit columns in the relevant quantity statement

② Since the percentage of completion of the closing WIP in terms of conversion cost (60%) is smaller than the wastage point (70%), no portion of the normal loss would be allocated to closing WIP.

③ Abnormal losses as per the equivalent unit columns in the relevant quantity statement

④ Closing WIP as per the equivalent unit columns in the relevant quantity statement

⑤ Cost per unit per the relevant production cost statement

d. General ledger – wastage at 70%

Dr					Cr
		WIP			
		R			R
1/2	Opening balance	30 000	28/2	Production account	30 000
28/2	Production account	84 192		Closing balance	84 192
		114 192			**114 192**
1/3	Opening balance	84 192			

Dr					Cr
		Production account			
		R			R
28/2	WIP	30 000	28/2	Completed goods (483 160 + 30 000)	513 160
	Material	253 000		WIP	84 192
	Conversion cost	363 165		Abnormal loss	48 888
	Rouding difference	75			
		646 240			**646 240**

Dr					Cr
		Abnormal loss			
		R			R
28/2	Production account	48 888			

Dr					Cr
		Completed goods			
		R			R
28/2	Production account	513 160			

Activity 18.5

Allocation statement: opening WIP passed wastage point in previous period; wastage point not at beginning of process

Wonderwash (Pty) Ltd. manufactures washing powder in a single process and uses a process costing system. Material is added at the beginning of the process and conversion takes place evenly throughout the process.

The following information is available for December 20X9:

Quantity statement for December 20X9

Physical units			**Equivalent units**			
Input (units)	**Details**	**Output (units)**	**Raw materials Units**	**%**	**Conversion cost Units**	**%**
50 000	Opening WIP					
350 000	Put into production					
	Completed from:					
	Opening inventory	50 000	–	0	40 000	80
	Current production	290 000	290 000	100	290 000	100
	Completed and transferred	340 000	290 000	100	330 000	
	Normal loss	28 000	28 000	100	2 800	10
	Abnormal loss	12 000	12 000	100	1 200	10
	Closing WIP	20 000	20 000	100	8 000	40
400 000		400 000	350 000		342 000	

Production cost statement for December 20x9

	Total R	**Material**	**Conversion cost**
Opening WIP	150 000		
Current production cost	2 651 000	770 000	1 881 000
Total	2 801 000		
Equivalent cost per unit	7,70	= 2,20	+ 5,50

REQUIRED

Calculate and allocate the rand value of the normal loss for purposes of the cost allocation statement.

Solution to Activity 18.5

Before we answer this question, it is important to note a few things about the organisation:

- You will notice from the format of the quantity statement and the production cost statement that the organisation uses the FIFO method of inventory valuation.
- Normal loss percentage can be calculated as follows from the statements provided:

Opening inventory % of completion (100% – 80%)	20%
Closing inventory % of completion	40%
Wastage point	10%

Therefore:

– since the 20% for opening inventory is larger than the wastage point % of 10%, opening WIP was therefore deducted in the normal loss calculation for December 20X9.

– closing inventory 40% is not smaller than the wastage point % of 10%. Closing WIP was therefore included in the normal loss calculation.

– normal loss / units to be included in calculation
  = 28 000 / (400 000 – 50 000)
  = 28 000 / 350 000
  = 8%

- Since the 20% for opening inventory is larger than the wastage point % of 10%, opening inventory would have already passed the wastage point in the previous month. We cannot apply the exception of section 2 here because the FIFO method is being used and the opening WIP should therefore not share in the normal loss rand value for December 20X9. We will therefore have to deduct/exclude the units completed from opening WIP when we do the allocation of the normal loss rand value.

a. Calculate the rand value of normal loss

NLR = NLM + NLC
= (28 000 x 2,20) + (2 800 x 5,50)
= 61 600 + 15 400
= R77 000

b. Allocate the rand value of normal loss

Material

	Units	Calculation	R
Completed and transferred (290 000 – 0①)	①290 000	290 000 / 322 000 x R61 600	55 478
Abnormal loss	12 000	12 000 / 322 000 x R61 600	2 296
Closing WIP	20 000	20 000 / 322 000 x R61 600	3 826
TOTAL	322 000		61 600

Conversion

	Units	Calculation	R
Completed and transferred (330 000 – 40 000①)	① 290 000	290 000 / 299 200 x R15 400	14 926
Abnormal loss	1 200	1 200 / 299 200 x R15 400	62
Closing WIP	8 000	8 000 / 299 200 x R15 400	412
TOTAL	299 200		15 400

Explanatory notes

① The opening WIP % of completion is larger than the wastage point % (which means that the opening WIP has already passed the wastage point in the previous month). We therefore need to deduct/exclude units completed from opening WIP from the units completed and transferred in the allocation of the rand value of the normal loss. Remember that this is only applicable when the **FIFO method** is being used **and** opening stock % of completion is larger than or equal to the wastage point %.

7 Summary

In this study unit, you learnt the following:

- A cost allocation statement brings together unit information from the quantity statement and cost information from the production cost statement.
- A cost allocation statement is used to value closing WIP, units completed and abnormal loss.
- If FIFO is used, separate sections for opening WIP and current period equivalent production activities need to be included in the allocation statement.
- If the weighted average method of inventory valuation is used, opening WIP and current period equivalent production activities are combined into a single section for cost of production transferred.
- If the **percentage** of completion of **closing** WIP (with regard to conversion cost) is *smaller than* the wastage point (*where* wastage occurs), the rand value of normal loss needs to be calculated, allocated to abnormal loss and the units completed and transferred and included under appropriate headings in the cost allocation statement.

Comprehensive Self-assessment Activity (combining all study units)

Tub Bob Ltd. produces foam bath in a single process and uses a process costing system. The following information is available for September 20X9:

	Units
WIP (opening)	10 000
– Percentage completion – 25%	
New units put into production during the current month	32 000
Completed	26 000
WIP (closing)	8 000
– Percentage completion – 60%	

Additional information

1. Wastage takes place when the process is 35% complete.
2. Tub Bob Ltd. applies the FIFO method of inventory valuation.
3. Raw materials are added at the beginning of the process.
4. Conversion takes place evenly throughout the process.
5. Normal losses are estimated as 10% of the units that reach the wastage point.
6. Cost data are as follows:

	R
Opening WIP	
Material	12 820
Conversion	33 744
In September 20X9	
Material	149 000
Conversion	178 800

REQUIRED

Draft the:

a. Quantity statement
b. Production cost statement
c. Allocation statement
d. General ledger accounts for WIP, production, abnormal loss and finished goods

for Tub Bob Ltd. for September 20X9.

Solution to Comprehensive Self-assessment Activity

a. **TUB BOB LTD**
Quantity statement for September 20X9

Physical units			Equivalent units			
Input (units)	**Details**	**Output (units)**	**Raw materials Units**	**%**	**Conversion cost Units**	**%**
10 000	WIP – opening					
32 000	Put into production					
	Completed from:					
	Opening inventory ①	9 000	–	0	④ 6 750	75
	Current production ③	17 000	17 000	100	17 000	100
	Completed and transferred	26 000	17 000		23 750	
	Normal loss ②	4 200	② 4 200	100	② 1 470	35
	Abnormal loss ③	3 800	3 800	100	⑤ 1 330	35
	WIP – closing	8 000	8 000	100	⑥ 4 800	60
42 000		42 000	33 000		31 350	

b. **TUB BOB LTD**
Production cost statement for September 20X9

	Total R	**Material**	**Conversion cost**
Opening WIP	46 564		
Current production cost	327 800	149 000	178 800
Total	374 364		
Equivalent units per quantity statement		33 000	31 350
Equivalent cost per unit	10,22	= 4,52	+ 5,70

c. i. Calculate the rand value of normal loss

NLR = NLM + NLC
= (4 200 x 4,52) + (1 470 x 5,70)
= 18 984 + 8 379
= R27 363

c. ii. Allocate the rand value of normal loss

Material

	Units	Calculation	R
Completed and transferred	17 000	17 000 / 28 800 x R18 984	11 206
Abnormal loss	3 800	3 800 / 28 800 x R18 984	2 505
Closing WIP	8 000	8 000 / 28 800 x R18 984	5 273
TOTAL	28 800		18 984

Conversion

	Units	Calculation	R
Completed and transferred	23 750	23 750 / 29 880 x R8 379	6 660
Abnormal loss	1 330	1 330 / 29 880 x R8 379	373
Closing WIP	4 800	4 800 / 29 880 x R8 379	1 346
TOTAL	29 880		8 379

c. iii **Prepare the cost alocation statement**

TUB BOB LTD
Allocation statement for September 20X9

		R
Opening WIP		46 564
Material		12 820
Conversion cost		33 744
Current period equivalent production activities		230 081
Material	(4,52 x 17 000)	76 840
Conversion cost	(5,70 x 23 750)	135 375
Normal loss	(11 206 + 6 660)	17 866
Completed and transferred		276 645
Abnormal loss		27 635
Material	(4,52 x 3 800)	17 176
Conversion cost	(5,70 x 1 330)	7 581
Normal loss	(2 505 + 373)	2 878
Closing WIP		70 139
Material	(4,52 x 8 000)	36 160
Conversion cost	(5,70 x 4 800)	27 360
Normal loss	(5 273 + 1 346)	6 619
Total cost allocated		374 419
Rounding difference		(55)
Total cost per production cost statement		374 364

Explanatory notes

① 10 000 x 90% = 9 000

② 42 000 x 10% = 4 200. Both opening and closing WIP, as well as the abnormal loss, passed the wastage point in the current period; therefore there is nothing to deduct in the normal loss unit calculation.

4 200 x 100% = 4 200
4 200 x 35% = 1 470

③ Balancing figure

④ (100% – 25%) x 9 000 = 6 750

⑤ 3 800 x 35% = 1 330

⑥ 8 000 x 60% = 4 800

a. General ledger

Dr					Cr
WIP					
		R			R
1/9	Opening balance	46 564	30/9	Production account	46 564
30/9	Production account	70 139		Closing balance	70 139
		116 703			**116 703**
1/10	Opening balance	70 139			

Dr					Cr
Production account					
		R			R
30/9	WIP	46 564	30/9	Completed goods	276 645
	Material	149 000		WIP	70 139
	Conversion cost	178 800		Abnormal loss	27 635
	Rounding difference	55			
		374 419			**374 419**

Dr					Cr
Abnormal loss					
		R			R
30/9	Production account	27 635			

Dr					Cr
Finished goods*					
		R			R
30/9	Production account	276 645			

* Remember, in MAC2601, we use the terms "finished goods" and "completed goods" interchangeably.

SUMMARISED STEPS FOR PROCESS COSTING

1. Determine total inputs for period and complete input column of quantity statement.
2. Determine units subject to normal wastage by taking total of input column and subtracting units that did not pass the wastage point.
3. Calculate normal loss units.

4. If FIFO is used, split units completed between opening WIP and new production.
5. Fill in the output column of the quantity statement.
6. Complete the "Equivalent units" section of the quantity statement for **ALL** line items, including the normal and abnormal losses.
7. Complete the production cost statement and calculate the equivalent production cost per unit.
8. Determine the value of normal loss based on its equivalent units for material and conversion cost (separately).
9. Determine whether opening WIP, abnormal loss and/or closing WIP will have to be excluded when normal loss is allocated (also refer to step 2).
10. Allocate the value of normal loss for material and conversion cost **separately**, based on the ratio of equivalent units in the quantity statement of those units sharing in normal loss.
11. Complete the allocation statement by multiplying each category of equivalent output by its equivalent cost per unit. Remember to include that category's share of normal loss.
12. Determine rounding and balance.
13. Complete T-accounts (if required).

References

IFRS Foundation. 2010. International Accounting Standard 2: Inventories. [Online] Available at: http://eifrs.iasb.org/eifrs/bnstandards/en/ias2.pdf. Accessed: 7 December 2011.

Additional reading

Drury, C. 2008. *Management and cost accounting*. 7th edition. London: South-Western Cengage Learning.

Niemand, AA, Meyer, L, Botes, VL & Van Vuuren, SJ. 2006. *Fundamentals of cost and management accounting*. Revised 5th edition. Durban: LexisNexis Butterworths.

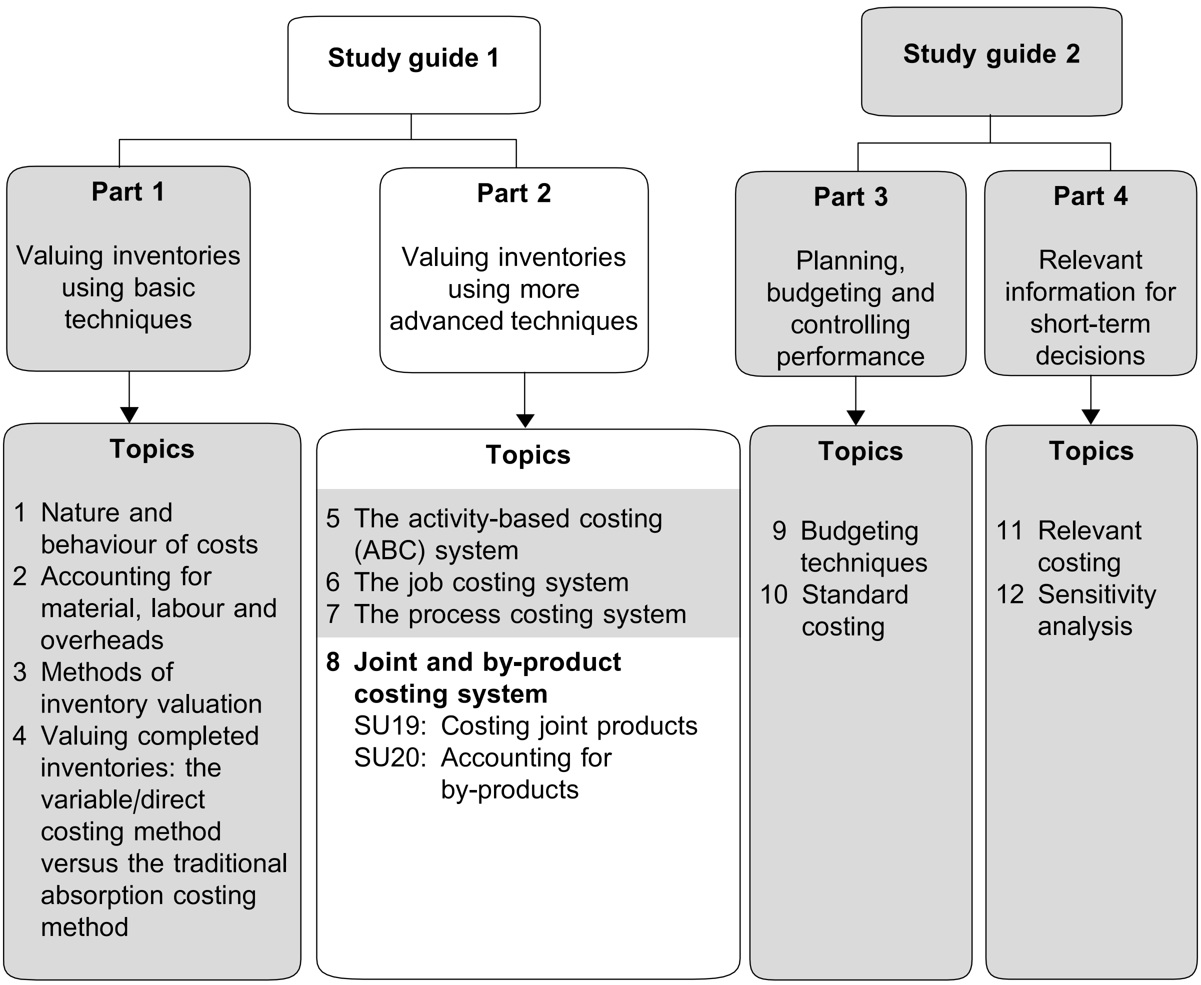
Joint and by-product costing system

LEARNING OUTCOMES

After studying this topic, you should be able to:

– differentiate between joint and by-products
– allocate joint costs, using different methods
– account for the net proceeds of by-products
– calculate the value of joint and by-product inventory
– calculate profits from the sale of joint products

STUDY UNIT	**TITLE**
Study unit 19	Costing joint products
Study unit 20	Accounting for by-products



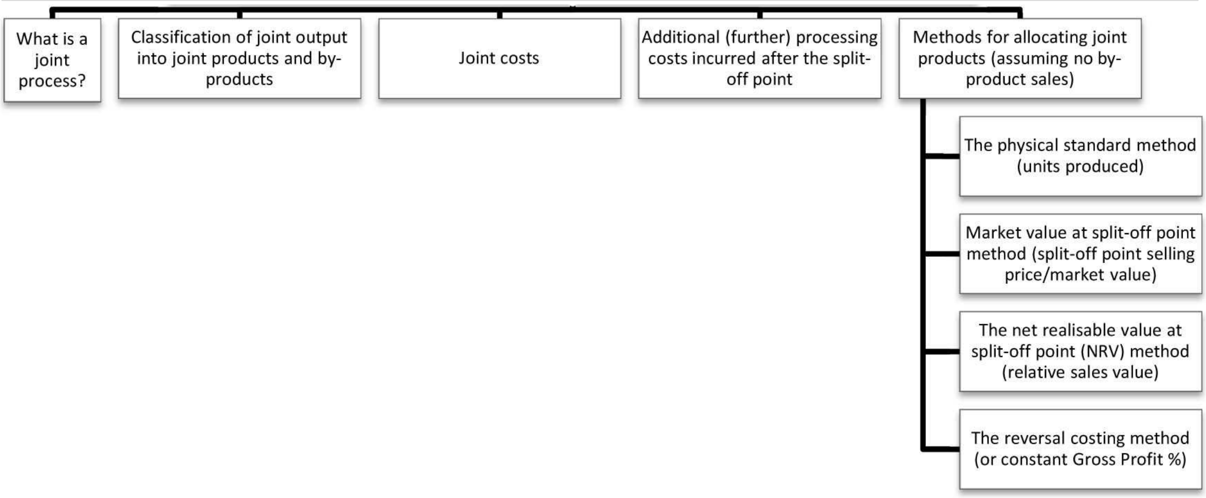
Introduction

In the previous topics, you have learned how to cost unique custom-made products (job costing) and masses of similar products (process costing). In this topic, we will demonstrate how to cost products that emerge from a joint process, that are dissimilar from each other. You will also learn how to treat the costing of the emergence of by-products and their proceeds (if any).

STUDY UNIT 19

Costing joint products

In this study unit



1 Introduction

In this study unit, we will discuss the joint and by-product costing system and explain how the cost of the joint output should be determined. We will illustrate how to calculate the profits from joint product (finished goods) sales, after apportioning joint costs, including instances where these are processed further.

2 What is a joint process?

Consider the following scenario:

A butcher, with his own abattoir, purchases an ox (weighing 875 kg) for R16 100 and slaughters it to yield the following:

	kg
Grade A meat cuts	420
Grade B meat cuts	250
Grade C meat cuts	50
Bones (clean)	75
Hide	15
Blood (disposed of)	65
Total	875

Given the above, how would you go about calculating the cost of, say, grade A cuts **per kilogram** and, say, the cost of the bones **per kilogram**?

Did you calculate the cost of grade A meat cuts as R18,40 (R16 100 / 875) per kilogram?

Did you calculate the cost of the bones as R18,40 per kilogram?

Do you have a problem with these answers?

The problem with the answers obtained above is that grade A meat and a bag of bones both cost R18,40 per kilogram. Our logic tells us that all the different types of output should not cost the same. Use of the joint and by-product costing system will help us to solve this problem!

JOINT PROCESS

In a joint production process:

- **two** or more **different products,** which are **not separately identifiable until this process is completed, emerge from the joint process; and**
- the output **cannot be manipulated** to yield only one or more desired products, but not the rest.

In our scenario above, the joint production process is the slaughtering process. The different products are the meat, bones etcetera. The meat, for instance, cannot separately be identified until the slaughtering process is completed. The slaughtering process will yield the bones (irrespective of whether the butcher wants this output or not). In other words, the butcher will not obtain the grade A meat without also obtaining all the other products.

SPLIT-OFF POINT

The split-off point is the point in the production process where the separate joint products can be identified for the first time (eg the hide and a carcass are identified). There can be various split-off points before all joint products can be identified (eg the carcass is cut up into smaller pieces to yield various grades of meat, bones and blood).

This is illustrated diagrammatically in figure 19.1 as follows:

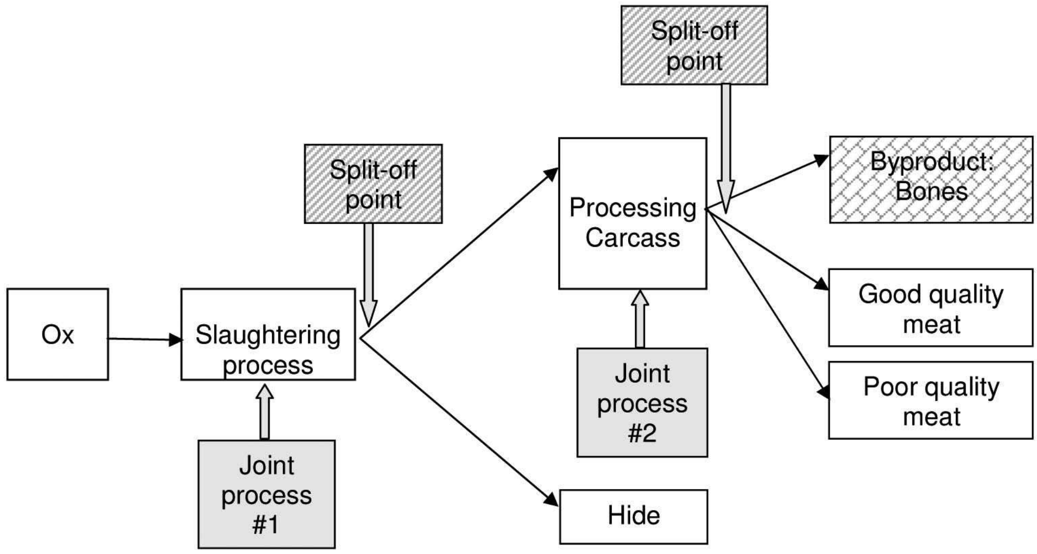


FIGURE 19.1: Diagram of a joint process with various split-off points

3 Classification of joint output into joint products and by-products

The products yielded by a joint process can be classified as either joint products or by-products.

> **JOINT PRODUCTS**
>
> Products arising from the joint process which have **significant value** are known as joint products. The joint process is **intentionally** completed to obtain these products. These are the main products on which the **survival** of the organisation depends.

A joint process may yield one million units of A (sales price of 50 cent each, total value = R0,5 million) and two million units of B (sales price of R1 each, total value = R2 million) and one unit of C (sales price of R1 000), in which case product A and B would be regarded as the joint product, whereas product C would not be regarded as the joint product.

> **BY-PRODUCTS**
>
> When a product is **insignificant in value** to the joint products, it is classified as a by-product, i.e. by-products have a limited sales value. They are **incidental** to the manufacturing process. In some cases the by-products may not even have a sales value at all, but they are nevertheless by-products arising from the manufacturing of the principal product(s). The organisation's survival is **not dependent** on the sales of the by-products!!

WASTE (SCRAP) PRODUCTS

A by-product with no sales value is also regarded as waste or scrap products. The organisation may sometimes even have to incur costs to get rid of the waste or scrap products in terms of health or environmental regulations!!

In our example, both the good and poor quality meat are produced in large quantities and make a substantial contribution to the market value of the output of the manufacturing process and are therefore regarded as joint products. The hide is a high-value item and will also be regarded as a joint product

The bones (and blood) are of lesser importance and make a relatively small contribution to the total market value. These are therefore classified as a by-product. Because the blood (in this scenario), had no sales value at all, it is treated as a waste product.

4 Joint costs

In our example of the ox, certain costs are common to the production of the various products. The cost of the ox, labour and overheads related to the slaughtering thereof are common to all products.

JOINT COSTS

All the common costs incurred prior to the split-off point are known as joint costs. These include all materials, labour and overheads incurred to yield the products at the split-off point.

5 Additional (further) processing costs incurred after the split-off point

It frequently happens that joint products are not sold directly after the split-off point, due mainly to two reasons:

1. There is **no market** for the joint product (or by-product) in its **current state.**
2. **Incremental value** can be added by processing the products further before sale thereof. For example, the selling price per unit will increase by R100 if we spent another R76 on further processing of the product.

The separated products then undergo further separate processing. For example, the meats may be marinated, hide cured etcetera. These additional processing costs will be assigned directly to the respective products by means of a job or process costing system.

FURTHER PROCESSING COSTS

These are the costs incurred to further process (convert) the separated joint products into final products. This would also include costs to prepare by-products for sale.

The good quality meat processed into tenderised steak and the poor quality meat processed into mince represent further examples.

Further processing costs therefore do not form part of the joint costs and are assigned to the specific product beyond the split-off point.

NOTE

In MAC3701 you will learn how to decide whether to process the joint-/by-product further, or to sell these at the split-off point. In this module you may assume that all separated products will be processed further before being sold, unless instructed otherwise in a question.

6 Methods for allocating joint costs (assuming no by-product sales)

In our introductory scenario we identified the problem of ALL output being costed at R18,40 per kilogram. How do we therefore assign the joint costs of the joint manufacturing process to the respective joint products?

Initially we will demonstrate appropriate methods by assuming that no by-products are produced. In study unit 20 we will then show the slight adjustments required to these methods, when accounting for by-products.

The following four methods are normally used:

6.1 The physical standard method (units produced)

According to this method the joint costs are allocated to each joint product in proportion to the physical quantity of each joint product produced.

Some joint products may, however, be solids (kilograms) and liquids (litres).

This approach is very limited, because it is only suitable where the output (ie the various different joint products) is very similar in nature and value. In fact, this is precisely the reason why our initial costing of the meat and bones of the ox was inappropriate (ie R18,40 per kg for both products) the assumption was made, when applying this particular approach, was that the bones and meat are very similar in nature and value.

6.2 Market value at split-off point method (split-off point selling price/ market value)

In this method the joint costs are allocated to each product in proportion to the potential market value of that product at the split-off point in the production process. The assumption is that higher selling prices are accompanied by higher costs. Joint costs are therefore borne to a greater extent by products with a high sales value than by products with a low sales value.

This method can be used if the joint products can be sold after the split-off point without the organisation having to incur any additional processing costs. The products which arise from the joint process therefore each have a given potential market value at the split-off point; in other words, there is a market for the products in their current state.

This method cannot be applied where there is no market for the separated products directly after the split-off point, because no market value would exist.

6.3 The net realisable value (NRV) at split-off point method (relative sales value)

According to this method, the market value of the final product (ie the product produced after further processing) is taken and reduced by any costs incurred for processing of the product beyond the split-off point and by any selling and distribution costs incurred to sell the final product. These NRV values are then used to establish the ratio in which the joints costs are to be apportioned. In this way an **estimated market value (net of all further costs) for the products at the split-off point** is achieved.

One therefore has to **work back** from the market value of the **final product** to determine an estimated market value at the split-off point. For example:

	R
Market price of **final** product	213
Less:	
Commission	13
Transport to customer	20
Further processing after split-off point	100
NRV at split-off point	80

This method is frequently used if further processing of the products is essential and the product cannot be sold at the split-off point (no market).

In practice, this approach is complicated, because products may split-off at different stages.

6.4 The reversal costing method (or constant gross profit percentage [GP%])

If we use the reversal cost method, the question is not what portion of the joint costs should be allocated to the products, but what amount should be **absorbed by each product** to **arrive at a constant GP%** for all (or only specific) products.

The management of a company often decides on a minimum rate of return (profit) which must be earned by all joint products that emerge from a joint process. This profit percentage can then be used to determine the estimated **gross profit** for each product separately.

This is done by using the estimated gross profit (rand value) as the basis and then deducting the selling price to arrive at the cost of sales from which we then deduct the further processing costs. The resulting answer is the portion of the joint costs that the joint product can absorb and still deliver the required GP%.

For example: if the final product sells for R250 and the standard GP% is 20%, then:

	R
Target gross profit (R250 x 20%)	50
Less:	
Selling price	250
Cost of sales	(200)
Less:	
Further processing costs, say	(73)
Amount of joint costs that can be absorbed	(127)

This is done for each joint product and the joint costs are once again apportioned based on this ratio.

The drawback of this method is that applying a constant GP% will mean that some joint products (which, in effect, may be unprofitable) may be kept (processed further and marketed) as part of the product range generated by the joint process, because they are assigned the same constant positive GP% as the other joint products.

Care should therefore be taken that the output ratios and products from a joint process are not manipulated to comply with the definition of a joint process so that the GP% method can be applied.

Secondly, products usually have different GP% and it is unrealistic to use the same percentage for all the joint products from one joint process.

NOTE

The following is very important for allocation purposes: In all methods where sales values or net realisable sales values are used as the allocation base, the sales values or NRVs are determined for the respective joint product **OUTPUT at the split-off point**, regardless of how many units of the respective joint products have actually been sold in the period. In other words, the sales value or NRV is NOT calculated for the units actually sold, but for the actual units PRODUCED in the period.

The next two activities demonstrate how these methods are applied. For now, we will assume that no by-productsare generated in the joint process.

Activity 19.1

Robertson Ltd. manufactures two types of joint products, Smokey and Red-hot, in a joint process. Each product is then processed further (separately) to completion, before being marketed. The joint costs amount to R140 000 per month and 900 units of Smokey and 600 units of Red-hot are manufactured and sold per month.

Additional information:

	Smokey	**Red-hot**
	R	**R**
Selling price of completed (final) unit	720	900
Further cost to complete a unit after split-off point	270	360
Sales commission per unit	60	75

REQUIRED

Calculate the total profit per month for each joint product if sold after further processing and joint costs are allocated according to:

a. the physical standard (units) method
b. the realisable market value at split-off point (NRV) method

Solution to Activity 19.1

a. Profitability if the physical standard method is used

	Smokey R	Red-hot R
Sales (900 x R720; 600 x R900)	648 000	540 000
Less: Cost of sales	327 000	272 000
Joint costs	① 84 000	① 56 000
Additional costs – further processing	② 243 000	② 216 000
Gross profit	321 000	268 000
Commission	③ 54 000	③ 45 000
Profit	267 000	223 000

① Smokey 900/1 500 x R140 000 = R84 000
Red-hot 600/1 500 x R140 000 = R56 000

② Smokey 900 x R270 = R243 000
Red-hot 600 x R360 = R216 000

③ Smokey 900 x R60 = R54 000
Red-hot 600 x R75 = R45 000

b. Profitability if the NRV method is used

	Smokey R	Red-hot R
Sales (from a.)	648 000	540 000
Less: Cost of sales	321 000	278 000
Joint costs	78 000	62 000
Additional costs (from a.)	243 000	216 000
Gross profit	327 000	262 000
Commission (from a.)	54 000	45 000
Profit	273 000	217 000

Calculation of allocation of joint cost

	Smokey R	Red-hot R
Sales (from a.)	648 000	540 000
Less: Commission	54 000	45 000
Less: Separable costs (from a.)	243 000	216 000
Relative sales value of the final product	351 000	279 000

Smokey R351 000/R630 000① x R140 000 = R78 000
Red-hot R279 000/R630 000 x R140 000 = R62 000

① R351 000 + R279 000 = R630 000

Activity 19.2

Videira Butchers has provided you with the following information:

When the carcasses are processed, two separate joint products are obtained, good quality meat (grade A) and poorer quality meat (grade B).

Potential selling prices per kilogram of the products at the **split-off point** immediately after the separation are:

Grade A	R20
Grade B	R16

In the course of a month, 150 carcasses are processed at a joint cost of R300 000. The processing of the carcasses in the joint process yielded 18 000 kg of grade A and 15 750 kg of grade B meat.

All joint products undergo further processing before they are sold as finished products. Grade A meat is converted into steak and grade B meat is converted into mince.

The selling price per kilogram of joint products **after further processing** is:

Steak	R30
Mince	R24

Additional costs per kilogram of the further processing of joint products after the split-off point are:

Grade A – steak	R6
Grade B – mince	R8

The target GP% for steak is 40%.

There was no opening inventory and the total production for the month was sold.

Sales and distribution costs for the month are:

Grade A (steak)	R20 000
Grade B (mince)	R30 000

REQUIRED

Draft a SCI, showing the **gross profit and GP%** if the joint cost is allocated according to the following methods:

a. the physical standard method
b. the market value at split-off point method if:
   i. all the products are sold at the split-off point
   ii. all the products undergo further processing

c. NRV at the split-off point
d. reversal cost method (constant GP%)

Assume in all cases that further processing takes places, except in b.i.

Solution to Activity 19.2

a. The physical standard method (output at split-off point)

Product	Quantity produced (kilograms)	Calculation	Joint cost allocated R	Cost per kg R
Grade A	18 000	$\frac{18\,000 \text{ kg}}{33\,750 \text{ kg}} \times \frac{R300\,000}{1}$	160 000	8,89
Grade B	15 750	$\frac{15\,750 \text{ kg}}{33\,750 \text{ kg}} \times \frac{R300\,000}{1}$	140 000	8,89
	33 750		300 000	

NOTE

Again this approach loses its appropriateness, because it clearly shows that each kilogram of grade A meat has the same cost allocation as each kilogram of grade B meat, even though their selling prices per kilogram differ.

Statement of comprehensive income

	Steak R	Mince R	Total R
Sales (18 000 kg x R30);(15 750 kg x R24)	540 000	378 000	918 000
Less: Cost of sales	268 000	266 000	534 000
Joint costs	160 000	140 000	300 000
Additional costs (18 000 kg x R6); (15 750 kg x R8)	108 000	126 000	234 000
Gross profit	272 000	112 000	384 000
GP%	50,37%	29,63%	41,83%

NOTE

The physical standard method of allocation of joint costs always produces the same joint cost per unit for each joint product identified at the split-off point. The assumption is made that the value of steak is similar to the value of mince. We know this to be highly unlikely.

In this example it was R300 000 ÷ (18 000 kg + 15 750 kg) = R8,89 per kilogram.If we use this method, the sales values are ignored when allocating joint costs, with the result that the costs allocated to a product may exceed the income from that product.

b. Market value at the split-off point method

Product	Production (kg)	Selling price at split-off point	Market value	Ratio	Portion of joint costs	Cost per kg
Grade A	18 000 x	R20 =	R360 000	$\frac{R360\ 000}{R612\ 000}$ multiplied by the total joint costs $\frac{R300\ 000}{1}$ =	R176 471 divided by 18 000 kg =	R9,80
Grade B	15 750 x	R16 =	R252 000	$\frac{R252\ 000}{R612\ 000}$ multiplied by the total joint costs $\frac{R300\ 000}{1}$ =	R123 529 divided by 15 750 kg =	R7,84
			R612 000		R300 000	

i. **Statement of comprehensive income** (if all the products are **sold at the split-off** point)

	Grade A R	Grade B R	Total R
Sales (from above)	360 000	252 000	612 000
Less: Joint costs	176 471	123 529	300 000
Gross profit	183 529	128 471	312 000
GP%	51%	51%	51%

NOTE

This method produces the same GP% for both products if the products are sold at the split-off point, because the costs are allocated in proportion to the sales. A greater proportion of the joint costs are allocated to the products with higher sales revenues.

ii. **Statement of comprehensive income** (if all the products **undergo further processing**)

	Steak R	Mince R	Total R
Sales (from a.)	540 000	378 000	918 000
Less: Cost of sales	284 471	249 529	534 000
Joint costs (from b.i)	176 471	123 529	300 000
Additional costs (from a.)	108 000	126 000	234 000
Gross profit	255 529	128 471	384 000
GP%	47,32%	34%	41,83%

NOTE

Did you notice that the total gross profit increased from R312 000 (in i.) to R384 000 (in ii.) if all products undergo further processing? This is because the selling price of the final product, steak, increased by more than the further processing costs. As we said earlier on in this module, you will learn more about deciding whether or not to incur further processing costs in MAC3701.

c. NRV at the split-off point

	Steak R	Mince R	Total R
Sales value (from a.)	540 000	378 000	918 000
Less: Selling and distribution	20 000	30 000	50 000
Additional costs (from a.)	108 000	126 000	234 000
NRV at split-off point	412 000	222 000	634 000
Joint costs allocated			R300 000
$\frac{R412\ 000}{R634\ 000} \times \frac{R300\ 000}{1}$	R194 953		
$\frac{R222\ 000}{R634\ 000} \times \frac{R300\ 000}{1}$		R105 047	
Joint costs per kg			
(R194 953 ÷ 18 000 kg)	R19,83		
(R105 047 ÷ 15 750 kg)		R6,67	

Statement of comprehensive income

	Steak R	Mince R	Total R
Sales (from a.)	540 000	378 000	918 000
Less: Cost of sales	302 953	231 047	534 000
Joint costs (from c.)	194 953	105 047	300 000
Additional costs (from a.)	108 000	126 000	234 000
Gross profit	237 047	146 953	384 000
GP%	43,90%	38,88%	41,83%

NOTE

If this method is used, the NRVs are taken into account, thus avoiding the problem which may arise when we use the physical standard method, namely, that the joint costs allocated to a product may exceed the income that product generates.

d. Reversal cost method

	Steak R	Mince R	Total R
Sales (from a.)	540 000	378 000	918 000
Less: Gross profit	① 216 000	④ 168 000	384 000
Cost of sales	324 000	③ 210 000	534 000
Less: Additional costs (from a.)	108 000	126 000	234 000
Joint cost absorbed	216 000	② 84 000	300 000

① (R540 000 x 40%) = R216 000
② R300 000 – 216 000 = R84 000 (balancing figure)
③ R84 000 + R126 000 = R210 000
④ R378 000 – R210 000

NOTE

You were provided with a target gross profit for steak. Determine the amount of joint costs steak can absorb and still achieve a 40% GP%. The balance of the joint cost is allocated to mince. Work back to calculate the gross profit of mince.

Statement of comprehensive income

	Steak R	Mince R	Total R
Sales (from a.)	540 000	378 000	918 000
Less: Cost of sales	324 000	210 000	534 000
Joint costs	216 000	84 000	300 000
Additional costs (from a.)	108 000	126 000	234 000
Gross profit	216 000	168 000	384 000
Gross profit percentage	40%	44,44%	41,83%

In summary, if we compare the results of the different methods:
If all joint products are processed further

a. Physical standard method

	Steak	Mince	Total
Gross profit	R272 000	R112 000	R384 000
GP%	50,37%	29,63%	41,83%

b. ii. Market value at split-off point method

Gross profit	R255 529	R128 471	R384 000
GP%	47,32%	34%	41,83%

c. NRV at the split-off point method

Gross profit	R237 047	R146 953	R384 000
GP%	43,90%	38,88%	41,83%

d. Reversal cost method (Constant GP%)

Gross profit	R216 000	R168 000	R384 000
GP%	40,00%	44,44%	41,83%

If all joint products are sold at split-off point

b. i. Market value at split-off point method

Gross profit	R183 529	R128 471	R12 000
GP%	51%	51%	51%

NOTE

① When all products are processed further, the total gross profit in rands increases, even though the GP% went down, compared with the total gross profit in rands when the products are sold at split-off point.

② Although the GP% in total for all joint products stays constants at 41,83%, the different methods used to allocate joint costs results in **huge changes in the GP% of individual products**. For example: steak's GP% ranges from 50,37% to 40%, and that of mince ranges from 44,44% to 29,63%.

③ If this was a large meat processing plant with separate divisions for each product, as the manager of, say, the steak division, you would be very concerned/interested in the method that the cost accountant uses to allocate joint costs. You will learn more about performance management in MAC3701.

7 Summary

In this study unit, you have learned the following about joint and by-products:

- how to **classify** joint process, joint products, by-products and scrap/waste;
- how to describe joint cost and **further processing** costs; and
- how to **cost** joint products by using **four different methods (assuming no by-product sales).**

In the next study unit we will investigate how to account for the production and sales of by-products and how this influences the inventory valuations of joint and by-products.

Self-assessment Activity

QUESTION 1

Mansini Ltd. uses a base material to manufacture products Syrup A, Syrup B, Syrup C and Syrup D in a joint process. In April, R1 800 000 worth of base material was put into the process. The following production and sales figures were recorded during April:

Product	Production	Sales	Selling price per litre
	litre	**litre**	**R**
Syrup A	14 000	12 000	50
Syrup B	20 000	17 000	60
Syrup C	25 000	21 000	20
Syrup D	1 000	Nil	100

There was no inventory on hand at the beginning of the month.

Syrup D is also considered a joint product, despite its sales revenue being lower than the other three products.

REQUIRED

Calculate the net profit or loss per product for April if joint costs are allocated according to the:

a. physical standard method
b. market value at the split-off point method

Solution to Self-assessment Activity

QUESTION 1

a. Calculation of the net profit or loss per product for April if joint costs are allocated according to the *physical standard method*

	Product				
	Syrup A	**Syrup B**	**Syrup C**	**Syrup D**	**Total**
Physical units produced	14 000	20 000	25 000	1 000	60 000

	Syrup A	**Syrup B**	**Syrup C**	**Syrup D**	**Total**
	R	**R**	**R**	**R**	**R**
Sales:					2 040 000
Syrup A: 12 000 x R50	600 000				
Syrup B: 17 000 x R60		1 020 000			
Syrup C: 21 000 x R20			420 000		
Syrup D: Nil				Nil	
Less: Cost of sales	360 000	510 000	630 000	nil	1 500 000
Joint costs:					1 800 000
Syrup A: $\frac{14\ 000\ell}{60\ 000\ell}$ x $\frac{R1\ 800\ 000}{1}$	420 000				
Syrup B: $\frac{20\ 000\ell}{60\ 000\ell}$ x $\frac{R1\ 800\ 000}{1}$		600 000			
Syrup C: $\frac{25\ 000\ell}{60\ 000\ell}$ x $\frac{R1\ 800\ 000}{1}$			750 000		
Syrup D: $\frac{1\ 000\ell}{60\ 000\ell}$ x $\frac{R1\ 800\ 000}{1}$				30 000	

	Syrup A	Syrup B	Syrup C	Syrup D	Total
	R	**R**	**R**	**R**	**R**
Less: Closing inventory:					300 000
Syrup A:					
$\frac{2\,000\ell}{14\,000\ell} \times \frac{420\,000}{1}$ (or 2 000ℓ x **R30**)	60 000				
Syrup B:					
$\frac{3\,000\ell}{20\,000\ell} \times \frac{R600\,000}{1}$ (or 3 000ℓ x **R30**)		90 000			
Syrup C:					
$\frac{4\,000\ell}{25\,000\ell} \times \frac{R750\,000}{1}$ (or 4 000ℓ x **R30**)			120 000		
Syrup D:					
$\frac{1\,000\ell}{1\,000\ell} \times \frac{R30\,000}{1}$ (or 1 000ℓ x **R30**)				30 000	
Profit/Loss	240 000	510 000	(210 000)	Nil	540 000

NOTE

Can you see that, if we use the physical standard method, the **joint cost per unit is the same (R30)** for all products? Again, as stated previously, this is not an appropriate basis of allocation if the products differ significantly in nature and value.

b. Calculation of the net profit/loss per product if the allocation of the joint costs are according to *market value at the split-off point*

Product	Market value of production at split-off point	Ratio	Joint costs	Joint costs per litre	Closing inventory (litres)	Value of closing inventory R
Syrup A	(14 000 x R50) = R700 000	$\frac{R700\ 000}{R2\ 500\ 000} = \frac{7}{25}$	$\frac{R1\ 800\ 000}{1} \times \frac{7}{25}$ = R504 000	$\frac{R504\ 000}{14\ 000\ell}$ = **R36**	2 000	72 000
Syrup B	(20 000 x R60) = R1 200 000	$\frac{R1\ 200\ 000}{R2\ 500\ 000} = \frac{12}{25}$	$\frac{R1\ 800\ 000}{1} \times \frac{12}{25}$ = R864 000	$\frac{R864\ 000}{20\ 000\ell}$ = **R43,20**	3 000	129 600
Syrup C	(25 000 x R20) = R500 000	$\frac{R500\ 000}{R2\ 500\ 000} = \frac{5}{25}$	$\frac{R1\ 800\ 000}{1} \times \frac{5}{25}$ = R360 000	$\frac{R360\ 000}{25\ 000\ell}$ = **R14,40**	4 000	57 600
Syrup D	(1 000 x R100) = R100 000	$\frac{R100\ 000}{R2\ 500\ 000} = \frac{1}{25}$	$\frac{R1\ 800\ 000}{1} \times \frac{1}{25}$ = R72 000	$\frac{R72\ 000}{1\ 000\ell}$ = **R72**	1 000	72 000
	R2 500 000		R1 800 000			331 200

NOTE

Can you see that, if we use the market value at split-off point method, a **different cost per litre** is obtained for inventory valuations?

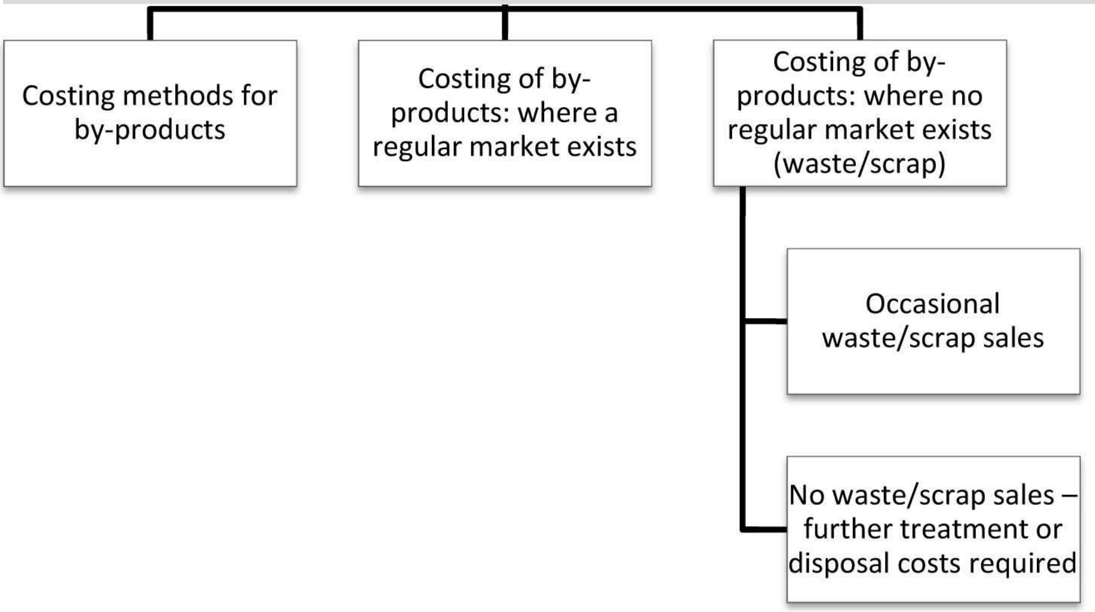
	Syrup A	Syrup B	Syrup C	Syrup D	Total
	R	R	R	R	R
Sales	600 000	1 020 000	420 000	–	2 040 000
Less: Cost of sales	432 000	734 400	302 400	–	1 468 800
Joint costs	504 000	864 000	360 000	72 000	1 800 000
Less: Closing inventory	72 000	129 600	57 600	72 000	331 200
Profit/Loss	168 000	285 600	117 600	–	571 200

In study unit 20 you will have more opportunities to practise the allocation of joint costs.

STUDY UNIT 20

Accounting for by-products

In this study unit



1 Introduction

In the previous study unit, you learnt how to distinguish between joint and by-products. We also covered the four methods used to allocate joint costs in scenarios where there were no by-products. In this study unit, we will investigate the two main methods for the accounting treatment of by-products and how these two methods influence the valuation of the joint product inventories.

2 Costing methods for by-products

Before we commence with the treatment of by-products, let's just first remind ourselves about what a by-product actually is. Essentially, a by-product is a production output that has little or insignificant value or, sometimes, no market value (in which case it is regarded as waste). By-products do not constitute part of the main purpose of any organisation's operations. On the other hand, they are unavoidable, given that the output of a joint process cannot be manipulated.

Given the above, the basic approach regarding by-products should be one that has a minimal effect on the operating results in those instances where by-products are sold. A starting point is to establish whether a regular market exists for the by-product or not. If by-products are sold on a regular and recurring basis, there is clearly a market for them (albeit one that is insignificant in value).

1. **Where a regular market exists**, the objective is to reflect the sales results of the by-product in such a way that these sales yield no profit. This is achieved by ensuring that the by-product inventories that arise from the joint process are valued at NRV. That is, net proceeds on sales (after deducting any selling and distribution costs) less the further cost of processing, if any. If this approach is adopted, there is no profit once the by-product units are sold, which means that a the SCI for any organisation reflects the profitability of its *main (joint) products only*.
2. **If there is no market for the by-products, they essentially constitute waste**, in which case these products would normally be destroyed or discarded. Incidental sales may, however, occur of these waste products. Since these transactions are isolated and sporadic, their impact, by implication, should be minimal on operating profits. The results of these transactions must, however, be accounted for.

We will now discuss each of the scenarios for the costing of by-products individually.

3 Costing of by-products: where a regular market exists

In this method, the total joint costs for the period will be reduced (credited) by the total NRV of the production of the by-product in the period concerned. After this, the NET joint costs are allocated to the remaining joint products using any of the four methods explained in study unit 19, section 6.

NOTE

The rationale for this treatment is very similar to that which you have encountered in topic 7 about process costing. Just as the value of the normal loss (based on an estimated ''normal'' percentage loss) is allocated to all production output in process costing, the NRV of the by-products generated in a specific period is credited to the joint process costs. This credit applies irrespective **of whether the sales and further processing of the by-products have actually occurred in the same period.**

This is done in order to achieve a ''normal'' price for the joint products which does not fluctuate from period to period (depending on when the by-product was processed further or sold). However, you should note that we can *only do this where there is a regular market* for the by-product and the organisation is assured of the eventual sale of the by-product at its NRV.

The next example shows how the NRV of the by-product is calculated:

	R
Total sales proceeds for the production of by-product (100 units x R20 per unit)	2 000
Less: any selling and distribution costs relating to the by-product (100 units x R2 per unit)	(200)
Less: total further processing for the production of the by-product (100 units x R8 per unit)	(800)
NRV of the by-product (R10 per unit)	1 000

Assume that the joint process cost for the period amounted to R40 000.

We will demonstrate the accounting entries in two scenarios.

Scenario 1:

Assuming all by-product production is processed further and sold in the same period (100 units produced by joint process and processed further 100 units sold = NIL closing inventories for byproducts):

1. The net amount (NRV) of the by-products produced is credited to the WIP account for the joint products:
   Dt WIP (by-products) (R10 x 100) R1 000
   Ct WIP (joint process) R1 000

2. Once further processing has occurred, the accounting entry is as follows:
   Dt WIP (by-products) with the further processing costs R800
   Ct Bank/Kreditors R800

3. When the sales occur the accounting entry is as follows:
   Dt Bank (net) (R2 000 – R200) R1 800
   Ct WIP (by-products) with the net proceeds of the sale R1 800

The result in the byproducts WIP account is then as follows:

WIP (by-products)			
1. WIP (joint products)	1 000	3. Bank	1 800
2. Bank/Creditors	800		
	1 800		1 800

Amount of joint costs allocated to joint products is R40 000 – R1 000 = R39 000.

Inventories in the statement of financial position (SFP):

- Any unsold joint products based on the allocation of R39 000 between units sold (cost of sales) and those still in inventory
- No by-products

Scenario 2

Assuming only 50 units of by-product production are sold in the same period (100 units produced by joint process; further processing occurred on all by-product units min 50 units sold = 50 units closing inventory for by-products):

In period 1:

1. Note that the NRV of ALL the by-product units produced is STILL credited to the WIP account for the joint products, because there is a regular market for the by-products:
   Dt WIP (by-products) (R10 x 100) R1 000
   Ct WIP (joint process) R1 000

2. When the further processing for the 100 units occur the accounting entry is as follows:
   Dt WIP (by-products) with all the further processing costs R800
   Ct Bank/creditors R800

3. When the sales for the 50 units occur the accounting entry is as follows:
   Dt Bank (net) (R1 000 – R100) R900
   Ct WIP (by-products) with the net proceeds of the sale R900

4. The 50 by-product units of closing inventory are then valued at NRV = 50 x R10 = R500.
   In order to achieve that balance, the following entry is made:
   Dt Unrealised profit [(R20 – R2) R10] x 50 R400
   Ct WIP (by-products) R400

The result in the by-products WIP account is then as follows:

WIP (byproducts)			
1. WIP (joint products)	1 000	3. Bank	900
2. Bank/Creditors	800	4. Unrealised profit	400
		Closing balance	500
	1 800		1 800
Opening balance	500		

Amount of joint costs allocated to joint products is R40 000 – R1 000 = R39 000.

Inventories in the SFP:

- Any unsold joint products based on the allocation of R39 000 between units sold (cost of sales) and those still in inventory.
- By-products = R500 + unrealised profit R400 = R900

NOTE

The R900 in effect represents the net proceeds that will be received when the 50 units are sold in the next period. You should not have a problem carrying this on your SFP, because R900 is the NRV you would have used to value by-product inventory where no further processing occurred (R18 x 50 units). Since you are assuming a regular market, the recoverability of the NRV is not in doubt.

In period 2:

1. When the sales for the remaining 50 units occur, the accounting entry is as follows:
   Dt Bank (net) (R1 000 – R100) R900
   Ct WIP (by-products) with the net proceeds of the sale R900

2. The unrealised profit account is then reversed:
   Dt WIP (by-products) R400
   Ct Unrealised profit R400

The result in the by-products Inventory account is then as follows:

WIP (by-products)			
Opening inventory	500	1. Bank	900
2. Unrealised profit	400		
	900		900

NOTE

In period 2 there is no impact on the joint costs of the joint products due to the fact that some of the by-product from period 1 was only sold in this period.

Irrespective of how much of the by-product is sold, the total NRV of all by-product units is credited to the WIP account for the joint process. The NET joint costs to be allocated to the joint (main) products, using any of the four methods described in study unit 19, section 6 will therefore be determined as follows:

Total joint costs incurred	RXXXX
Less: NRV of by-product produced in the period	(Ryy)
Net joint costs to be allocated to joint products	RZZZZ

NOTE

The accounting entries relating to the treatment of the by-products were provided to give you a better understanding of cost flow. You will not be expected to draw up the journals and T-accounts for by-products.

4 Costing of by-products: where no regular market exists (waste/scrap)

What does one do with waste, or by-products for which no market exists? It is dumped, destroyed or discarded. Two scenarios should once again be considered. It is important to make a distinction between cases where there is an occasional sale of the waste/scrap and cases where the organisation has to incur further costs to dispose of waste/scrap safely etc and NO SALES take place.

4.1 Occasional waste/scrap sales

Although there is no regular market for the waste, there may be incidental (totally irregular and rare) sales of this waste, in which case proceeds (revenue) will be received. Further occasional processing costs may also be incurred in order to facilitate the waste/scrap sale transaction (eg cleaning the products, bottling/packing, etc).

The approach taken in this case is that the net proceeds (after any occasional further processing costs or other incidental costs, if any) are NOT APPLIED to reduce the total joint costs. The total joint costs will therefore be assigned to joint (main) products in exactly the same manner as set out in the methods shown in study unit 19, section 6.

The net result for the waste/scrap trade (which would be scarce) is merely accounted for as a single line item in the SCI. Various alternatives are available for the net proceeds of such incidental transactions. These options are:

Method 1: As part of revenue, sales or turnover
Method 2: Offset against the cost of goods (joint products) sold
Method 3: As other income

NOTE

In method 2, we are not talking about setting waste/scrap trade off against the WIP joint process account, which we did where the by-products had a regular market. Instead, in method 2, the joint process costs are UNAFFECTED by the incidental sales. It is only in the grouping of the general ledger accounts making up the "Cost of sales" line item in the SCI that the net income from the waste sales are grouped together with the cost of sales of the main (joint) products, resulting in a netting off.

Refer to the example in section 3. Assume that the by-products are now classified as waste units and need to be washed before the sale. The washing costs would now constitute the further processing cost of R8 per unit.

In this case, the joint process cost will remain unchanged at R40 000 and will be allocated to the respective joint products. The R1 000 net proceeds from the sale of the waste products will be treated using any of the three methods described above.

4.2 No waste/scrap sales further treatment or disposal costs required

In this case, the safe disposal/treatment costs are debited to the WIP joint process account based on the units of scrap/waste produced. *This is the inverse of the NRV treatment where a regular market exists. Instead of the NRV of the by-products being credited to the WIP joint process account, the total estimated disposal/treatment cost for the waste/scrap units generated is DEBITED to the WIP joint process account*. The rationale is that these waste/scrap units are the result of the joint process and therefore the joint process should carry the cost of disposing the waste/scrap units safely or treating the units before disposal.

Refer to the example in section 3. Assume that the by-products are now classified as waste units and that they need to be treated before being removed from the premises. Treatment and removal cost is R8 per unit. However, there are no sales in this case.

In this case, the joint process cost of R40 000 will be debited with the R800 treatment and disposal costs. R40 800 will be allocated to the joint products.

NOTE

The NRV from a by-product is normally used to reduce the **joint cost of the joint products, because the assumption is that a regular market exists for the by-product.** If a question is silent on the treatment of by-product sales, you should offset the NRV of the by-product against the joint process cost; otherwise follow the instructions given in the question. Indications that you should NOT offset the by-product NRV are words such as 'occasional', 'incidental', 'sporadic', 'in this period', etc. All such words are clear indications that a regular market does not exist.

NB: You may encounter other approaches (treatments) of by-products in other textbooks, but for the purposes of this module, we will limit the approaches explained above.

Activity 20.1

Refer to the information in Activity 19.2 (Videira Butchers). The following *additional information* is provided:

When the carcasses are processed, two separate joint products are produced: good quality meat (grade A), which is processed further to produce steak, and poorer quality meat (grade B), which is processed further to produce mince. The bones yielded from the process represent a by-product, each carcass yielding 75 kg of bones.

The selling price of the bones at the **split-off point** amounts to R4 per kilogram.

In the course of a month 150 carcasses were processed at a joint cost of R300 000. The processing of the *carcasses in the joint process yielded* 18 000 kg of grade A and 15 750 kg of grade B meat.

All joint products were processed further before being sold as finished products. However, further processing is *only initiated once an order is received for the finished product*. The sales of finished products during the month were:

Steak	16 000 kg
Mince	13 750 kg

There was no opening inventory and the total production of final products (steak and mince) for the month was sold.

10 250 kg bones were sold this month.

Other relevant revenue and cost information is as provided in Activity 19.2.

Company policy regarding by-products is that joint process costs are allocated based on the physical standard method.

You may assume that no losses (in yield) occur in the further processing (ie 1 kg into the process = 1 kg out from the process).

REQUIRED

Draft the SCI for the month, assuming each of the following assumptions for the byproduct (each case is independent):

a. **A regular market exists** for the byproduct.
b. **No regular market exists** for the byproduct and proceeds are regarded as 'other income' (separate income item) directly in the SCI.
c. **No regular market exists** for the byproduct and proceeds are regarded as 'a reduction of the cost of sales', directly in the SCI.

Solution to Activity 20.1

Statement of comprehensive income (combined) for the month (a.–c.)

	a. Reduction of joint costs R	b. Separate income item R	c. Reduction of the cost of sales R
Sales – joint products	① 810 000	① 810 000	① 810 000
Less: Cost of sales (net)	430 778	470 445	429 445
Less: Proceeds from by-products			① (41 000)
Cost of sales (gross)			470 445
Joint costs	300 000	300 000	300 000
Less: Proceeds from byproducts	② 45 000		
	255 000	300 000	300 000
Less: Closing inventory joint products	④ 30 222	35 555 ⑥	35 555 ⑥
	224 778	264 445	264 445
Plus: Further processing costs	⑤ 206 000	⑤ 206 000	⑤ 206 000
Gross profit	379 222	339 555	380 555
Less: Sales and distribution costs	50 000	50 000	50 000
Net profit	329 222	289 555	330 555
Plus: Income from by-products		① 41 000	
Net operating profit	329 222	330 555	330 555

Calculations

① Steak (16 000 kg x R30) + mince (13 750 kg x R24)
= R480 000 + R330 000
= R810 000

= 10 250 kg x R4 = R41 000 (bones)

			R
②	Sales value of bones	150 x 75 kg x R4 =	45 000
	Further processing costs		–
	NRV of bones (based on production per kilogram, not sales)		45 000
	Total joint costs		300 000
	Therefore net joint cost to assigned to joint products		255 000

NOTE

Did you notice we are crediting the joint process costs with the total NRV of the bones yielded (11 250 kg), even though only 10 250 kg bones were sold in the period?

③ Allocation of joint costs (physical standard method)

		R
Grade A	R255 000② x 18 000 kg/33 750 kg =	136 000
Grade B	R255 000② x 15 750 kg/33 750 kg =	119 000
Total joint costs		255 000

NOTE

The allocation is based on the physical output yielded, not the kilograms sold.

④ Value of unprocessed inventory on hand at end of period

Grade A	R136 000 / 18 000 kg x 2 000 kg =	R15 111
Grade B	R119 000 / 15 750 kg x 2 000 kg =	R15 111
Value of inventory of unprocessed joint products		R30 222#
Bones at NRV (11 250 10 250)	1 000 kg x R4 =	R4 000
Total inventory on hand at end of period in SFP		R34 222

\# The physical standard method is used, which means that each kilogram has the same unit cost:
R255 000 / 33 750 kg = R7,55556/kg x 4 000 = R30 222

⑤ (16 000 kg x R6) + (13 750 kg x R8)
= R206 000

⑥ Physical standard method is used, hence each kilogram has the same unit cost:
R300 000 / 33 750 kg = R8,88889/kg x 4 000 kg = R35 555

NOTE

For parts b. and c., where no regular market exists, the total joint costs will NOT BE REDUCED by the proceeds from the bones. The net proceeds of R41 000 of the bones actually sold will merely be shown in the SCI as a separate item. Also, for parts b. and c., the total joint costs will be allocated to grade A meat and grade B meat (as done in part a. of Activity 19.2 previously), namely R160 000 for grade A and R140 000 for grade B meat.

The only inventory valued the end of the period will be:

		R
Grade A	R160 000 / 18 000 kg x 2 000 kg =	17 778
Grade B	R140 000 / 15 750 kg x 2 000 kg =	17 778
⑥ Total joint product inventory at split-off point		35 556

Bones – no value, because it is assumed that no market exists = Rnil

A breakdown of the joint products' gross profit in the SCI a. is as follows:

	Steak R	Mince R	Total R
Sales	480 000 ①	330 000 ①	810 000
Less: Cost of sales	(216 889)	(213 889)	(430 778)
Joint cost	136 000 ③	119 000 ③	255 000
Less: Unprocessed inventory ④	(15 111)	(15 111)	(30 222)
	120 889	103 889	224 778
Add: Further processing ⑤	96 000	110 000	206 000
Gross profit	263 111	116 111	379 222

A breakdown of the joint products' gross profit in the SCI b. is as follows:

	Steak R	Mince R	Total R
Sales	480 000 ①	330 000 ①	810 000
Less: Cost of sales	(238 222)	(232 222)	(470 444)
Joint cost	160 000 ③	140 000 ③	300 000
Less: Unprocessed inventory ④	(17 778)	(17 778)	⑥ (35 556)
	142 222	122 222	264 444
Add: Further processing ⑤	96 000	110 000	206 000
Gross profit	241 778	97 778	339 556

In the SCI c. the combined cost of sales is reduced by R41 000 resulting in a gross profit of R380 556.

Activity 20.2

Do the same as in Activity 20.1, but assume that:

- the bones are first cleaned at R0,20 per kilogram, before being sold;
- all the bones produced by the joint process underwent further processing (cleaning) during the month; and
- only10 250 kg bones were then sold at R4,50 per kilogram.

Assume further that a regular market exists for the cleaned bones for a. only.

Solution to Activity 20.2

Statements of comprehensive income for the month

	a. Reduction of joint costs R	b. Separate income item R	c. Reduction of the cost of sales R
Sales – joint products	810 000	810 000	810 000
Less: Cost of sales (net)	427 803	470 445	429 445
Less: Proceeds from by-products			(43 875) ③
			470 445
Joint costs	300 000	300 000	300 000
Less: Proceeds from by-products	48 375 ①		
	251 625	300 000	300 000
Less: Closing inventory of unprocessed joint products	29 822 ②	35 555	35 555
	221 803	264 445	264 445
Plus: Further processing costs	206 000	206 000	206 000
Gross profit	382 197	339 555	383 430
Less: Sales and distribution costs	50 000	50 000	50 000
Net profit	332 197	289 555	334 430
Plus: Income from by-products		43 875 ③	
Net operating profit	332 197	334 430	333 430

① NRV of **clean** bones:

Sales value of bones	150 x 75 kg x R4,50 =	R50 625
Further processing costs	150 x 75 kg x R0,20 =	(2 250)
NRV of clean bones (total yield)		R48 375
Total joint costs		R300 000
Hence, total joint cost to assigned to joint products		R251 625

② $\frac{\text{Closing inventory grade A + closing inventory grade B}}{\text{Total production}} \times \frac{\textbf{Net}\text{ joint costs}}{1}$

$= \frac{\text{2 000 kg grade A + 2 000 kg grade B}}{\text{(18 000 + 15 750) kg}} \times \frac{\text{R251 625}}{1}$

$= \frac{\text{4 000 kg}}{\text{33 750 kg}} \times \frac{\text{R251 625}}{1}$

= R29 822

③

		R
Sales	10 250 kg x R4,50 =	46 125
Costs	11 250 kg x R0,20 =	(2 250)
Incidental net income from by-product during the year		43 875

Byproduct inventory are valued at NIL.

5 Summary

In this study unit, you have learned the following about joint and by-products:

- **By-products** often result from a joint manufacturing process, but their NRV is insignificant in comparison to the total realisable value of the joint products.
- The **NRV of by-products** can be reflected in the accounts in various ways.

VERY IMPORTANT NOTE

After you have passed this module, you should not get rid of your study guides and other study material (like tutorial letters). You may have to refer back to these in your future studies. The principles that are dealt with in this module will not be repeated in subsequent modules! In subsequent modules it is assumed that you completely got the hang of the learning outcomes of prior modules.

REMEMBER THAT THERE ARE TWO STUDY GUIDES FOR THIS MODULE!

Self-assessment Activity

QUESTION 1

The following information regarding joint product production of Go-Go Oil Company at split-off point for April is available:

	Yield	Selling price per litre
	Litres	R
Petroleum	2 560 000	3,25
Motor oil	40 000	13,00
Grease	25 000	20,80
Petroleum jelly	32 000	32,50

In the course of the month, these products were processed at a joint cost of R9 360 000. It is policy to allocate joint costs in terms of market value at split-off point.

During the joint manufacturing process a by-product, AB gel is produced and for April the process yielded 2 000 kg of AB gel. There is no regular market for the by-product. However, in April all of the by-product was sold and generated R40 000 in net proceeds. Byproduct sales are treated as "Other income" as and when they occur.

The joint products can also be processed further beyond the split-off point, in which case the following information is applicable:

	Total additional processing costs	Selling price per litre	Litres lost during further processing
	R	R	
Petroleum	325 000	4,00	256 000
Motor oil	75 000	15,00	–
Grease	100 000	24,00	1 000
Petroleum jelly	90 000	37,50	–

REQUIRED

a. Calculate the profit or loss per product for April if all the products were sold at split-off point.
b. Calculate the profit or loss of each product for April if all the products were processed beyond the split-off point. All of these final products were then sold after some losses had been occurred during further processing.
c. A buyer has expressed interest in buying the monthly production of AB gel for the next five years. Assume the joint product, grease, was not processed further, but sold at the split-off point, whilst all three other products were processed further. At the end of April there were 5 000 litres of grease in the inventory. Determine the value of the grease inventory.

Solution to Self-assessment Activity

QUESTION 1

a. **Calculation of the profit or loss per product if the products are** *sold at split-off point* and joint costs are allocated according to the *potential market value of the products at split-off point*

	Total	Petroleum	Motor oil	Grease	Petroleum jelly
Yield (litres)	2 657 000	2 560 000	40 000	25 000	32 000
	R	R	R	R	R
Selling price per unit at split-off point		3,25	13,00	20,80	32,50
Sales value of **yield** at split-off point	10 400 000	8 320 000	520 000	520 000	1 040 000
Less: Joint cost	9 360 000	① 7 488 000	② 468 000	③ 468 000	④ 936 000
Net profit	1 040 000	832 000	52 000	52 000	104 000

Joint costs are allocated according to potential market value at split-off point (units yielded x selling price):

① Petroleum: R8 320 000/R10 400 000 x R9 360 000 = R7 488 000
② Motor oil: R 520 000/R10 400 000 x R9 360 000 = R 468 000
③ Grease: R 520 000/R10 400 000 x R9 360 000 = R 468 000
④ Petroleum jelly: R1 040 000/R10 400 000 x R9 360 000 = R 936 000

The profit for the by-product is R40 000.

b. **Calculation of profit or loss of each product** *if processed further after split-off point*

	Total	Petroleum	Motor oil	Grease	Petroleum jelly
	R	**R**	**R**	**R**	**R**
Sales					
Less: Cost of sales	11 592 000	9 216 000	600 000	576 000	1 200 000
	9 950 000	7 813 000	543 000	568 000	1 026 000
Joint costs (in a.)	9 360 000	7 488 000	468 000	468 000	936 000
Further processing costs (given)	590 000	325 000	75 000	100 000	90 000
Net profit	1 642 000	1 403 000	57 000	8 000	174 000

① 2 560 000 litres – 256 000 litres = 2 304 000 litres x R4,00 = R9 216 000
② 40 000 litres x R15 = R600 000
③ 25 000 litres – 1 000 litres = 24 000 litres x R24 = R576 000
④ 32 000 litres x 37,50 = R1 200 000

The profit for the by-product is R40 000.

NOTE

Did you notice that the net profit of the joint product, grease, only declined when this joint product was processed further? The total net profit improved by R602 000.

c. Determining closing value of grease inventory after split-off point

The treatment of the byproduct should now change, because a regular market now exists owing tothe five-year contract. The net proceeds from the by-product should now be used to reduce the joint process costs.

	R
Total joint process cost	9 360 000
Less: Net proceeds of by-products	40 000
Net joint process cost to be allocated	9 320 000

Joint costs are still allocated based on potential sales value at split-off point:

Per a. grease is:

R 520 000/R10 400 000 x R9 320 000 = R 466 000

NOTE

The fact that there are 5 000 litres in the closing inventory means that only 20 000 litres of the 25 000 litres produced were actually sold. However, we still apply the joint cost allocation as determined in a. because the joint costs are always allocated based on the potential sales value of the OUTPUT (units yielded at split-off point) and not the actual units sold.

Joint cost per litre of grease is: R466 000 / 25 000 litres = R18,64

Therefore, closing inventory of grease is valued at 5 000 litres x R18,64 = R93 200.

WORD LIST

TERM/CONCEPT	DEFINITION/EXPLANATION
ABC (ACTIVITY-BASED COSTING)	ABC – a more accurate system than traditional costing – was designed to improve the allocation of overheads. ABC assumes that **activities cause or drive the cost and that products are created by activities**. The allocation of costs is therefore based on the utilisation of activities. The purpose of ABC is to allocate cost **based on the cause of the cost.**
ABNORMAL LOSSES	Controllable losses *avoidable* in the manufacturing process. Indicate that a part/parts of the process is/are ineffective.
ABSORPTION COSTING METHOD	The **absorption costing** method includes **both variable** and **fixed manufacturing costs** in the product cost. It excludes all non-manufacturing costs, which are treated as period costs.
ACTIVITY	An activity is a task, action, or unit of work that is carried out in the organisation.
ACTUAL OVERHEADS	These are the actual overhead costs incurred during a period.
ALLOCATION STATEMENT/COST ALLOCATION STATEMENT	A statement that links the equivalent unit input costs in the production cost statement to the output from the quantity statement in order to value inventory, abnormal losses and production for the period, including any normal losses for the period.
ALLOWED COSTS	Allowed costs are the total of the standard cost per input for the actual production level. The budget is flexed to reflect costs and revenues for the actual production level.
APPLIED OVERHEADS	These are the total overheads included/allocated to the cost of the products based on the predetermined, budgeted allocation or recovery rate. For each **actual** unit produced, a **budgeted rate** will be assigned, thus accounting for the total applied overheads.
AVOIDABLE COSTS	If we can prevent a certain cost from being incurred by selecting a specific option, this cost can be referred to as an *avoidable cost*.
BASIC FORMAT OF CONTRIBUTION STATEMENT OF PROFIT OR LOSS AND OTHER COMPREHENSIVE INCOME	The basic format of a contribution statement of profit or loss and other comprehensive income is as follows: R Sales xxx Less: Variable costs (xx) Contribution xxx Less: Fixed costs (xx) Profit xxx
BLANKET OVERHEAD RATE	All the manufacturing overheads (for all production departments) are added together and allocated, based on one collective allocation basis common to all products and all production/service departments.

BRANCH	A *branch* connects one node to the following. In MAC2601, a branch will be represented by a solid line.
BREAKEVEN POINT	The breakeven point is the point where the total contribution is equal to total fixed costs (*the point where profit is zero)*.
BREAKEVEN VALUE	The breakeven value is the sales value of the breakeven units or quantity.
BUDGET	A budget is a short-term operational plan (presented in an approved document), expressed in monetary (rand) value and non-monetary terms, which the organisation endeavours to adhere to in order to achieve its short-term goals (which are aligned with the organisation's long-term goals).
BUDGETED LABOUR RECOVERY RATE	The budgeted labour recovery rate is the expected/ budgeted labour cost per hour.
BUDGETED OVERHEADS	These are overhead costs estimated before, or at the start of a financial year.
BY-PRODUCTS	When a product is **insignificant in value** to the joint products, it is classified as a by-product i.e. by-products have a limited sales value. They are **incidental** to the manufacturing process. In some cases the by-products may not even have a sales value at all, but they are nevertheless by-products arising from the manufacturing of the principal product(s). The organisation's survival is **not dependent** on the sales of the by-products!
CASH BUDGET	The cash budget provides an estimate of all payments and receipts for a given period and determines an organisation's cash and cash equivalent position.
CLOCK HOURS	Clock hours are the hours that the employees clock in to be on the premises. Gross remuneration is normally based on hours clocked by the employee. Clock hours would include normal working hours as well as any overtime hours actually worked.
COMMITTED (UNAVOIDABLE) COSTS OR INCOMES	These are future cash flows that arise as a result of a decision or action taken in the past. They are unaffected by the decision that needs to be taken now and cannot be prevented by selecting any one of the available alter-natives.
CONSUMABLES	Consumables refer to smaller items kept in the stores that are used by all departments (manufacturing, support and administrative). Consumables are items which, as the term suggests, are consumed. They can be destroyed, wasted or spent.
CONTRIBUTION	Contribution is the amount remaining after the deduction of all variable cost from sales. (Amount for which product is sold less all variable costs.) This amount *contributes* towards covering the organisation's fixed cost.

TERM/CONCEPT	DEFINITION/EXPLANATION
CONTRIBUTION RATIO	The ratio of the contribution to total sales is known as the contribution ratio (also referred to as the profit-volume ratio or contribution margin ratio). This ratio ban be expressed as a %.
CONTROLLABLE COSTS	*Controllable costs* are costs that the responsible person can influence directly or for which a person can be held accountable. An example of such a cost is the usage of raw material by the production manager or delegated shift supervisor. The production manager or shift supervisors are responsible for ensuring that the correct type and quantity of material is used efficiently during the production process.
CONVERSION COST	Conversion cost is the total cost incurred when converting raw material into finished products. It is the total of the direct labour costs and manufacturing overheads.
CONVERSION TAKING PLACE ``EVENLY THROUGHOUT THE PROCESS"	The *activity* of converting process inputs into outputs and *does not mean* that the cash outflows involved take place evenly throughout the process.
COST OBJECT	A cost object is any activity, unit or phenomenon for which cost can be accumulated and measured.
COST TO COMPANY (CTC)	This represents the total amounts expended by the employer *to and on behalf of* the employee. It is equal to the gross remuneration plus employer contributions to retirement funds and medical aid schemes, memberships of professional bodies etcetera.
COST-VOLUME-PROFIT ANALYSIS	The cost-volume-profit analysis investigates the change in profit that results from changes in • activity levels (units produced and sold); • per unit selling prices; • per unit variable costs; and • total fixed costs. The CVP analysis is a powerful tool that management uses for short-term decision-making and planning to investigate the impact of decisions on profit.
CRITERIA FOR RELEVANCE	To be *relevant* to a specific decision, a cost or income should meet all of the following *criteria*: • It **relates to the future** (should not be a sunk cost). • It is payable or receivable in **cash.** • It is directly determined by the alternative selected (differs between **alternatives**). • It arises as a **result of the decision.**
DECISION TREE	A graphic representation of decisions to be made and the uncontrollable events that could affect these decisions.
DEPARTMENTAL OVERHEAD RATE	Overhead recovery rates are determined for each department separately, based on the individual department's overhead costs and an appropriate allocation basis, depending on the type of activity that takes place in that specific department.

DIFFERENTIAL APPROACH TO RELEVANT COSTING	When we use the *differential approach*, we calculate the **net relevant income or cost associated with choosing one alternative rather than another**. If the result is a net cash inflow, it would be appropriate to select that specific alternative (purely from a quantitative perspective). If the result is a net cash outflow, the *other* alternative would be the better option, because this will result in a higher profit for the organisation (expressed in cash terms).
DIRECT COST	Direct costs can be traced easily or physically to *a particular cost object*.
DIRECT COSTING METHOD (OR VARIABLE / MARGINAL	Only **variable manufacturing costs**, namely direct materials, direct labour and variable manufacturing overheads, are taken into account when inventory is valued. **Variable selling and distribution** costs are added to arrive at the total variable cost. All variable costs are therefore accounted for to arrive at marginal income. Variable non-manufacturing costs, as well as *ALL* fixed costs, will be treated as period costs.
DIRECT LABOUR	Direct labour is the work needed to convert direct materials into an individual finished product. The term *direct labour cost* is reserved for those labour costs that can be physically and conveniently **traced to individual units of products**.
DIRECT MATERIALS	Direct materials are all materials that can be identified as forming part of the individual, finished product and can be included directly in calculating the cost of the product.
DISCRETIONARY COSTS	Discretionary costs are costs over which management has some form of control. Examples include advertising, training and development costs.
DURATION DRIVERS	Duration drivers represent the **length of time required** to perform an activity.
EOQ (ECONOMIC ORDER QUANTITY)	The EOQ is the quantity of inventory to be ordered at one time in order to minimise annual ordering and carrying costs.
EQUIVALENT UNITS	A comparable number of fully completed units to account for the partially completed units in a process costing system.
EXPECTED VALUE	The expected value is a weighted average of all the outcomes, where each weight is determined by the probability of the specific outcome.
FIFO	According to the FIFO method, the accounting assumption is that materials received or purchased first are issued first. We assume that the units are issued in the order received: the oldest units first and then the units received from the next batch etcetera.
FINISHED GOODS	Finished goods inventory refers to the finished products on the factory floor, in the finished goods store, in transit, at warehouse distribution points and in retail outlets. These goods are ready for sale.

TERM/CONCEPT	DEFINITION/EXPLANATION
FIXED BUDGET	A fixed budget is the approved plan of action for achieving a predetermined goal (e.g. total revenue of R30m, or net profit of R5m). In the context of this topic, a fixed budget is also referred to as the **original** budget.
FIXED COST	Fixed cost is a cost that remains *constant,* **in total**, regardless of changes in the level of activity or volume within the relevant range and in a specific time frame.
FLEXIBLE BUDGET	A flexible budget is one that restates the position if a **variation from the expected sales and production volume** occurs on which the fixed budget is based. In other words, a flexible budget is a budget that calculates budgeted income and budgeted costs according to **actual** production volume; it also recalculates the budgeted net profit or loss.
FURTHER PROCESSING COSTS	These are the costs incurred to further process (convert) the separated joint products into final products. This would also include costs to prepare by-products for sale.
GROSS REMUNERATION	Gross remuneration is an amount earned by the employee for total hours worked. It includes overtime wages or earnings, and other allowances that the employee is entitled to in terms of the employment contract, such as a travel allowance, or a guaranteed bonus/13th cheque. These amounts are amounts due to the employee.
IDLE TIME	Idle time *for cost accounting purposes* is when the employee is clocked in, but not actively working owing to tea, lunchtime or scheduled meetings. (This definition might be different from that in the BCOE Act.)
INCREMENTAL COSTS	These are **additional** costs that will be incurred if a specific alternative is selected and that will lead to future **cash outflow** for the organisation.
INCREMENTAL INCOME	This is the **additional** income generated if a specific alternative is selected and that will lead to a future **cash inflow** for the organisation.
INDIRECT COST	Indirect costs *cannot be traced easily* or physically to a particular cost object.
INDIRECT LABOUR	Labour costs that **cannot be physically traced** to the manufacture of individual product units are known as *indirect labour costs,* and are treated as part of manufacturing overheads, along with indirect materials.
INTERDEPARTMENTAL SERVICES	When one *service* department renders services to another *service* department, this type of service is regarded as an interdepartmental service.
INVENTORY	Inventory can be defined as any tangible property bought, manufactured, processed, developed, or sold by an organisation in the ordinary course of business.

INVENTORY CARRYING OR HOLDING COSTS	Inventory carrying or holding costs are the relevant costs of keeping inventory on the organisation's premises until it is used and includes costs such as handling costs, warehouse or storage costs, insurance and obsolescence costs. The relevant costs are only those costs that change with a change in inventory levels. The interest incurred or forfeited as a result of the unit's purchase is usually expressed as a percentage of the unit purchase price.
INVENTORY VALUATION	Inventory valuation is the process of assigning costs to inventory.
JOB CARD	Each employee receives a job card showing the work to be done and the expected time it should take. The employee records the starting time and finishing time for each job. Breaks for tea and lunch may be noted on the card as standard times.
JOB COSTING	This method of calculating the cost per unit (unit costing) is used where goods are manufactured according to a client's specifications, that is, where heterogeneous (different) products are manufactured using the same production facilities.
JOINT COSTS	All the common costs incurred prior to the split-off point are known as joint costs. These include all materials, labour and overheads incurred to yield the products at the split-off point.
JOINT PROCESS	In a joint production process: • **two** or more **different products**, which are **not separately identifiable until this process is completed, emerge from the joint process; and** • the output **cannot be manipulated** to yield only one or more desired products, but not the rest.
JOINT PRODUCTS	Products arising from the joint process which have **significant value** are known as joint products. The joint process is **intentionally** completed to obtain these products. These are the main products on which the **survival** of the organisation depends.
LIMITING FACTOR/ CONSTRAINT	A limiting factor/constraint exists when: • the availability of a resource is limited, i.e. the resource is scarce, or is a physical restriction; AND • the scarcity/constraint prevents the company from manufacturing (buying in the case of retailers) all the products it would be able to sell.
MANUFACTURING COST	Manufacturing costs, also called factory costs or production costs, are the total of the costs incurred in the manufacturing or production process: direct material, direct labour, direct expenses and manufacturing overheads.
MANUFACTURING OVERHEADS	Manufacturing overheads are the total costs of indirect materials, indirect labour and all other indirect manufacturing costs that cannot be traced directly to specific individual products.

TERM/CONCEPT	DEFINITION/EXPLANATION
MANUFACTURING PROCESS	Mainly consists of physical *inputs* (material or partially completed units), working on those inputs, ie *converting* them using labour and overheads (eg electricity and machine time) and the fully or partially completed units, or physical *output*.
MARGIN OF SAFETY	The margin of safety is the excess of budgeted (or actual) sales over the breakeven sales, that is, *the amount or percentage by which sales revenue may decline before losses commence.*
MARGIN OF SAFETY RATIO	The margin of safety can also be expressed as a *percentage of the total sales* value or sales units, which is known as the margin of safety ratio.
MATERIAL	Material refers to the group of costs that includes all the physical materials converted into products during the manufacturing process, indirect material, and other consumables used by the organisation.
MOST LIKELY TO OCCUR	The individual outcome that is most likely to occur is the **outcome with the highest probability** of occurring.
NET REMUNERATION	Net remuneration is the amount remaining after all deductions from gross remuneration. This is also referred to as the 'take home pay'.
NODE	A *node* represents a **decision** that needs to be made or an **external event** (uncontrollable) that will be taking place and that could lead to different outcomes.
NON-MANUFACTURING COST	Non-manufacturing costs fall into two categories: • ***Marketing costs*** (selling and distribution costs) include all the costs related to the sale and delivery of products. These costs start once the manufacturing of the products is completed. Examples of marketing costs are advertising, sales commission, sales salaries and shipping (distribution). • ***Administrative costs*** are the costs incurred in directing and controlling the organisation. Administrative costs include compensation of executives, general accounting costs, secretarial costs and similar costs relating to the general management of an organisation. Note that products can be produced without incurring these costs.
NORMAL LOSSES	Unavoidable losses *inherent* in the manufacturing process. Do *not* indicate that a process is ineffective.
NORMAL WAGE	Normal wage is the amount of money paid or payable to an employee **in respect of ordinary hours of work** or, if they are shorter, the hours an employee ordinarily works in a day or week.
OPPORTUNITY COSTS	An opportunity cost is represented by the net amount of cash inflow that will have to be given up (forfeited) if a specific alternative is selected.

ORDERING COSTS	Ordering costs are the relevant costs of ordering inventory and may include delivery and transport costs, as well as the administrative cost of preparing and processing the order. Again, these costs only include the costs that will fluctuate if order numbers/quantities fluctuate.
OVERTIME PREMIUM	An overtime premium is an *additional* amount paid over and above the normal rate/time.
PERIOD COSTS (EXPENSES)	Period costs are costs that are not included in product costs.
PRECAUTIONARY MOTIVE FOR HOLDING INVENTORY	This refers to holding extra inventory when future demand is uncertain and/or the supply is unreliable.
PRIME COST	Prime cost is the total of all the direct costs. It is the costs for direct materials and direct labour.
PROBABILITY	Probability refers to the chance that a future event will result in a specific outcome or range of specific outcomes. A probability is usually expressed as a percentage or a fraction.
PROCESS COSTING SYSTEM	A costing system used to **obtain, record and report cost data** in industries where large quantities of similar products pass through a single process or consecutive processes in the course of **production**.
PRODUCT COST (ABSORPTION COSTING SYSTEM)	Product cost is the *variable* plus the *fixed* costs incurred in the *manufacturing* of a product.
PRODUCT COST (DIRECT COSTING SYSTEM)	Product cost is the *variable* cost incurred in the *manufacturing* of a product.
PRODUCTION COST STATEMENT	A summary of the following: • Total manufacturing cost for a specific period • Number of units produced in the specific period equivalent units from the quantity statement • Resultant average cost per unit for each category of input
PRODUCT COSTING SYSTEM	A product costing system represents a specific method according to which the manufacturing cost of a single product, job or group of products or jobs is accumulated, processed and recorded.
PRODUCTIVE WORK HOURS	Productive work hours are the hours that the employees are expected to be physically working in the production process or on jobs. These hours correspond to the job card hours.
PROFIT	Profit is the amount left after all costs are covered.
QUALITATIVE FACTORS (*INCLUDING SUSTAINABILITY*)	These are non-financial factors that should also be taken into consideration. They usually relate to the impact on the rest of the business, existing customers and the social, environmental and governance impacts of a decision. The risks associated with each decision should also be taken into consideration.

TERM/CONCEPT	DEFINITION/EXPLANATION
QUANTITY STATEMENT/ PRODUCTION STATEMENT	A summary of the flow of physical units in a process costing system. Will include information about the number of units placed into the system and what happened to them, but *no* information about cost or rand values.
RAW MATERIALS	Raw materials are the inventory used in the manufacturing process. Raw materials are natural, unprocessed or partially processed materials that are converted into a more refined product.
RELEVANT INFORMATION	This is the information that should be taken into account in order to choose an appropriate course of action from a set of possible options (alternatives).
RELEVANT RANGE (context: cost-volume-profit analysis assumptions)	The relevant range is the upper and lower levels of production (= sales) activity levels within which the organisation normally operates and for which cost and revenue behaviour are known and can be predicted.
RELEVANT RANGE (context: cost behaviour)	The relevant range is normally defined by the *production capacity* (number of units) within which the organisation *normally operates*.
REMUNERATION	Remuneration is the amount an **employer** pays to an **employee** or on behalf of an employee (eg employer contributions to a medical aid scheme) for services rendered in terms of the employment agreement.
RISK AVERSE	When a person/company tries to avoid risk as far as possible
RISK NEUTRAL	When a person/company is indifferent to risk neither risk averse, nor risk seeking.
RISK SEEKING	When a person/company likes/prefers to take risks.
SELLING PRICE VARIANCE	The selling price variance is the difference between the actual selling price per unit and the standard/budgeted selling price per unit for the actual volume sold.
SEMI-FIXED (STEPPED) COST	Certain kinds of fixed costs increase or decrease only in fixed increments or in steps.
SEMI-VARIABLE COST	Semi-variable or mixed cost contains both fixed and variable cost. The mixture of cost includes a fixed amount within a relevant range of output and an amount that varies proportionately with output changes.
SPECULATIVE MOTIVE FOR HOLDING INVENTORY	This refers to holding more or less inventory than usual, because a change in the supplier's price is anticipated.
SPLIT-OFF POINT	The split-off point is the point in the production process where the separate joint products can be identified for the first time (eg the hide and a carcass are identified). There can be various split-off points before all joint products can be identified (eg the carcass is cut up into smaller pieces to yield various grades of meat, bones and blood).

STANDARD COSTING SYSTEM	A standard costing system is a tool used for control (financial AND operational) and inventory valuation purposes. This system enables deviations from the budget to be analysed in detail, thus enabling costs to be controlled more effectively. Inventory can be valued at a standard.
STANDARD COSTING VARIANCE PER UNIT	A standard costing variance per unit is the difference between the standard input cost and quantity used per unit and the actual input cost and quantity used per unit. When used for income items, it relates to the difference between the standard selling price per unit and the actual selling price per unit.
STANDARD COSTING VARIANCE TOTALS	A standard costing variance total is the difference between the **standard costs in total** for a specific input and the **actual costs in total** for that input based on the *actual volume of product manufactured*. It also applies to the difference between the **standard sales income in total** and the **actual sales income in total** for the *actual volume of units sold.*
STANDARDS	Standards are predetermined targets; they are target inputs/variables that should be achieved under **efficient operating** conditions.
SUNK COSTS	The following are characteristics of a *sunk cost*: ● It has been incurred in the past (no future cash flow involved). ● It cannot be changed by any future decision.
TAXABLE INCOME	Taxable income is the balance of the gross remuneration remaining after deducting any contribution by the employee concerned to any pension fund (provident funds are excluded).
TIME CLOCK CARDS	Time clock cards record the arrival and departure times of each employee. Each employee takes the card with his/her number from the rack and punches it in. This may also be done electronically (with or without fingerprint identification).
TIME SHEETS OR TICKETS	Employees fill in time sheets or tickets for hours worked on each job (job code) or area of work (area code). The time ticket shows the specific use that has been made of the time acquired from the employee and is similar to the *materials requisition card*.
TRADITIONAL COSTING	In the traditional costing method, fixed production overhead cost is allocated to products by linking it to only one volume-driven allocation base (eg labour hours or machine hours). In this method, fixed production overhead cost is assumed to be the most significant cause for the production cost (refer to topic 2).
TRANSACTION DRIVERS	Transaction drivers **count the number of times that an activity is performed.** They are the least expensive to determine, but they are also likely to be the least accurate.

TERM/CONCEPT	DEFINITION/EXPLANATION
TRANSACTION MOTIVE FOR HOLDING INVENTORY	This refers to holding inventory for day-to-day use in the production process or for sales, where the supplier might not be able to supply at short notice.
TYPES OF RESPONSIBILITY CENTRES	**COST CENTRE** An account for costs only (e.g. a production or maintenance department) **INCOME CENTRE** An account for income only (e.g. a sales department) **PROFIT CENTRE** An account for income and costs (e.g. a specific branch or production site) **INVESTMENT CENTRE** An account for profits and assets invested (e.g. a geographical area or broad category of products)
UNCONTROLLABLE COSTS	*Uncontrollable costs* are costs that the responsible person (eg member of management) cannot control directly. Examples of such costs are head office over-heads and depreciation. These costs should be excluded from a manager's performance report, simply because the manager cannot be held responsible for costs he or she cannot control.
UNCONTROLLABLE EVENT	Something that takes place independent of management's actions, i.e. management cannot control what happens under the specific circumstances.
UNDER OR OVER APPLIED OVERHEADS	If the applied overheads are less than the actual overheads, this is known as an under application. Over applied overheads occur when applied overheads are greater than the actual overheads.
VALUATION OF INCOMPLETE UNITS: FIFO METHOD	Units completed in the current period and transferred to the finished goods store *are split* between those completed from the opening WIP and those that were started (and completed) in the current period.
VALUATION OF INCOMPLETE UNITS: WEIGHTED AVERAGE METHOD	Units completed in the current period and transferred to the finished goods store are *not split* between those completed from the opening WIP and those that were started (and completed) in the current period. In other words, all units that were completed in the current period are treated exactly the same, regardless of whether they come from the opening WIP or the units started in the current period.
VARIABLE COST	Variable cost is a cost that *varies, in total*, in direct proportion to changes in the level of activity or volume. The variable cost *per unit is constant* within a relevant range.

VARIABLE SALES AND DISTRIBUTION COST RATE VARIANCE	The variable sales and distribution cost rate variance is the difference between the actual variable sales and distribution cost incurred and the standard variable sales and distribution cost allowed for units actually sold.
WASTE (SCRAP) PRODUCTS	A by-product with no sales value is also regarded as waste or scrap products. The organisation may sometimes even have to incur costs to get rid of the waste or scrap products in terms of health or environmental regulations!
WEIGHTED AVERAGE METHOD	The weighted average method makes no assumptions about the flow of materials. The issuing of materials at a weighted average cost *assumes* that each batch taken from the storeroom is made up of the same quantities from each consignment in inventory at the date of issue. No attempt is made to identify when the units were purchased.
WORK-IN-PROCESS (WIP)	Work-in-process inventory refers to partially completed products or components that cannot be classified as finished products.

VERY IMPORTANT NOTE

After you have passed this module, you should not get rid of your study guides and other study material (like tutorial letters). You may have to refer back to these in your future studies. The principles that are dealt with in this module will not be repeated in subsequent modules! In subsequent modules it is assumed that you completely got the hang of the learning outcomes of prior modules.

Your separate Study Guide 2 will contain the following: