Principles of Management Accounting

Study guide two of two for

MAC2601

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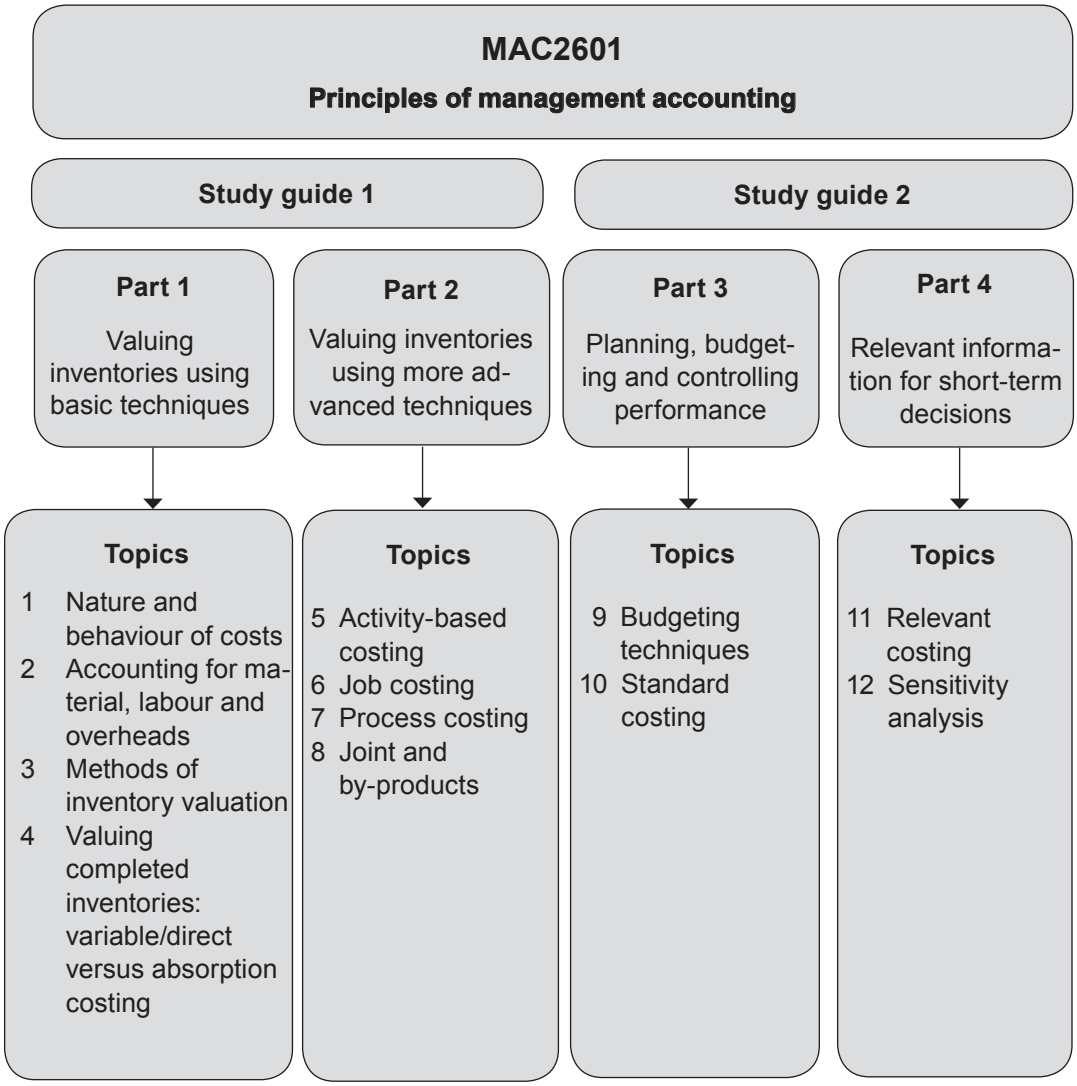
INTRODUCTION

For a detailed introduction to an overview of MAC2601, refer to Study Guide 1 of 2.

SCHEMATIC REPRESENTATION OF THE CONTENT OF THE STUDY GUIDES



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.

PART 3

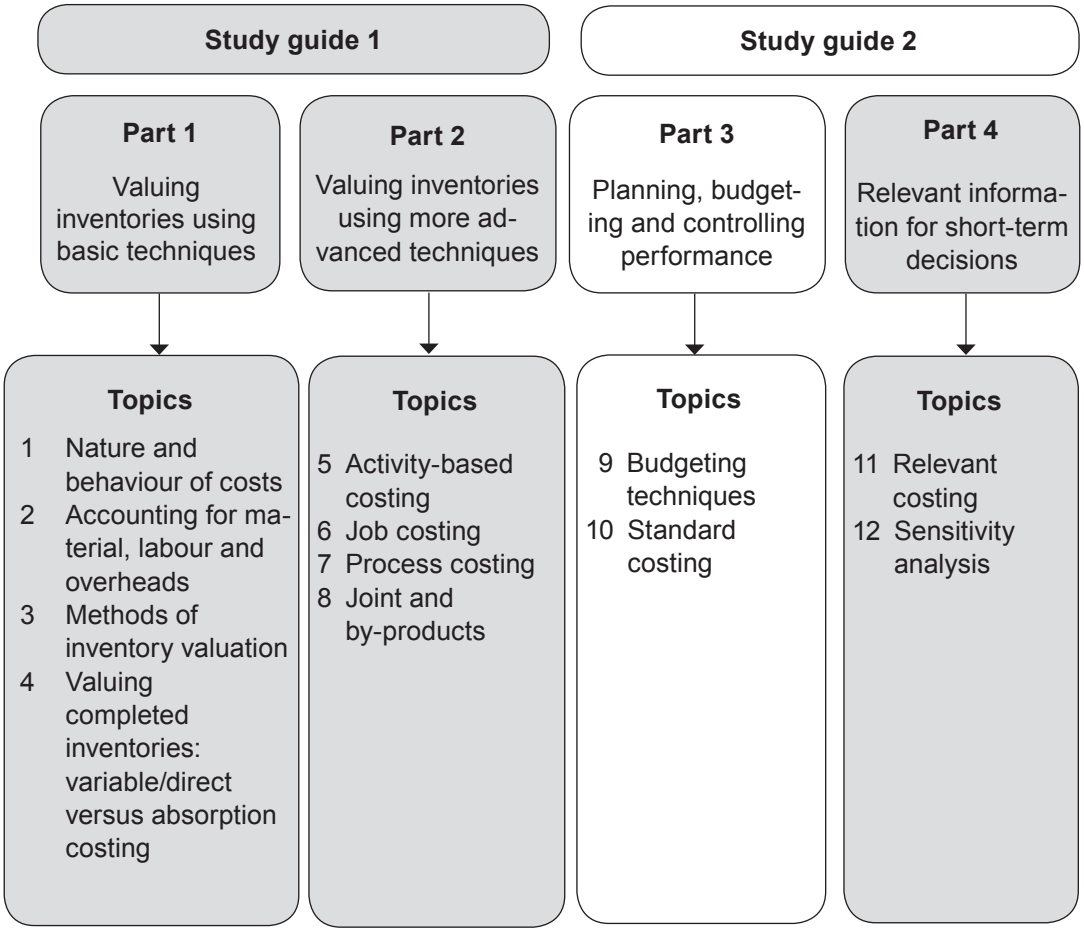
Planning, budgeting and controlling performance

PURPOSE

The purpose of part 3 is to discuss the budgeting process as a control mechanism, to compile selected budgets and to flex the budget, secondly to introduce the standard costing system, and lastly to calculate and analyse selected variances and reconcile budgeted and actual profit.

TOPIC 9 – BUDGETING TECHNIQUES

TOPIC 10 – STANDARD COSTING

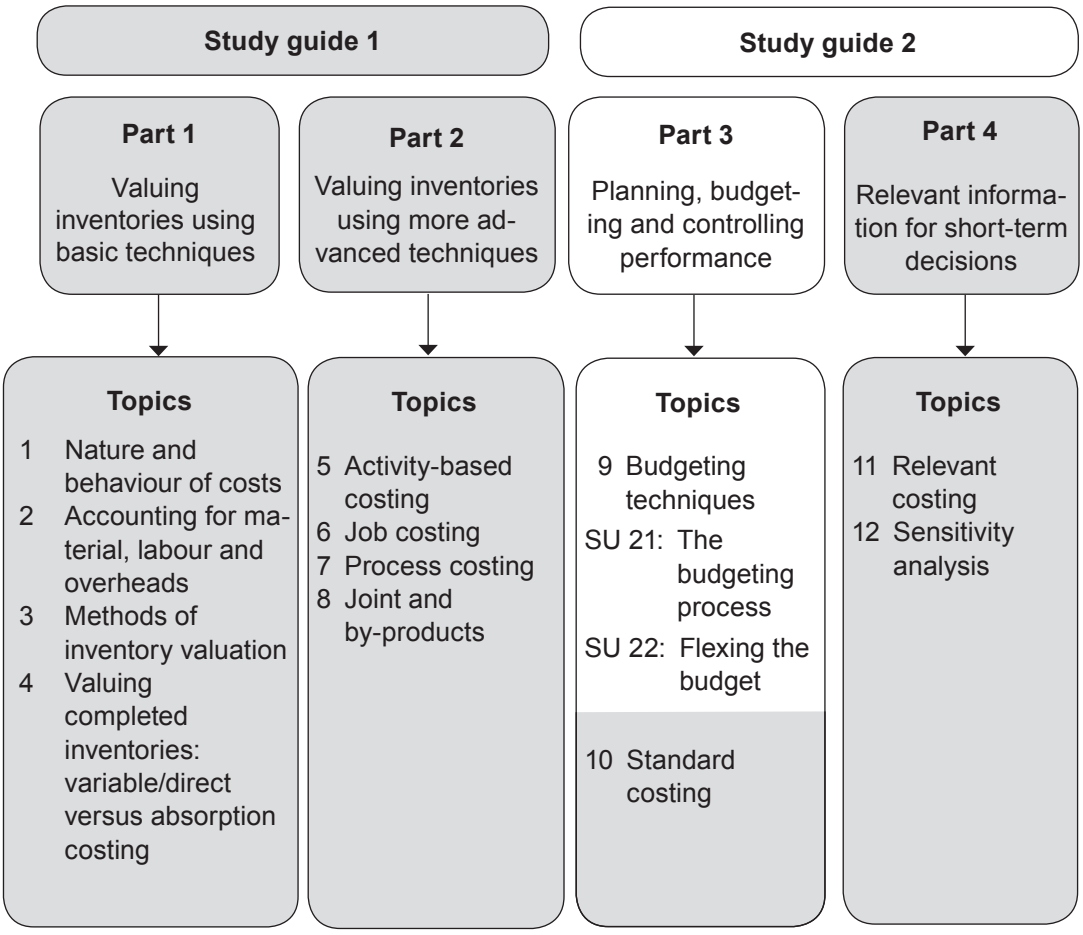


TOPIC 9
Budgeting techniques

LEARNING OUTCOMES

After studying this topic, you should be able to:

- define the concepts “budgeting” and “budgetary control”
- explain the functions and aims of budgetary control
- differentiate between controllable and uncontrollable costs
- define the different responsibility centres
- list the various types of budgets
- draft any fixed cost budget
- draft a cash budget using information on payments and receipts
- define a flexible budget
- compile a flexible budget
- list the advantages and disadvantages of budgeting



STUDY UNIT	TITLE
Study unit 21	THE BUDGETING PROCESS
Study unit 22	FLEXING THE BUDGET

Introduction

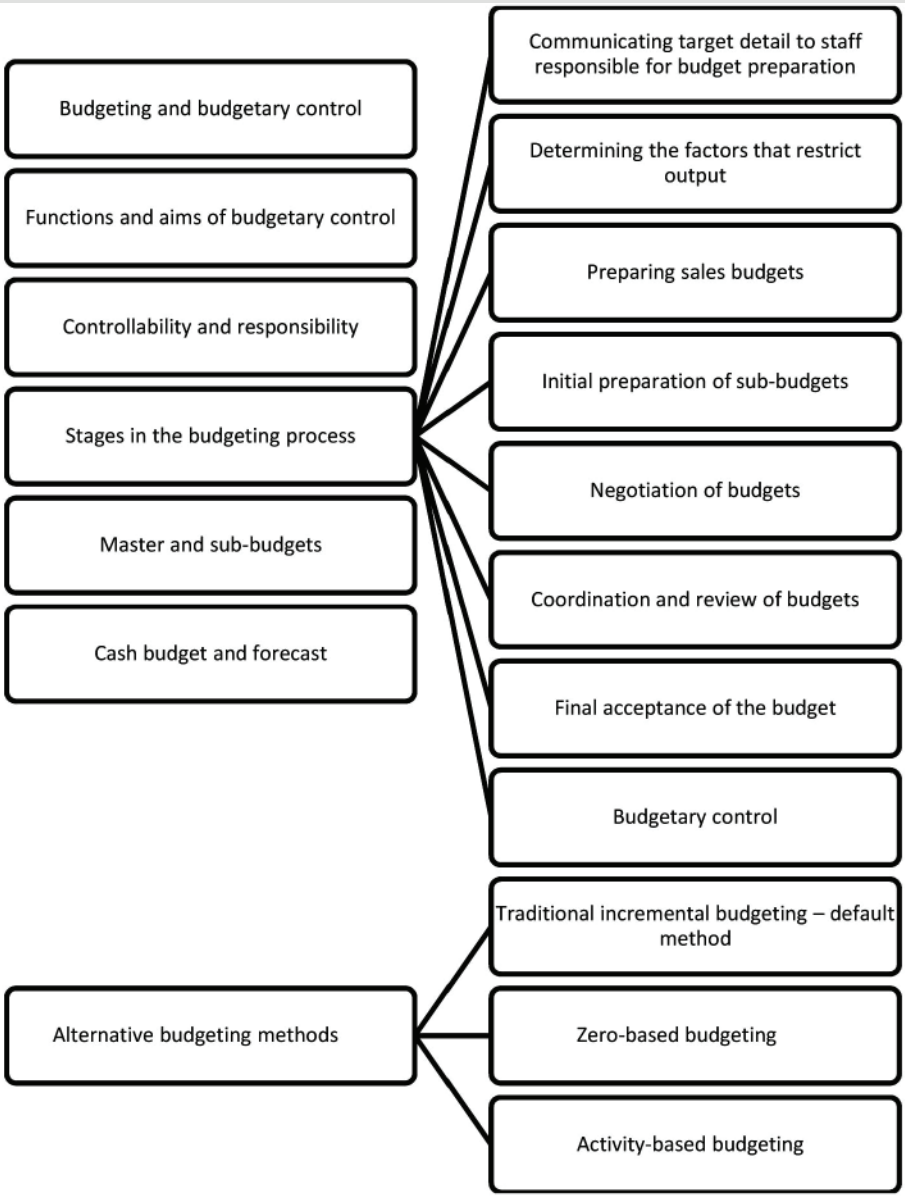
Every organisation needs to plan on how it intends to achieve its objectives. These objectives are defined in the organisation's vision and mission, and various strategies should have been drawn up with a view to achieving these objectives. This is referred to as **strategic** or **long-term planning**. You will learn more about strategy and the factors that influence strategy in the module MAC2602 dealing with the principles of strategy, risk and financial management techniques.

The long-term objectives of a strategy are broken down into short-term objectives and targets, and organisations use operational plans to achieve short-term objectives. All this is included in the organisation's budgeting process. In this topic, we shall be focusing on budgets, budget control and budgeting techniques.

STUDY UNIT 21

The budgeting process

In this study unit



1 Introduction

Everyone has some experience with a budget. A budget may be your personal monthly budget or your employer's organisational budget. Every February, the government's budget for the next fiscal year is presented in parliament and made available to the public via the media.

In this study unit, we are going to focus on how organisational budgets are developed and we shall be discussing how to prepare a cash budget.

2 Budgeting and budgetary control

> **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).

From the definition above, it is clear that any organisation must identify, set and strive for specific goals. Goals must be **SMART**:

- **S**ustainable
- **M**easurable
- **A**ttainable
- **R**esults orientated
- **T**ime bound

Once goals are set (by the strategic planning process), a budget can be developed. Most organisations use some form of budget. For most businesses, achieving long-term sustainable profit is the main goal and, to achieve this, careful planning and effective control are necessary.

Even non-profit entities, such as a government department or a non-government organisation (NGO), have service delivery targets and they too use budgeting as a tool to plan and monitor their activities.

Budgets are developed to help management in the planning, coordination and control required in any organisation. A comparison between the budget and the actual results serves as a basis for evaluating performance and taking corrective steps.

The **budget** is therefore a **document**; it is the result of a lengthy planning process with input by all the relevant parties, based on the significant factors influencing an organisation. **Budgetary control** is a **continuous process** of maintaining, comparing actual data with budgeted data and making appropriate adjustments to budgeted data, as circumstances dictate.

3 Functions and aims of budgetary control

Budgeting and budgetary control have three main functions:

Functions	Aims
• **Planning** This entails a study of what must be done to achieve long-term targets, the resources needed to do this, how tasks must be executed (efficiently and effectively), and what the eventual result should be.	• Annual planning with a view to sustaining profitability • Utilising production facilities and other resources in the most efficient way
• **Coordination** This bridging function directs departments and divisions to achieve the same organisational goals.	• Achieving goal congruence for all activities • Focussing on the long-term goals of the business • Coordinating all the activities of the business efficiently
• **Control** This entails setting standards, comparing results achieved with those planned, identifying reasons for variances, and implementing corrective steps.	• Serving as a standard by which to measure results • Ensuring continuous control (at least monthly – some crucial indicators are checked weekly and even daily) • Ensuring that any material variation is investigated immediately

4 Controllability and responsibility

For the budget to fulfil its controlling function, it is important that costs be classified as controllable or uncontrollable.

CONTROLLABLE AND UNCONTROLLABLE 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.

Uncontrollable costs are costs that the responsible person (eg member of management) cannot control directly. Examples of such costs are head office overheads 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.

Activity 21.1

Buddy's Ltd. manufactures plastic bottles. It uses plastic pellets as raw material; these pellets are then extruded (blown up by heat and air) by the equipment into moulds according to the type of bottle manufactured. Sales personnel make regular visits to long-standing customers and 'cold calls' to new potential customers; they receive commission on each order placed. Production depends on customer orders placed. The company remunerates its employees with a

basic package plus performance bonuses. Here is a list of some of Buddy's Ltd.'s costs:

- Spillage cost (the cost of plastic pellets wasted when poured into the equipment's containers)
- Overtime labour cost
- Factory rent
- Electricity and water
- Sales commission paid
- Head office management fees
- Royalties for plastic moulds used
- Cost of written-off obsolescent finished goods inventory

Here is a list of some of Buddy's Ltd.'s key personnel:

- Shift supervisor
- Marketing manager
- CEO
- Finance manager
- Legal advisor
- Production manager

REQUIRED

For each cost, identify the employee(s) who should be able to control or exert the greatest influence on this cost and who should therefore be responsible for this cost. Give reasons for your answers.

Solution to Activity 21.1

Cost	Responsible person	Reason
Spillage cost	Shift supervisor	He/She directly overseas the workers and should ensure that appropriate care is taken.
Overtime labour cost	Production manager	He/She determines the production schedule, which determines what production runs take place during normal hours and during overtime.
Factory rent	Finance manager and CEO	They determine where the factory operates and negotiate the rental terms.
Electricity and water	Production manager and shift supervisor	The production manager determines the production schedule which, in turn, determines the amount of electricity and water used. The shift supervisor has to ensure that operations takes place efficiently.
Commission costs	Marketing manager	He/She determines the commission structure that will best motivate the sales force.
Head office management fees	CEO and Finance manager	The CEO and finance manager are ultimately responsible for running an efficient head office structure. The production and sales managers should be able to complain if the fee allocated to them is too high.
Royalties for plastic mould used	Legal advisor	He/She negotiates the fee with the patent holder.
Cost of obsolete inventory	Marketing manager	Production only takes place once orders are received. An obsolete finished goods inventory is the result of customers who do not collect their order. The marketing manager is responsible for the orders placed.

NOTE

Remember: personnel cannot be held responsible for costs not under their control.

Control can also be exercised at different levels of the organisation. Activities are grouped into departments or centres and, at the higher levels, into divisions. Responsibility centres are created along the following lines:

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)

NOTE

You will learn more about the implications of controllability in MAC3701, which covers responsibility accounting (including divisionalisation or centralisation) and performance management.

Activity 21.2

Refer to the background information provided for Buddy's Ltd. in Activity 21.1.

Buddy's Ltd. also operates its own transport fleet. The transport department operates the delivery trucks and charges customers a delivery fee based on the distance travelled and a flat fee per delivery.

REQUIRED

For each of the departments below, identify whether the department is a cost, income or profit centre:

a. Production
b. Marketing
c. Transport

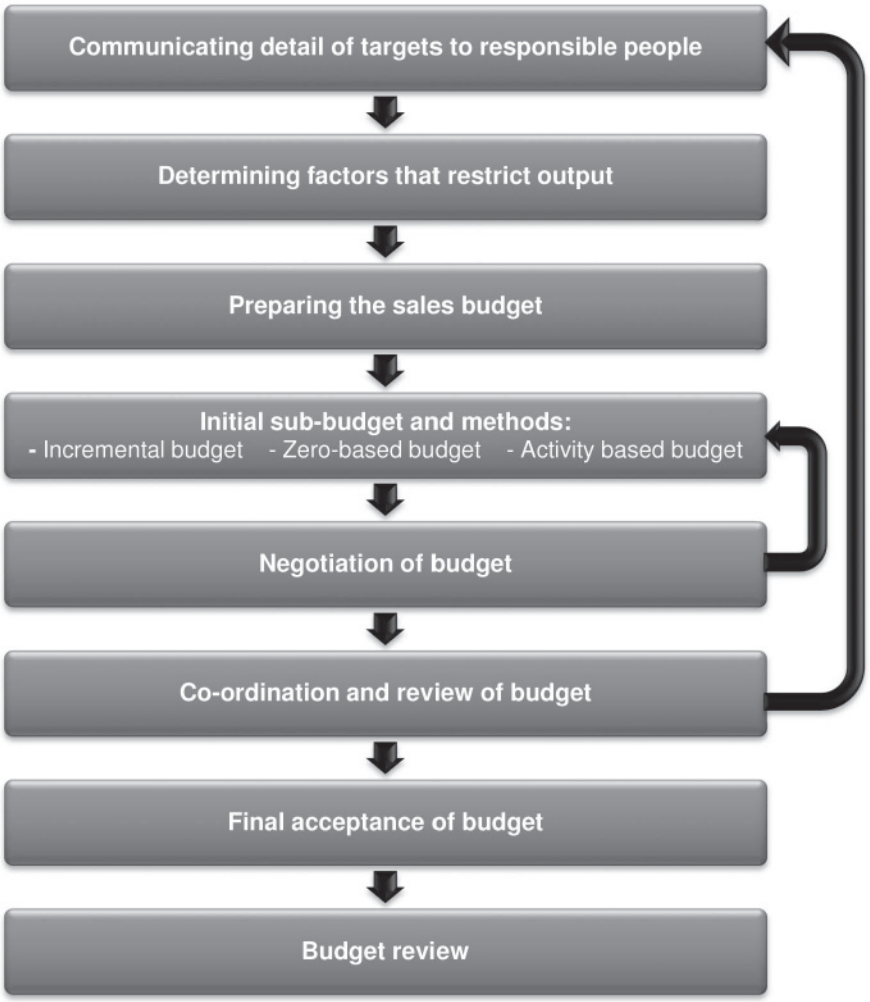
Solution to Activity 21.2

a. Production department: Cost centre
b. Marketing department: Income centre
c. Transport department: Profit centre

At the company level, Buddy's Ltd. is an investment centre, because its net profit and capital invested is measured.

5 Stages in the budgeting process

The important stages in the budgeting process are set out in figure 21.1 below:



Source: Author, 2012

FIGURE 21.1: The stages in the budgeting process

5.1 Communicating target detail to staff responsible for budget preparation

This links up with the organisation's long-term plan, which is the starting point for preparing the budget. The policies and targets decided on, or changes to these on the basis of the long-term planning process, are communicated to all levels of staff responsible for budgets. Changes in objectives may include changes in planned sales, changes in productivity and allowances made for price and wage increases. This communication is a 'top-down' process.

Cost-volume-profit (CVP) analysis plays an important role in determining whether the initial profit targets will be achieved. You will learn more about CVP as a sensitivity tool in topic 12. The basics of CVP were covered in topic 1 when we explained cost behaviour and you may wish to refer back to this topic 1 now.

5.2 Determining the factors that restrict output

All organisations are faced with factors that limit what they can do. This stage in the budgeting process requires the identification of factors that might restrict output. These could be production capacities, scarcity of raw materials or logistical (ie transport or storage) restrictions. You will learn more about optimising limiting factors in topic 11 on relevant costing). For now, it is important to realise that the objectives of any organisation are, in effect, designed around their limitations.

5.3 Preparing sales budgets

This is the key driver in the budgeting process. After the number of units to be sold (subject to production capacity constraints) are calculated or forecasted, a sales budget is prepared. Unit sales will determine the production output, resources required, etcetera.

5.4 Initial preparation of sub-budgets

Individual budgets for each cost and income centre (departments) must be prepared at each level based on the required sales and production output. There is no single right way to prepare budgets. However, a 'bottom-up' process is advised. This means preparing budgets at the lowest level and consolidating the budget at higher levels. Costs are usually estimated at current levels with factors built in for inflation and other anticipated cost escalations (called **incremental budgets**). Later on in this topic, you will learn about variations in this methodology.

5.5 Negotiation of budgets

People in lower level management who prepared the initial budgets need to submit these budgets to their line managers for approval: budgets are negotiated and agreed upon between these levels of management. The negotiation process is of importance in the budgeting process, and can determine whether the budget becomes an effective management tool or is simply a 'paper exercise'.

NOTE

You will learn more about the behavioural aspects (ie the extent to which budgets motivate or demotivate employees) of budgeting in MAC3701, dealing with the application of management accounting techniques.

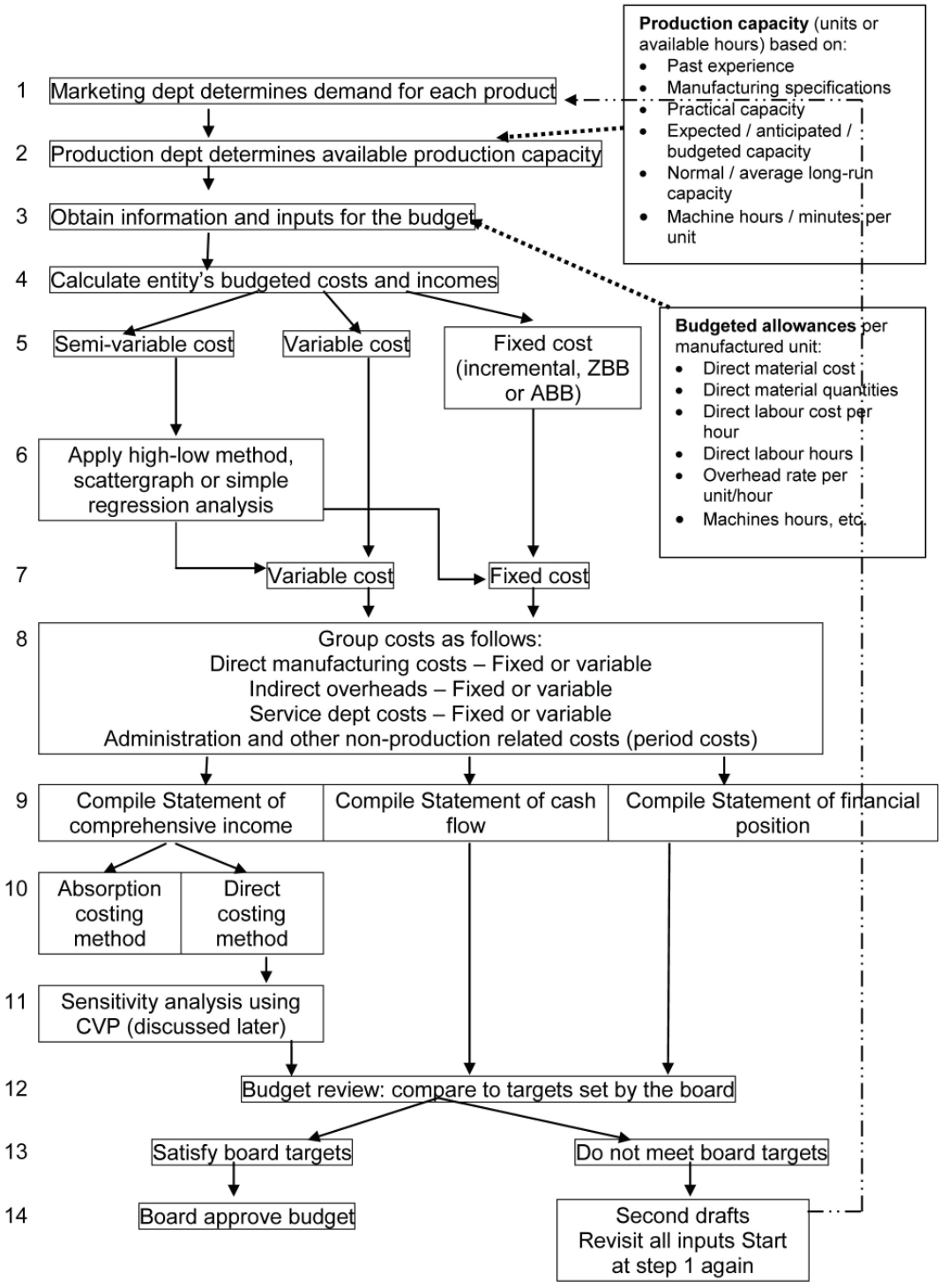
Budgets that were approved at lower levels are consolidated at the next level and, once again, presented for approval by a process of negotiation.

5.6 Coordination and review of budgets

Eventually, the first draft of the main budget is presented to the board of directors for approval. If the board believes that its targets are not being met, it may devise new strategies by which to achieve its original targets: these may then be handed down to lower management levels for budgetary revision purposes. Those responsible then need to make the necessary changes to the budget; this may require that any budgetary adjustments be coordinated and communicated back to all parties involved. The process might repeat itself a few times before a final budget is accepted. See figure 21.1.

5.7 Final acceptance of the budget

After a few versions have been put forward for approval, a final budget (including all its sub-budgets) will be approved. Once this happens, all budgets are said to be in harmony. See figure 21.2 for details of the process followed to generate the budgeted financial statements for the next financial period.



Source: Author, 2012

FIGURE 21.2: Compilation of the final approved budgeted financial statements

5.8 Budgetary control

The budgetary control stage now commences. Actual results should be compared with budgeted results. This enables management to identify budget items that are deviating from the budgeted amounts and to investigate the reasons for such deviance. You will learn more about this in study unit 22 on flexible budgeting and topic 10 about standard costing.

6 Master and sub-budgets

As you can imagine, there are various types of budgets, especially in a manufacturing organisation. We will briefly explain the various components that make up a budget.

DIFFERENT BUDGETS

6.1 Master budget

A master budget can also be called the main budget. This is the consolidated budget, which is usually loaded on to the organisation's mainframe computer. A master budget will consist of all the activities in the organisation as a whole. Given that any organisation includes a number of functions, there are many sub-budgets. These sub-budgets make up the master budget. In most organisations, senior management is involved in developing and implementing a master budget.

The flow chart illustrates the detailed process followed to obtain all the inputs into the budgeting process, the calculation of the budgeted financial statements and the final approval of the budget by the board of directors.

Let's now look, in more detail, at some of the sub-budgets that feed into the main or master budget:

6.1.1 Sales budget

Here, a forecast is required of the number of units that will be sold. All the other sub-budgets are based on the sales budget. It is obviously important, therefore, that sales forecasts are accurate.

6.1.2 Production budget

After the sales budget has been developed, management knows how many units must be manufactured. The function of the production budget is to ensure that sufficient inventory is always available to meet expected sales and that inventory is kept at an optimal level.

6.1.3 Plant utilisation budget

Plant utilisation is based on the total of all the production budgets, and enables management to establish the total production requirement for all its manufacturing plants. This budget can help to identify whether work must be transferred or subcontracted. It is essential that plants that are operating either over or under capacity be identified. (You will learn more about optimising plant utilisation in topic 11.)

6.1.4 Trading purchases budget

Manufacturing organisations produce their own products, whilst trading companies buy and sell completed products. A trading purchases budget determines the estimated amount of goods to be purchased for resale during the budget period.

6.1.5 Direct material budget

This budget shows the estimated quantity and the cost of raw material required to manufacture the budgeted finished goods. Some companies use standard material specifications to calculate the quantity of raw material needed; standard costing is discussed in more detail in topic 10.

6.1.6 Direct labour budget

A budget must be prepared to estimate labour requirements that will support the sales and production budget.

6.1.7 Manufacturing overheads budget

This budget contains various budgets for all the cost items in the production section that do not fall under direct material or direct labour. Some of the expenses vary according to production, while others are fixed costs. These figures must be forecast as accurately as possible, because they serve as a basis for calculating the predetermined overhead rate. (Refer to topic 2.)

6.1.8 Production cost budget

This budget is a summary of the direct material, direct labour and manufacturing overheads budgets.

6.1.9 Marketing or selling and distribution cost budget

All expenses such as advertising, transport, storage, insurance, collection cost and sales staff salaries, bonuses and commissions, are shown in this budget. **Note:** for control purposes, fixed and variable costs must be separated.

6.1.10 Administrative budget

Costs for the finance, IT and human resource departments, as well as divisional or departmental managers, are budgeted here. This budget does not have a direct connection with the sales and production budget. These costs are usually fixed (they are incurred irrespective of sales). The administrative budget forms part of all master budgets, irrespective of the type of organisation involved (ie service, retail, or manufacturing).

6.1.11 Research and development budget

Research and development costs will be incurred by any organisation that wants to stay ahead technologically. For this, a detailed budget is required. Some organisations do not have a research and development budget.

NOTE

For the purpose of this module, designing and preparing **detailed, integrated (balanced) master and sub-budgets based on sales and production volumes are not required**. However, it is essential that you are at least able to identify the various budgets. Preparation of these will be taught in MAC3701 (Application of management accounting techniques).

You should, however, be able to produce elementary overall budgets (relying on the basic cost concepts explained in topics 1 and 2), detailed budgets for any fixed cost (including allocation rates), and cash budgets (see section 7).

6.1.12 Capital budget

This budget is designed to provide for new or replacement investment in non-current assets. This budget is usually based on an organisation's long-term plan to expand market share, launch new products, etcetera. You will learn more about capital budgeting techniques in your MAC2602 module.

6.1.13 Cash budget

Liquidity, that is, the ability to meet cash obligations, is very important in any organisation. The cash budget is prepared when all the other budgets are completed, because it uses these figures together with the payment terms to forecast both cash receipts and payments. Further discussions follow in the next section.

7 Cash budget and forecast

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.

The objective of the cash budget is to forecast the monthly and year-end cash position and highlight the financial requirements for the forecast period. The organisation's objectives will be jeopardised if it finds itself with a shortage of cash and no plans for borrowing. A cash budget is vital to the management of an organisation's cash. It shows, over a period varying between a single day, a week, a month, a year or even longer, the expected in-flows and outflows of cash through the organisation. It facilitates detection of both cash surpluses and cash shortages.

Management can use a cash budget in order to plan for such eventualities (ie cash surpluses and shortages). This will involve timeous borrowing when a deficit is forecast, or buying short-term investments during periods of excess cash.

NOTE

The objective of proper cash management is to keep shortages within the available overdraft facility and to invest surpluses in short-term investments that can be withdrawn at short notice when required. You will learn more about working capital and cash management in MAC2602 about the principles of strategy, risk and financial management techniques.

If an organisation only uses an annual summarised cash budget, this may cause problems. Although the opening balance and the closing balance of such an annual cash budget may both be healthy, large outflows occurring in quick succession at the beginning of the period (eg tax outflows, dividend outflows and the reduction of long-term debt) may lead to a cash shortage. This is why monthly cash forecasts are preferred, although these require more information and planning. Note that some organisations even do weekly cash flow forecasts. The technique, however, is the same.

The cash budget consists of the following three sections:

1. The receipts section
2. The payment section
3. The cash surplus or shortage section

The **receipts section** includes cash sales, collections (payments) from debtors and any other cash received during the period.

The **payment section** includes all cash payments planned for the budget period. For example: raw material purchases (cash purchases), payments to creditors, direct labour payments and cash manufacturing overhead costs as calculated in the different budgets. The payment section also includes other payments such as equipment purchases, dividends, taxation and interest on a loan or overdraft.

The **cash surplus or shortage section** is calculated as follows:

	R
Opening balance	x
Plus: total receipts	xx
Total cash available	xxx
Less: payments	xx
Surplus/(Shortage)	**X**
Available overdraft facility	y

When preparing the cash budget, supporting schedules (documentation, including, but not limited to, client lists, labour schedules etc.) must be used. **All non-cash items, such as depreciation and amortisations, are excluded from the cash budget**. This is because **only transactions that influence the organisation's cash position are required**.

Activity 21.3

Davinci Ltd. has an opening positive (favourable) bank balance of R45 000 on 1 January 20X1.

The sales were budgeted as follows:

	R
November 20X0	120 000
December 20X0	134 000
January 20X1	112 500
February 20X1	105 000
March 20X1	120 000

All sales are on credit. Credit sales are collected as follows:

- 60% within the month of sales
- 25% in the following month
- 15% in the month thereafter

Davinci's purchases were as follows:

	R
December 20X0	90 000
January 20X1	82 500
February 20X1	67 500
March 20X1	81 500

All purchases are on credit, but 80% are settled in the month of purchase and the balance of 20% a month later. Wages are R22 500 per month and overheads R30 000 per month, including depreciation of R5 000. These amounts are settled monthly. The company is liable to pay tax to the amount of R9 000 at the end of February 20X1. At the end of February 20X1, the company will sell an old machine for an estimated R20 000.

REQUIRED

Prepare the 20X1 cash budget for January, February and March.

Solution to Activity 21.3

Receipts from sales		**R**
January 20X1		
November	(15% x R120 000)	18 000
December	(25% x R134 000)	33 500
January	(60% x R112 500)	67 500
Total		119 000
February 20X1		
December	(15% x R134 000)	20 100
January	(25% x R112 500)	28 125
February	(60% x R105 000)	63 000
Total		111 225
March 20X1		
January	(15% x R112 500)	16 875
February	(25% x R105 000)	26 250
March	(60% x R120 000)	72 000
Total		115 125

Payments for purchases		**R**
January 20X1		
December	(20% x R90 000)	18 000
January	(80% x R82 500)	66 000
Total		84 000
February 20X1		
January	(20% x R82 500)	16 500
February	(80% x R67 500)	54 000
Total		70 500
March 20X1		
February	(20% x R67 500)	13 500
March	(80% x R81 500)	65 200
Total		78 700

	R January 20X1	R February 20X1	R March 20X1
Opening balance	45 000	32 500	36 725
Receipts:			
Receipts from sales	119 000	111 225	115 125
Sale – machine		20 000	
Cash available	164 000	163 725	151 850
Payments:			
Purchases	84 000	70 500	78 700
Wages	22 500	22 500	22 500
Overheads (less: depreciation) (30 000 – 5 000)	25 000	25 000	25 000
Taxation		9 000	
Total payment	(131 500)	(127 000)	(126 200)
Closing balance	**32 500**	**36 725**	**25 650**

NOTE

Did you see that January's closing balance *became* February's opening balance?

Do you think it is to the benefit of the company to have so much cash continuously available in its bank (cheque) account?

What other item of income could we include in this cash flow?
(Hint: What do you earn on a positive bank balance?)

8 Alternative budgeting methods

8.1 Traditional incremental budgeting – default method

During the preparation of budgets, sales and production activities are determined first. This directly influences estimated variable costs. However, fixed production, support and administrative costs are usually based on the prior year's levels. These costs are then escalated with inflation, increases in exchange rates, etcetera. This is called the incremental budgeting technique, and is the most commonly used method.

The drawback to this method is that any current underutilisation of fixed resources remains entrenched. As part of the budgeting process, an organisation should continuously re-evaluate all fixed overhead expenditure relating to its business infrastructure.

8.2 Zero-based budgeting

Zero-based budgeting (ZBB) emerged in the late 1960s as an attempt to overcome the limitations of incremental budgets. Firstly, ZBB takes the view that projected expenses start from zero, which means that budgets are compiled as though the organisation had only just begun its activities. Secondly, budgets are compiled on a line for line basis.

ZBB is the best budget tool to use when dealing with discretionary costs.

DISCRETIONARY COSTS

Discretionary costs are costs over which management has some form of control. Examples include advertising, training and development costs.

ZBB has the following advantages when compared with traditional incremental budgeting:

- ZBB represents an allocation of resources based on need or benefit, unlike traditional budgeting that tends to extrapolate past data.
- ZBB requires answers to questions like: "Why do you want to spend Rx on expense item Y?"
- ZBB focuses on output.

ZBB has certain shortcomings: it is more costly and time-consuming than traditional budgeting.

8.3 Activity-based budgeting

With activity-based costing (ABC), *resource drivers* assign resource expenses to *activity cost pools* (1st stage allocation) and then use *activity cost drivers* to assign activity costs to cost objects (2nd stage allocation) (refer to topic 5). Activity-based budgeting (ABB) is the reverse of this process.

The budgeted final product output determines the required support activities; these are then used to estimate the resources that are required for the budgeted period (bottom-up). This process is usually most effective for production support costs, that is, maintenance costs, set-up costs and other overheads such as order processing, debtor administration etcetera.

The following steps are followed in ABB:

- Estimate the production and sales volume by individual products and customers.
- Estimate the demand for organisational activities.
- Determine the resources that are required to carry out the organisation's activities.
- For each resource, estimate the quantity that must be supplied to meet the demand.
- Take action to adjust the capacity of resources to match the projected supply.

NOTE

You will learn more about ZBB and ABB in later MAC modules.

9 Summary

In this study unit, you learnt the following:

- The purpose of a budget
- The functions and aims of a budget
- The importance of controllability and responsibility centres
- How the budgeting process works
- The different types of sub-budgets
- How to compile the budget to account for fixed costs
- How to compile a cash budget
- Different ways of compiling a budget

In the next study unit, you will learn how to *flex* a budget and calculate budget variances. We will also discuss the advantages and disadvantages of budgeting.

Self-assessment activity

QUESTION 1

Acu Darts Ltd. buys and sells dartboards. The manager prepared the following budgeted contribution statement of comprehensive income for the month of March.

	R
Sales	1 200 000
Variable cost	1 075 000
Opening inventory	100 000
Purchases	1 075 000
Closing inventory	(175 000)
Variable selling costs	75 000
Contribution	125 000
Fixed cost	145 000
Production overheads	100 000
Administration	45 000
Net profit before tax	(20 000)

Additional information

- Bank opening balance is R120 000.
- Cash sales amounted to 70% of total sales for this month.
- Selling price per unit equals R120.

- 60% of inventory purchased in this month is on a cash basis.
- Acu Darts Ltd. plans to achieve a closing inventory level of 17,5% of units sold in this month.
- Cash payments in March to settle February credit purchases amounted to R312 000.
- Cash receipts in March in respect of credit sales of February amounted to R390 000.
- The variable cost per unit remained the same from February to March.
- Depreciation on both production and other assets amounts to R12 000 per month.
- All other expenses are incurred on a cash basis.

Cash sales and purchases as percentages of total sales and purchases in any month vary, depending on the available cash and discounts on offer.

REQUIRED

a. Calculate the total variable cost per unit.
b. Calculate the budgeted number of units purchased, on hand, and sold for March.
c. Prepare a cash budget for March and calculate the estimated closing balance in the bank account.

QUESTION 2

Lexis Ltd. is in the process of finalising its budget. Various production levels are still being considered. Lexis Ltd. uses various techniques to determine the fixed and variable components of individual cost items in the budget for production department A (a cost centre).

Machine hours are used as the basis for allocating overheads. The historical capacity utilisation varied from 8 000 to 12 000 direct machine hours per month. The average long run capacity utilisation is 10 000 machine hours per month.

An analysis showed the following for the budget year:

1. The salaries of supervisors amounted to R48 000 for the previous year and management is now contemplating a further 5% increase for the budget year.
2. Property tax is estimated at R2 850 for the year.
3. The analysis of the monthly cost data according to the least squares method for the previous nine months produced the following results (the fixed component is per month and the variable rate is indicated per machine hour):

Depreciation:	Y =	R1 440 + R0 per hour
Materials handling:	Y =	R 240 + R0,6 per hour

   Management reviewed these results and decided to raise material handling costs by 10% (fixed and variable).

4. Water and electricity for this department is estimated at R1 200 at a monthly production volume of 12 000 machine hours. Industrial engineers agree that the cost at this level should be 20% fixed and 80% variable.
5. Indirect wages (semi-variable) are estimated as follows:

	R
9 600 machine hours	4 500
12 000 machine hours	5 250

6. Maintenance (variable) is estimated as follows:

		R
At maximum output	of 12 000 hours	6 250
At minimum output	of 9 600 hours	5 000

7. The method of least squares analysis indicates that the other semi-variable overheads should be as follows (on a monthly basis):

Fixed	R400
Variable	R0,50 per machine hour

A general price reduction of 10% will occur, and this will have an influence on the cost item.

REQUIRED

a. Use the information above to draft the monthly overhead cost budget for production department A for months one to three, based on production volumes of 9 000, 9 500 and 10 000 machine hours per month respectively.
b. Determine the total monthly budgeted overhead allocation to the work-in-process (WIP) account for each month.
c. Calculate the over or under recovery/allocation of budgeted fixed overheads.

Work to five decimals.

Solution to Self-assessment activity

QUESTION 1

a. Total variable cost per unit

		R
Value of closing inventory		175 000
Units	(① 10 000 x 17,5%)	1 750
Purchase cost per unit	(R175 000 / 1 750 units)	100,00
Variable selling cost	(R75 000 / 10 000)	7,50
Total variable cost		107,50

① Units sold R1 200 000 / 120 = 10 000

NOTE

Remember that, in terms of International Accounting Statement IAS2 – Inventories, selling costs cannot be allocated to the value of closing inventory because they are only incurred once the sale is made. We therefore value the closing inventories based on purchase cost only. For this activity, we only worked with contributions – fixed production overheads were excluded from the valuation.

b. Units purchased, on hand and sold

		Units
Opening inventory	(R100 000 / R100,00)	1 000
Purchase	(R1 075 000 / R100)	10 750
Available for sale		11 750
Sales ①		10 000
Closing inventory	(R175 000 / R100)	1 750

c. Cash budget

	R
Opening balance bank	120 000
Receipts	1 230 000
March (R1 200 000 x 70%)	840 000
February credit sales	390 000
Payments	(1 177 000)
Purchase cost: March (R1 075 000 x 60%)	(645 000)
February credit purchases	(312 000)
Selling cost	(75 000)
Fixed overheads	(100 000)
Fixed administration	(45 000)
Add back non-cash expenses (depreciation)	12 000
Closing balance	**185 000**

NOTE

As you can see, there is a difference between accounting profit and the cash generated. Although the organisation made an accounting loss of R20 000, its closing cash balance was R185 000.

QUESTION 2

a. Monthly overhead cost budget

	Calculation no	Fixed amount per month	Variable rate per machine hour
		R	**R**
Material handling	①	264,00	0,66000
Water and electricity	②	240,00	0,08000
Indirect wages	③	1 500,00	0,31250
Maintenance	④	–	0,52083
Other semi-variable overheads	⑤	360,00	0,45000
Supervisors' salaries	⑥	4 200,00	–
Depreciation	Given	1 440,00	–
Property tax	⑦	237,50	–
Totals		**8 241,50**	**2,02333**

Average long-run capacity (hours)		10 000
Allocation rate per hour (R8 241,50 / 10 000 hours)	=	R 0,82415
Month 1: R8 241,50 + (9 000 x R2,02333)	=	R26 451,47
Month 2: R8 241,50 + (9 500 x R2,02333)	=	R27 463,14
Month 3: R8 241,50 + (10 000 x R2,02333)	=	R28 474,80

NOTE

Remember that, where the long-term average capacity utilisation is provided in a question, you should use that as the allocation base for overheads and not the budgeted utilisation level. (Refer to topic 2 on overheads.)

Did you notice that the **total** budgeted variable production overheads vary as the number of hours budgeted to be utilised **varies**? The budgeted variable production overhead is **constant per unit**. This is in line with the definition of a variable cost. (Refer to topic 1.)

b. Overhead allocation (fixed and variable) to WIP account

Month 1: 9 000 x (R0,82415 + R2,02333)	=	R25 627,32
Month 2: 9 500 x (R0,82415 + R2,02333)	=	R27 051,06
Month 3: 10 000 x (R0,82415 + R2,02333)	=	R28 474,80

c. Budgeted over- or under-recovery of fixed production overheads

Month 1: R8 241,50 – (9 000 x R0,82415)	=	R824,15 under recovered
Month 2: R8 241,50 – (9 500 x R0,82415)	=	R412,075 underrecovered
Month 3: R8 241,50 – (10 000 x R0,82415)	=	R0,00

NOTE

Where the allocation base (hours utilised) differs from the budgeted utilisation, the organisation will have a budgeted over- or under-recovery of fixed production overheads. Note that this only occurs for fixed production overheads. This is because the total fixed production overheads remain constant regardless of production volume, but the amount of costs allocated to production via the WIP account varies based on the budgeted capacity (hours) utilisation. The budgeted total variable overheads will vary as the budgeted production volumes (based on the hours utilised) vary, leaving the variable overhead allocation rate constant and no over- or under-recovery.

Calculations

① Material handling (semi-variable overheads)

Increase of 10%

Fixed	:	R 240 x 110%	=	R264
Variable	:	R0,60 x 110%	=	R0,66 per machine hour

② Water and electricity (semi-variable overheads)

Fixed (20%)	:	R1 200 x 20%	=	R240
Variable (80%)	:	R1 200 x 80%	=	R960
				R1 200

∴ Variable rate per direct machine hour:

R960 ÷ 12 000 hours = R0,08000 per machine hour

③ Indirect wages (semi-variable overheads) – using high-low method to separate

	Machine hours	Total cost
		R
At maximum level	12 000	5 250
At minimum level	9 600	4 500
Difference	**2 400**	**750**

Variable overheads:

R 750 ÷ 2 400 machine hours = R0,31250 per machine hour

Fixed overheads:

R5 250 – (R0,31250 x 12 000) = R1 500

④ Maintenance (variable costs)

	Machine hours	Total cost	Cost per machine hour
		R	R
At maximum level	12 000	6 250	0,52083
At minimum level	9 600	5 000	0,52083

NOTE

Once again, did you see that the variable cost per machine hour is constant (because this is a variable cost)?

⑤ Other semi-variable overheads

Fixed	:	R400 x 90%	=	R360
Variable	:	R0,50 x 90%	=	R0,45

⑥ Supervisors' salaries (fixed costs)

R48 000 x 105%	=	R50 400 (allowing for 5% increase)
R50 400 ÷ 12	=	R 4 200 per month

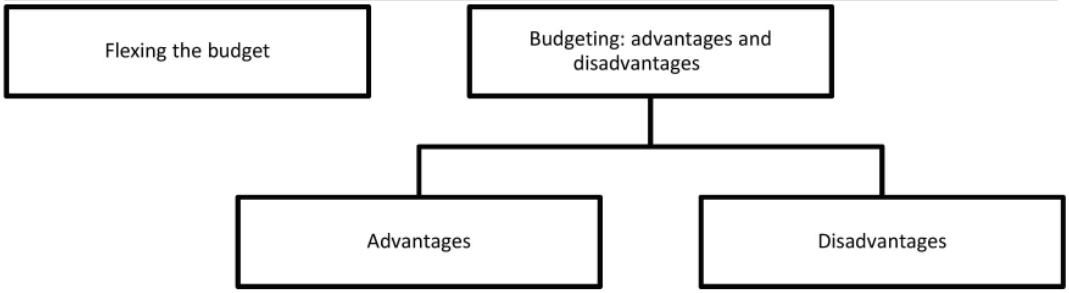
⑦ Property tax (fixed cost)

R2 850 ÷ 12 months	=	R237,50 per month

STUDY UNIT 22

Flexing the budget

In this study unit



1 Introduction

In the previous study unit, you learnt how an organisational budget is compiled and how to complete a cash budget. In this study unit, you are going to learn how to draft a flexible budget. We will also discuss the advantages and disadvantages of budgeting.

2 Flexing the budget

The original ("official") budget is approved on the basis of specific sales and production levels. We classify the original budget as a 'fixed' budget, because it is based on fixed sales and production levels.

FIXED BUDGET

A fixed budget is the approved plan of action for achieving a predetermined goal (eg total revenue of R30 m, or net profit of R5 m). In the context of this topic, a fixed budget is also referred to as the original budget.

You learnt that one of the main functions of budgets is to act as a CONTROL mechanism. The original budget would therefore be used to measure and control actual performance once the new financial period commences.

However, in practice we know that forecast sales and production levels are rarely achieved, largely owing to changes in market conditions and other unanticipated events (eg power and gas shortages, changes in exchange rates, selling prices etc). On the other hand, actual sales and production units could exceed budgeted levels, causing variable costs to be higher than budgeted. In such circumstances, it would be extremely unfair and de-motivating to accuse personnel of overspending. To overcome this shortcoming of a fixed budget, the concept of a flexible budget was developed.

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.

In order to do all this, it is necessary to calculate the variable cost per unit. The budgeted fixed cost remains fixed irrespective of the volume produced. We can therefore examine the flexible budget from two perspectives: as a unit-based budget or in total.

In the next activity, we will demonstrate how to flex the budget.

Activity 22.1

Pumi drafted the following condensed budget for her Supreme Pie business according to the direct costing method for June. She based her calculations on an activity level of **5 000** units:

	Per Unit R	Total R
Sales (5 000 units @ R20 each)	20,00	100 000
Less: Variable cost	11,50	57 500
Material (7 500 kg @ R4,00)	6,00	30 000
Labour (500 hours @ R20,00)	2,00	10 000
Manufacturing overheads (500 labour hours @ R10,00)	1,00	5 000
Sales commission (5 000 units @ R2,50 per unit)	2,50	12 500
Contribution	8,50	42 500
Less: Fixed cost		27 500
Manufacturing		20 000
Sales and administrative		7 500
Budgeted net profit		**15 000**

The following were the actual results of Pumi's Supreme Pie, who manufactured and sold **6 000** units. The extra sales came about owing to an order Pumi herself secured from a government department.

	R
Sales (6 000 units @ R22,50 each)	135 000
Less: Variable cost	70 365
Material (8 400 @ R3,90 per kg)	32 760
Labour (630 hours @ R22,50 per hour)	14 175
Manufacturing overheads	6 930
Sales commission (6 000 units @ R2,75 per unit)	16 500
Contribution	64 635
Less: Fixed costs	27 800
Manufacturing	20 500
Sales and administrative	7 300
Budgeted net profit	**36 835**

Pumi is very satisfied with her company's performance, which is better than she expected. She wants to pay her staff a bonus of 5%, based on the difference between the actual and budgeted profit. This will amount to R1 091,25. [(R36 835 – R15 000) x 5%)]

REQUIRED

Draw up a comparison between actual results and the flexible budget based on the actual production of 6 000 units; then advise Pumi on whether the bonus should be paid.

Solution to Activity 22.1

	(1) Actual	(2) Flexed budget	(3) (1–2) Diff	(4) Fixed budget	(5) (2–4) Diff
Volume	**6 000**	**6 000**		**5 000**	**1 000**
	R	**R**	**R**	**R**	**R**
Sales (6 000 units @ R22,50)	135 000				
(6 000 units @ R20,00)		120 000	15 000 (f)	100 000	20 000 (f)
Less: Variable cost	70 365	69 000	1 365 (u)	57 500	11 500 (u)
Material					
(8 400 kg @ R3,90 per kg) [(7 500 kg / 5 000 x 6 000) @ R4 per kg]	32 760	36 000	3 240 (f)	30 000	6 000 (u)
Labour					
(630 hours @ R22,50 per hour) [(500 hours / 5 000 x 6 000) @ R20,00 per hour]	14 175	12 000	2 175 (u)	10 000	2 000 (u)
Manufacturing overheads (actual) [(500 hours / 5 000 x 6 000)@ R10,00 per hour]	6 930	6 000	930 (u)	5 000	1 000 (u)
Sales commission					
(6 000 units @ R2,75 per unit) (6 000 units @ R2,50 per unit)	16 500	15 000	1 500 (u)	12 500	2 500 (u)
Contribution	64 635	51 000	13 635 (f)	42 500	8 500 (f)
Less: Fixed cost	27 800	27 500	300 (u)	27 500	–
Manufacturing	20 500	20 000	500 (u)	20 000	–
Sales and administrative	7 300	7 500	200 (f)	7 500	–
Net profit	**36 835**	**23 500**	**13 335 (f)**	**15 000**	**8 500 (f)**

(f) favourable
(u) unfavourable

Since the bulk of the increase in profit is attributable to Pumi's own efforts and not to the efforts of her staff, on the basis of the original fixed budget, she would be overpaying if she gave bonuses.

NOTE

What this activity illustrated is the effect volume can have on analysing variances between actual and budgeted figures. At first glance it seems that there was a favourable variance of (R36 835 – R15 000) R21 835 on the budgeted profit. However, after converting (flexing) the budget to 6 000 units, the variance was only R13 335. It was then analysed further on a line for line basis, and all the variances were identified.

Can you see that the total variance between the fixed and flexed budget arises at the contribution level (column 5)? This can be reconciled as follows: budgeted contribution R8,50 x 1 000 units = R 8 500.

In organisations that use a standard costing system, the difference (column 5) between the original fixed and the flexed budgeted profit is called the volume variance. The difference (column 3) between actual results and the flexed budget is further analysed into price/rate and usage/efficiency variances. You will learn more about standard costing in topic 10.

3 Budgeting: advantages and disadvantages

Now that you have prepared a few budgets or budgeted items, let's look at the advantages and disadvantages of preparing budgets and implementing budgetary controls.

Advantages

- Budgets serve as a 'roadmap' in terms of whether the organisation is achieving its goals.
- Budgets can be integrated with a standard costing system (refer to topic 10).
- Budgets help with cost control.
- Budgets lead to more effective management (negotiations, buy-in, follow-up).
- Budget variances can expose weak points in an organisation.

Disadvantages

- Some variables (eg exchange rates) can change rapidly, making the budget outdated.
- It can be difficult to assign responsibility for any variances.
- Forecasts can never be 100% accurate.

- Implementing budgets can be expensive, especially in large organisations with complex holding structures.
- It is important that all employees participate, and this might make it cumbersome.
- It is impossible to prevent at least some relaxation of any budget.

It is important to note that the advantages of budgeting clearly outweigh the disadvantages.

4 Summary

In this study unit, you learnt the following:

- How to define a flexible budget.
- How to compile a flexible budget.
- How to evaluate the advantages and disadvantages of budgeting.

Self-assessment activity

Refer to Self-assessment activity, question 2 in study unit 21 (Lexis Ltd), where you prepared the budgeted overhead cost for months one to three. Assume that the **actual overhead costs** for month two are as follows:

1. Supervisors' salaries amounted to R4 160 after a 4% raise was negotiated.
2. Property tax was R240 for the month.
3. The monthly cost data produced the following results (the variable rate is indicated per direct machine hours):

(a)	Depreciation:	Y =	R1 440	+	R0 per hour
(b)	Materials handling:	Y =	R 245	+	R0,65 per hour

4. Water and electricity was R 970. The fixed component was as per budget.
5. Indirect wages (semi-variable) were R4 800 (65% variable and 35% fixed).
6. Maintenance (variable) was R5 400.
7. The other semi-variable overheads were as follows:

Fixed	R360
Variable	R0,48 per machine hour

The actual machine hours for the month were 9 800 hours.

REQUIRED

a. Flex the budget for month two and determine whether the performance was favourable or unfavourable.
b. Determine the over-/under- recovery of fixed overheads for the month.

a Flexible budget

Fixed overheads	Calc	Actual	Flexed budget = original budget	Difference	
Material handling	1	245,00	264,00	19,00	f
Water and electricity	2	240,00	240,00	0,00	
Indirect wages	3	1 680,00	1 500,00	(180,00)	u
Semi-variable cost	5	360,00	360,00	0,00	
Supervisors' salaries		4 160,00	4 200,00	40,00	f
Depreciation		1 440,00	1 440,00	0,00	
Property tax		240,00	237,50	(2,50)	u
Total		**8 365,00**	**8 241,50**	**(123,50)**	**u**

Variable overheads	Calc	Actual		Flexed budget			
		9 800 x rate	**Variable rate**	**9 800 x rate**	**Variable rate**	**Difference**	
Material handling	1	6 370,00	0,65000	6 468,00	0,66000	98,00	f
Water and electricity	2	730,00	0,07449	784,00	0,08000	54,00	f
Indirect wages	3	3 120,03	0,31837	3 062,50	0,31250	(57,53)	u
Maintenance	4	5 400,00	0,55102	5 104,13	0,52083	(295,87)	u
Semi-variable cost	5	4 704,00	0,48000	4 410,00	0,45000	(294,00)	u
Total		**20 324,03**	**2,07388**	**19 828,63**	**2,02333**	**(495,40)**	**u**

Actual total: R8 365,00 + (9 800 x R2,07388) = R 28 689,02
Flexed total: R8 241,50 + (9 800 x R2,02333) = R 28 070,13

Variance (28 689,03 – 28 070,13) = R 618,90 (unfavourable)

Calculations

1. Material handling (semi-variable overheads):

   Fixed : R 245
   Variable : R0,65 x 9 800 = R6 370

2. Water and electricity (semi-variable overheads)

   Fixed – per budget : R240
   Variable : (R970 – R240) R730
   R730 / 9 800 = 0,07449

3. Indirect wages (semi-variable overheads):

   Fixed overheads:

   (R4 800 x 35%) = R1 680

   Variable overheads:
   (R4 800 – R 1 680) = R3 120
   R3 120 / 9 800 machine hours = R0,31837 per machine hour

4. Maintenance (variable cost):
   R5 400 / 9 800 = R0,55102 per machine hour

5. Other semi-variable overheads:
   Fixed : R360
   Variable : R0,48 x 9 800 = R4 704
   R4 704 / 9 800 = R0,48000 per machine hour

b. Fixed production overheads: over- or under-recovery

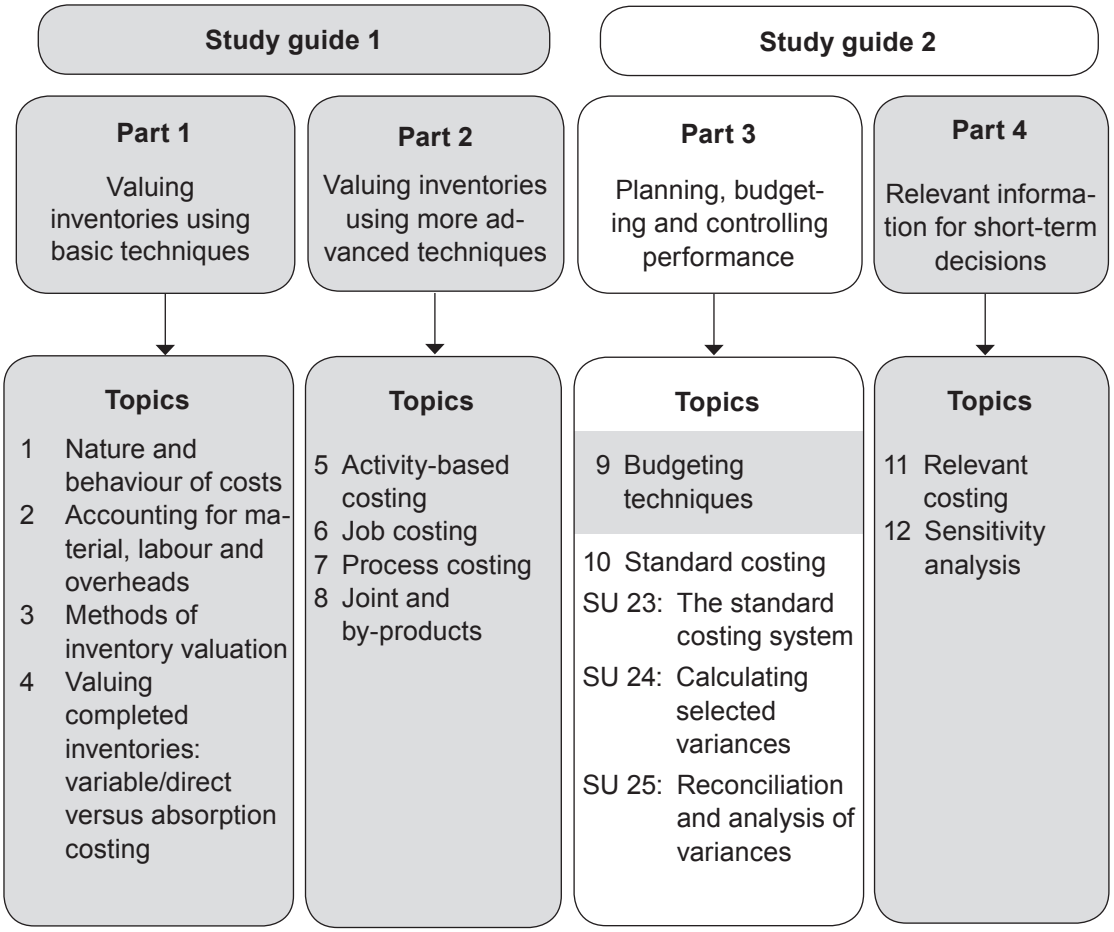
Actual fixed overheads:	R8 365,00
Applied overheads:	R8 076,67 = (0,82415 x 9 800)
Thus under-recovered	= R288,33

TOPIC 10
Standard costing

LEARNING OUTCOMES

After studying this topic, you should be able to:

- explain the concept, aims and operations of an efficient standard costing system
- differentiate between budget and standard data
- establish cost standards and compile a standard cost card
- calculate selected variances using a standard costing system in combination with the direct costing system
- give valid reasons for variances
- reconcile budgeted and actual profit and analyse variances
- describe the characteristics of an efficient standard costing system



STUDY UNIT	TITLE
Study unit 23	THE STANDARD COSTING SYSTEM
Study unit 24	CALCULATING SELECTED VARIANCES
Study unit 25	RECONCILIATION AND ANALYSIS OF VARIANCES

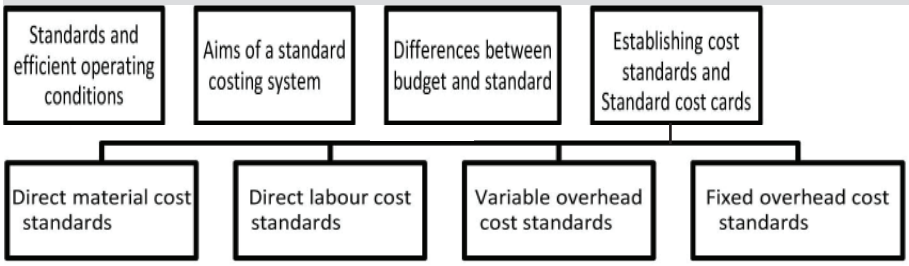
Introduction

In a complex manufacturing environment that includes many different products, constantly changing prices, varying production output per period, etcetera, it is very difficult to monitor and control the organisation's performance against its target as set by the budget (see previous topic). In these circumstances, a standard costing system can help to control and evaluate the organisation's performance. Reporting on the causes of variances should lead to corrective action, thus keeping the organisation on target.

STUDY UNIT 23

The standard costing system

In this study unit



1 Introduction

In your Financial Accounting modules, you learnt that financial statements are compiled on the basis of historical costs. Given the increase in global competition, companies are now required to 'stay on top of the game'. The limitations of relying on historical costs led to the development of pre-calculated methods with a view to obtaining better cost information for planning and pricing purposes.

In this study unit, we will introduce you to the concepts, uses and advantages of implementing a standard costing system.

2 Standards and efficient operating conditions

Let us explain this by using a practical example. Think of your monthly fuel budget: let us say it is R900. This is based on:

- driving 900 km per month
- using 90 litres of fuel (assuming your car achieves 10 km per litre)
- a fuel price of R10 per litre

However, at the end of the month you add up all your fuel slips and you find that your actual fuel expenditure was R1 050. If I were you, I would want to know why the extra R150 per month was spent. The reason could be that:

- you drove more kilometres than expected;
- your car was less fuel efficient than you believed (doing less than 10 km per litre); or
- the fuel price increased.

After you have worked through this topic, you will be able to pinpoint the exact cause or causes for this over expenditure.

Let us start by investigating what a standard is. In the example above, you have set yourself various monthly standards:

- I drive *900 km* per month (referred to as the *volume* standard).
- The fuel price is *R10 per litre* (referred to as the *price/rate* standard).
- I fill up with *90 litres* of fuel (referred to as the *input* standard).
- My car's fuel efficiency is *10 km per litre* (referred to as the *usage/efficiency* standard).

STANDARDS

Standards are predetermined targets; they are target inputs/variables that should be achieved under **efficient operating** conditions.

Standards are compiled for operating conditions that are efficient or optimal. These standards are attainable: this means that, although they might be exacting, it is not impossible to meet these standards. Efficient, attainable standards ensure that the variances that arise when actual results are reported lead to management acting to correct any inefficiency in operations. For example, if a specific plant continues to report inefficiencies in its hourly output, this should lead to an investigation. The reason might be that the plant is old, in which case management should think about replacing the plant, or it may be that the operators are not properly trained, which means that management should initiate a training programme.

Your role as a management accountant is pivotal in ensuring that standards are set for efficient operating conditions. In MAC3701 you will learn more about how standards influence employee motivation.

3 Aims of a standard costing system

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.

The main aim of a standard costing system is to enable managers to draw comparisons between what should have been achieved (as compiled in the budget), giving standard operating conditions, and what actually was achieved (at actual costs, incomes and actual operating conditions). This enables managers to correct past irregularities and revise their plans in order to achieve the budgeted targets.

Standard costing therefore facilitates 1) planning (it is used in compiling the budget), and 2) controlling costs and performance.

Standard costing systems can improve cost control by:

- establishing standards for each cost or income element
- determining actual costs for each cost or income element
- comparing actual costs income with standard costs income and determining the variances

- analysing the variances
- facilitating measures to correct these variances, if necessary

Note that, although we use the term standard 'costing', this term also applies to income.

Another reason for applying standard costing is to simplify the inventory valuation process. You will remember that, in topic 3, we listed standard costing as one of the methods that are acceptable for inventory valuation in terms of International Accounting Standard 2 – Inventory (this applies only if standard costs are not significantly different from actual costs).

NOTE

The implication is that the variances reported by the standard costing system should not be significant. In later MAC modules you will learn what to do in cases where the differences between actual and standard are significant. For the purposes of this module, we will treat all differences/variances as non-adjustable (for inventory valuation purposes).

4 Differences between budget and standard

Standards **are not** the same as budgeted costs or revenue but they are, however, used in the budgeting process. A **budget** represents the **costs of an entire activity or operation**, whereas a **standard** presents the same information **per unit**. In the previous example (fuel usage), the standard for fuel input (90 litres) and standard for price per input (R10) were used to compute the budgeted fuel expenditure of R900 per month (90 x R10).

In the case of an organisation, the budget would for instance state that 10 000 units need to be manufactured and sold. The standard of each individual variable required to achieve the stated outcome is then applied to calculate the budgeted costs and revenues.

A standard costing system and a budget control system are two different management tools, although the one system complements the other. The most significant differences between budgets and standards may be summarised as follows:

- A budget is a statement which sums up the intended, estimated or desired income and costs at a certain capacity level and serves as a guideline for keeping the organisation on track.
- Standards reflect not what the total costs may possibly amount to, but what the cost per unit should be when manufacturing takes place under particular (usually the most optimal) production conditions.
- A budget emphasises the volume and cost levels that have to be maintained in order to achieve a certain result.
- Standards emphasise the cost level at which optimum profitability will be achieved. This is especially useful when a break-even analysis is carried out.

5 Establishing cost standards

As mentioned before, one of the main aims of a standard costing system is cost control. Cost control is best implemented through action/control at the point where the costs are incurred.

The first step is to establish all the standards that make up or contribute to the product's cost per unit. You already know that product costs consist of material, labour and overheads. Standards should therefore be set for the material, labour and overhead services to be consumed in performing an operation or process.

We can follow two common approaches to set or determine standard costs:

- We can use historical information to estimate standards (incorporating regression analysis and probabilities).
- We can base the standards on engineering (time and motion) studies.

Both approaches have drawbacks and advantages. For example, if historical data is used, it is possible that past mistakes or inefficiencies will be carried forward to the future. On the other hand, historical data is a good indicator of the future (if the same operating conditions prevail) and will not be as costly as engineering studies. Engineering studies entail a detailed study of each operation based on careful specifications of material, labour and overheads used.

NOTE

A basic principle in setting cost standards per unit of production is that it always involves two issues:

1 The **cost** of the resource per unit of resource required/input (ie R/kg, or R/hour)

2 The **quantity** of resource units/input required (ie 4,2 kg or 30 minutes)

For MAC2601 you are only required to cost (calculate) the standards set. In later MAC modules you will learn more about establishing the standards and the effect this has on employee motivation etcetera.

Now let us look at how we calculate cost standards for each type of resource (direct material, direct labour and manufacturing overheads).

5.1 Direct material cost standards

Following the basic principles, establishing direct material standards is a two-fold process: price/cost and quantity of material. This simply means the quantity of material multiplied with the cost in rand per unit of material input to arrive at a standard cost for each completed unit. The quantity of material is based on product specifications, taking into consideration product quality and the optimal quantity.

The price (how much) is obtained from the purchasing department. This would involve a search for the most suitable supplier as far as quality and reliability are concerned.

Material quantities are usually recorded on a *bill of materials.* This describes the required quantity of material for each operation (ie to complete the product) and is determined by the engineering or product team that developed and designed the product.

The standard for direct material cost can now be calculated by multiplying the price by the quantity. The standard material cost can then provide a suitable cost against which actual cost can be evaluated.

A simple example of an organisation's standard direct material cost: a product (let's say a steel braai) requires 10 kg of steel and the organisation can purchase the steel at R20 per kilogram. The standard direct material cost is therefore:

10 kg x R20 = R200 per braai

5.2 Direct labour cost standards

Establishing labour standards is, once again, a two-fold process. Instead of price and quantity, we can now establish the tariff/rate and efficiency (how much time). The concept of how many for how much still applies.

The rate/tariff is the amount paid to workers per hour. This will be determined by negotiations with unions, overtime policies and inflation. This rate/tariff also differs according to class/category of worker based on their cost to the organisation (ie remuneration). The process is the same as that described in topic 2 for determining the labour recovery rate.

To calculate the efficiency (how many) is to measure the number of hours/minutes required by a worker to complete a specific task in the manufacturing of a single unit. Factors that should be taken into consideration when determining the average labour time required are idle time, machine breakdowns and routine maintenance. More than one task might be required in a specific process and can be performed by the same or a different class of worker.

The standard for direct labour cost can now be calculated by multiplying the rate/tariff with the quantity. The standard cost can then provide a suitable cost against which actual cost can be evaluated.

A simple example of an organisation's standard direct labour cost: a product (let's continue with the steel braai) takes 30 minutes to assemble and the organisation has to pay the worker R25 per hour. The standard labour cost is therefore 0,5 hours x R25 per hour = R12,50 per braai.

5.3 Variable overhead cost standards

Establishing variable overhead cost standards is, once again, two-fold. We will establish the tariff/rate and efficiency (number of hours or units)

The variable rate will be established using the same procedure as that used for establishing predetermined overheads rates as discussed in topic 2. Since we are dealing with variable costs, the rate will therefore be based on a rate-per-recovery base (direct material or direct labour) that varies with the number of units produced.

The efficiency will be based on the recovery basis applied, that is, the same number of hours as used to calculate the recovery rate.

An example of variable overheads for the braai is the electricity used for cutting the metal required to make the braai.

5.4 Fixed overhead cost standards

For the purposes of MAC2601 we will only determine the standard cost for fixed manufacturing overheads in total. The standard therefore only consists of the budgeted costs of the individual expense items contained in fixed overheads (ie salaries of supervisors, rent of factory space etc).

An example of a fixed overhead will be the rent for the factory where the braais are made.

NOTE

In this module a standard costing system is used in conjunction with a traditional costing system and not an activity based costing (ABC) system (refer to topic 6). Integration with ABC will only occur in later MAC modules.

6 Standard cost card

Once the standard for each of the components of product cost has been set, a document is prepared that records this standard. A standard cost card is compiled for each product which is manufactured or each service rendered. This card shows the following per unit of completed product/service:

- standard price of each raw material per unit of supply (ie R per kg, R per litre)
- standard quantities of each raw material
- standard labour rate of each type of labour
- standard labour hours of each type of labour
- standard variable manufacturing overhead rate (per hour or per unit of production)
- standard variable manufacturing overhead hours (if variable with hours)
- standard fixed manufacturing overhead rate (not required for MAC2601)
- standard fixed manufacturing overhead allocation base usage (not required for MAC2601)
- total costs allowed according to the standard for manufacturing a unit of a completed product

NOTE

The standard cost card total is used to value the closing inventories (if the variances were not significant).

Figure 23.1 is an example of a standard cost card where variable and fixed production overheads are allocated based on direct labour hours.

STANDARD COSTS OF PRODUCT: X

DATE OF STANDARD: for the year ended 30 June 20X5

	Material code	Quantity	Standard price per unit of input	Production departments			Total per unit
				1	2	3	
			R	R	R	R	R
Direct material	NT-769	3	3			9	9
	GL-461	6	5		30		30
	WP-590	36	0,50	18			18
	VS-178	12	2,50	30			30
	Total material costs			**48**	**30**	**9**	**87**
	Job No	**Standard hours**	**Standard rate per hour**				
Direct labour	22	4	4		16		16
	15	15	4,50	67,50			67,50
	45	10	5	50			50
	46	5	4,60			23	23
	Total labour overheads			**117,50**	**16**	**23**	**156,50**
	Standard hours per unit allowed	**Standard rate per labour hour**					
Variable and fixed overheads	4	2			8		8
	25	3		75			75
	5	2,50				12,50	12,50
	Total manufacturing overheads			**75**	**8**	**12,50**	**95,50**
Total standard cost per unit of completed product							**339**

Source: Author, 2012

Figure 23.1: Example of a standard cost card

NOTE

In topic 2 you learnt that the manufacturing overheads are allocated using departmental allocation rates. In this example there are three departmental allocation/recovery rates: R75, R8 and R12,50. In department 1, two types of direct labour tasks are performed; these hours are therefore added together when allocating the overhead cost based on labour hours for that department.

Activity 23.1

Stan's Dart Ltd. manufactures a single product: aluminium darts used in dart games. These are high quality darts that are tournament quality. The balance and weight must therefore meet exact standards. Since Stan's Dart has been in the dart business for many years now, their operations are at an optimal level.

Manufacturing the darts is a labour-intensive process. Production takes place in batches or 'jobs' of 20 darts. After completion of every job, it is inspected for quality. On average one dart is normally rejected as below quality. The darts that pass inspection are then mechanically packed in boxes of 25 darts. The following information is available for the manufacturing operations of Stan's Dart Ltd.

Material

Stan's Dart Ltd. can obtain the aluminium required to manufacture the darts at R12 per 50 g from a local supplier, even though it is available at R11 per 50 g if the aluminium is imported from overseas. Since Stan's Dart is 'proudly South African' it prefers to buy the aluminium locally. The plastic needed to complete the darts can be purchased from Taiwan at R4 per 10 square centimetres (cm^2). The factory foreman has done a study that showed the following:

- 700 grams of aluminium is required to complete 10 darts.
- 100 square centimetres of plastic is required for completion of 20 darts.

Labour

A typical labour day is broken down into 'jobs'. Workers are paid based on jobs completed at the end of each day, including any defective darts. The average worker finishes five jobs per day. After negotiations with the union Stan's Dart pays its workers R80 per completed job.

The packers are paid R10 per carton box packed.

Overheads

Overheads consist mostly of the salary of the shift supervisor, inspection costs and the cost of operating the packaging machine, which is used to produce the boxes.Stan's Dart follows the traditional method of overhead allocations. Because, in this case, there is only one product all overheads are allocated based on units packed and sold. The total manufacturing overheads are R114 000 per month.

Packaging

The unit cost of the corrugated carton box used for packing the 25 'good' darts is R8.

Sales

Stan's Dart aims to sell 760 sets of 25 darts each per month.

REQUIRED

Establish a standard cost card for Stan's Dart Ltd. for the manufacture of one complete **SET** of darts.

Work to four decimals.

Solution to Activity 23.1

STANDARD COST CARD FOR ONE SET OF 25 DARTS

	Material	Quantity	Standard price per input	Totals
			R	R
Material	Aluminium	① 73,6842 grams	① 0,24	17,6842
	Plastic	② 5,2632 cm	② 0,40	2,1053
	Total material costs per dart			19,7895
Labour	**No of jobs**	**Cost per job**	**Cost per dart**	
	③ 1,0526	R80	④ 4,00	4,2104
	Total labour overheads per dart			4,2104
Overheads	**Standard rate per dart**			
			⑤ 6,00	6,00
	Total manufacturing overheads			6,00
	Total standard cost for one dart			**29,9999**
	Total standard cost for 25 darts			**749,9975**
	Packaging			⑥ R8,00
	Total standard cost for set of 25			**757,9975**

NOTE

Remember to allocate the normal spillage (1/20) to all the cost elements. For every 20 darts completed per job, only 19 are accepted for packaging as good quality. Refer back to topic 7 about process costing for the principles of accounting for normal losses or spillage.

Calculations

① Aluminium quantity

Gram required for 10 darts	=	700 g
Gram required for 1 dart	=	700 g / 10
	=	70 g
Gram per dart after loss	=	70 x 20 / 19
	=	73,6842 g

① Aluminium price

Cost per 50 g	=	R12
Cost per gram	=	R12 / 50
	=	R0,24

② Plastic quantity

cm^2 required for 20 darts	=	100 cm^2
cm^2 required for 1 dart	=	100 cm^2 / 20
	=	5 cm^2
cm^2 per dart after loss	=	5 x 20 / 19
	=	5,2632 cm^2

② Cost per cm^2	=	R4 / 10 cm^2
	=	R0,40

③ Labour quantity

Number of jobs required	=	20/19
	=	1,0526

④ Labour cost

Cost per job	=	R 80
Darts per job	=	20
Cost per dart	=	R80 / 20
	=	R4,00

⑤ Overheads

Good quality darts packed	=	760 x 25	= 19 000
Overheads	=	R114 000	
Cost per dart	=	R114 000 / 19 000	= R6

NOTE

⑥ There is no spillage to account for in the packaging because it is only the good quality darts that are packaged.

Proof

In order to sell 760 sets (= 19 000 good darts), Stan's Dart has to manufacture 20 000, because one in every 20 is lost as normal spillage. The cost for making 20 000 darts is:

		R Total	R Per set ÷ 760
Aluminium	R12 x 70 / 50 x 20 000	336 000	442,1053
Plastic	R 4 x 5 / 10 x 20 000	40 000	52,6316
Labour	R80 x 20 000 / 20	80 000	105,2632
Overheads		114 000	150,0000
Packaging	760 x R8	6 080	8,0000
Total		576 080	758,0001

Cost per set of darts (R576 080 / 19 000) R758,00

The difference to the standard cost card is attributable to rounding

7 Summary

In this study unit, you learnt the following:

- How to define a standard costing system
- The aims of a standard costing system
- How to differentiate between standard and budgeted costs
- The advantages of a standard costing system
- How to set up a standard cost card

Now that you know how the standards are set, in the next study unit we will learn how to calculate the variances between actual and standard costs.

Self-Assessment activity

A MAC2601 student, Samson, is struggling to prepare for the standard costing assignment. He has asked you to explain some of the concepts of standard costing. He asks you the following questions:

a. What is the difference between standard and budgeted costs?
b. Why do organisations employ standard costing?
c. How do organisations know what to use as the price and quantity for their standard direct material costs?

REQUIRED

Answer Samson's questions.

a. Standard costs are predetermined costs. They are the target costs that should be incurred under efficient operating conditions. They **are not** the same as budgeted costs. A budget relates to an entire activity or operation, while a standard gives the same information on a per unit basis.

b. Organisations use standard costing for the following reasons:

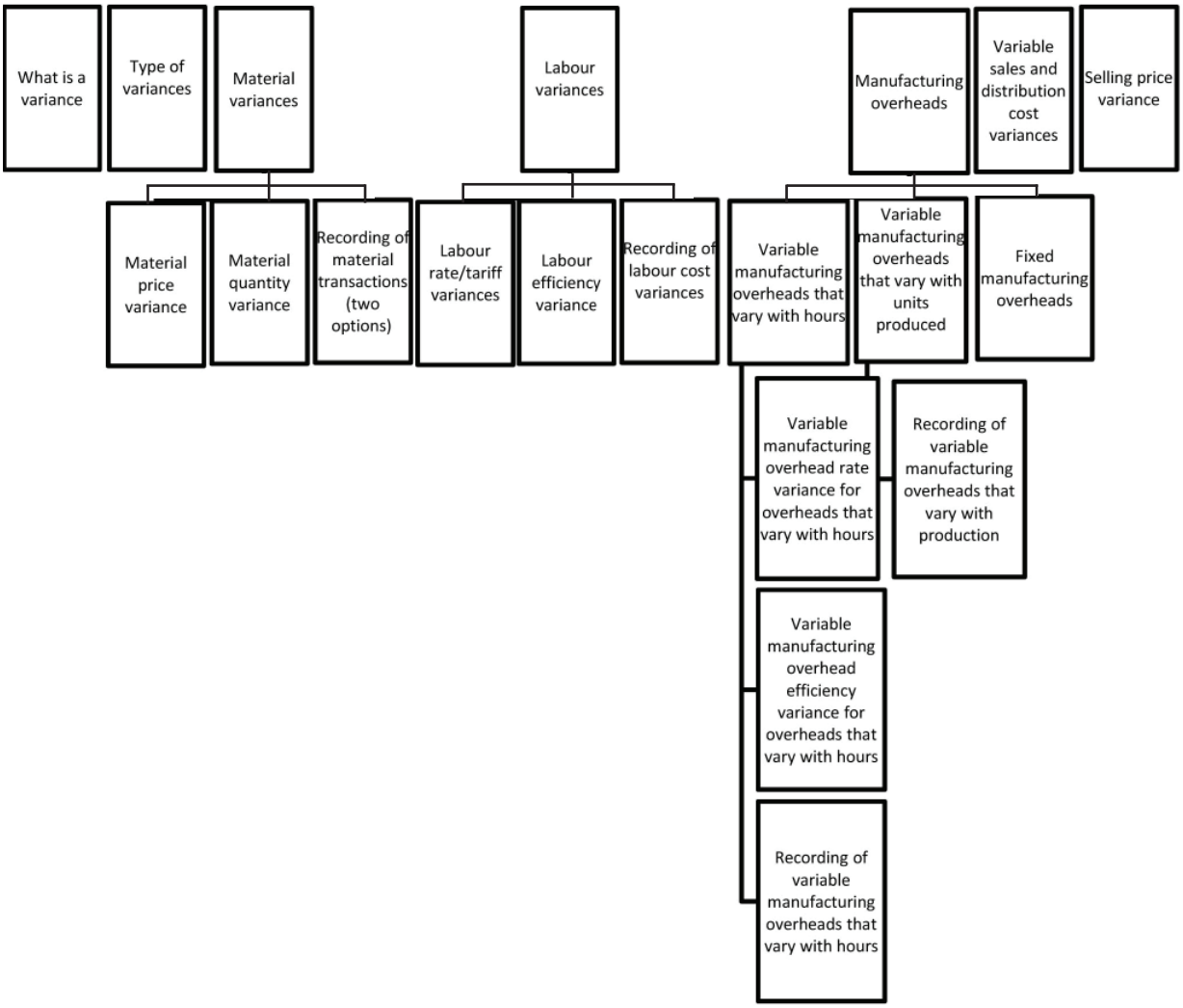
- It helps with planning. The standards of individual cost and revenues can be used to compile the budget.
- Actual performance can be controlled by measuring it against the standard. Any variances can then be investigated, and corrective action taken.
- Standards can be used to value inventories when the standard costs are not significantly different from actual costs.

c. As far as the price of material is concerned, the organisation will have to do some market research in order to find suitable suppliers. Some factors to consider here are the quality of material, reliability and willingness to negotiate about the price (competitiveness). As far as quantity is concerned, the organisation has to consider factors such as normal wastage of material and availability of raw material.

STUDY UNIT 24

Calculating selected variances

In this study unit



1 Introduction

In the previous study unit we discussed what a standard is, how it is determined and how to set up a standard cost card. You learnt that two of the main reasons for using a standard costing system is to help with planning, that is, firstly, preparing the budget and, secondly, controlling activities by measuring actual performance against the standards (incorporated in the budget).

We will now go on to demonstrate how some of the variances are calculated.

NOTE

1 **The variances covered are those applicable to a direct costing system. The application of standard costing in an absorption costing system will be covered in MAC3701.**

2 **We assume that the ACTUAL VOLUME of completed goods manufactured and sold is equal to the BUDGETED VOLUME of goods manufactured and sold.**

3 **The focus in MAC2601 is on price/rate and usage/efficiency variances.**

2 What is a variance?

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.*

For example: raw material issued to production in the period amounts to R225 000 and the number of units manufactured was actually 5 000. The standard raw material cost for manufacturing 5 000 units is R220 000. The total raw material variance is therefore R5 000 (unfavourable).

An example for income would be that 4 800 units were sold and the sales revenue was R45 000. The budgeted (standard) sales revenue if 4 800 units were sold should be R48 000. The total selling price variance is therefore R3 000 (unfavourable).

Do not worry if you do not yet understand how the variances are calculated: we will get to that in the next section where we will break down the total variance into sub-variances. All you need to know at this stage is that the total variance is the difference between the total actual costs or income and total budgeted (standard) costs or income for the actual level of activity.

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.

For example, the standard input required was 20 g per unit and the actual input was 22 g per unit. The standard cost variance per unit is therefore 2 g per unit (unfavourable). In this case, the production manager would have to explain why an extra 2 g per unit were used, because this constitutes a 10% variance.

An example for income would be: the standard selling price was R318 per unit, and the actual achieved was R290 per unit. The sales manager would have to explain why selling prices were R28 per unit lower than standard

NOTE

Can you see that the performance is measured and controlled at the per-unit level? Providing only total variances reveals no additional information for management. You always need to be able to calculate the variance at the per-unit level and obtain reasons for this deviation. Variances may be favourable (positive) or unfavourable (negative).

You should always regard the possible reasons for the variances (which will be mentioned in the question) as a guideline only. Of course, it is impossible to make provision for all situations which may arise in practice. However, you do need to understand the basic principles in the calculation of standard cost variances, since only then will you be able to determine the exact origin of the variance (as mentioned above).

Suitable suggestions should be made regarding what action would be necessary to eliminate negative variances in future or, inversely, what should be done to maintain or capitalise on positive variances.

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.

What do we mean by **flexing the budget**? Remember that the standard was set for an efficient or optimal production environment. The standards are used to compile the budgeted costs and profits based on the anticipated sales and production levels. However, in practice one rarely sells and produces volumes that are equal to those budgeted. It would therefore be unfair and demotivating to measure actual costs against budgeted costs, because budgeted costs were determined for a totally different production volume!

For example: the organisation budgeted to produce 3 000 units of completed product using 3 kg of raw material per product and the raw material standard price is R10 per kg. The budgeted raw material cost would therefore be 3 000 x 3 kg x R10 = R90 000. The organisation actually produced 3 200 units at a raw material cost of R96 000.

At first glance it looks as if the organisation overspent R6 000 on raw material. However, if we flex (adjust – see topic 9) the budget to the actual production level, we arrive at a total **allowed** raw material cost of 3 200 x 3 kg x R10 = R96 000. The total raw material variance is therefore NIL, because the organisation operated as expected for a production volume of 3 200 units.

3 Types of variances

There are a few basic principles that you should master thoroughly before you proceed to study the way variances are calculated. The following abbreviations are of relevance for this topic. We suggest you study these now to help you work through later activities in this study guide:

Key abbreviations:

Volume (manufactured)	V
Actual volume	AV
Budgeted volume	BV
Standard (allowed) cost	SC
Actual cost	AC
Price	P
Standard (allowed) price	SP
Actual price	AP
Quantity (input)	Q
Standard (allowed) quantity	SQ
Actual quantity	AQ
Standard (allowed hourly) rate	SR
Actual (hourly) rate	AR
Hours (labour or machine)	H
Standard (allowed) hours	SH
Actual hours	AH
Favourable	f
Unfavourable (also referred to as adverse)	u

NOTE

1 What is the difference between volume and quantity? Volume refers to the **volume of COMPLETED units** sold or produced. Quantity refers to the **quantity of an INPUT resource** utilised, that is, the quantity of raw material or quantity of labour hours in each unit of volume.

2 On the other hand, the 'P' may refer to the cost **(price)** of the raw material or the selling **price** of the completed product sold.

In order to gain a complete picture of the standard costs and the standard cost variances which will be covered in this module, we can summarise as follows:

Direct material

- Total variance
- Material purchase price variance
- Material quantity (usage) variance

Direct labour

- Total variance
- Labour rate/tariff variance
- Labour efficiency variance

Manufacturing overheads

- Variable manufacturing overheads
  - Variable with l*abour hours worked* (can be applied equally to any other allocation base, excluding completed units)
    - Total variance
    - Overhead rate variance
    - Overhead efficiency variance
  - Variable with *units produced*
    - Total variance
    - Overhead rate variance
    - Overhead efficiency variance
- Fixed (Period) overheads – expenditure variance (as indicated earlier, an absorption costing approach is not covered in MAC2601)

Variable sales and distribution

- Total variances
- Expenditure variance
- Volume variance

Sales

- Sales price variance

Cost variances are calculated according to the following categories:

For ACTUAL volume of completed units produced						**BUDGETED volume produced**
AQ x AP AH x AR	– **Allowed** AQ x SP AH x SR	AQ x SP AH x SR	– **Allowed** SQ x SP SH x SR	SQ x SP (=AV x SC) SH x SR (=AV x SC)	–	BV x SC (Mat) BV x SC (Lab & o/h)
Price / rate variance		**Usage / efficiency** variance		**Volume** variance		
AQ x (SP – AP) AH x (SR – AR)		(AQ – SQ) x SP (AH – SH) x SR		(BV – AV) x SC for Mat (BV – AV) x SC for Lab & o/h		

FOR MAC3701

NOTE

The **volume variance** is used to adjust the budgeted costs for the budgeted volume to the level of the actual volume produced (all at standard cost). For example: the original budget was set for production levels of 2 000 units, but the actual production was only 1 950 units. This is equivalent to what takes place when the budget is flexed (see topic 9). The flexed budget represents the standard for the actual volume of completed units produced.

As we have already explained, variances are the differences between the norm or standard (allowance) set and the actual results achieved. Actual results are taken to mean the following in all the variances that we are going to calculate:

- Actual units manufactured in the period under review
- Actual quantity of material used to manufacture the actual units or actual hours of labour/overheads used to manufacture the actual units
- Actual price paid for material consumed for actual production or actual rate/tariff paid for labour/overheads used to manufacture the actual units

Some textbooks use formulae and some use the 'basket method'. In this study guide both methods will be taught in conjunction. We will also calculate the variances per variable, because this clearly highlights where the variance arose and which manager should account for it.

We will now proceed to show you how the selected variances are calculated. The different variances will be discussed briefly before the calculation of the variances is explained.

4 Material variances

The total cost of material consumed during the manufacturing process is determined by two basic elements:

- The unit **price** for the material
- The **quantity** of material issued for consumption or application

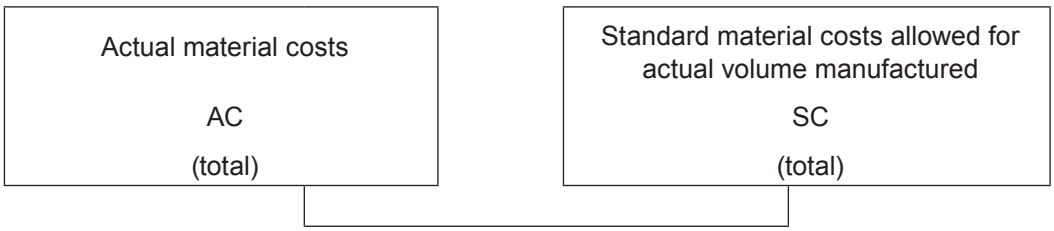
The total variance is therefore caused by a variance in one of these two elements or both.

TOTAL MATERIAL VARIANCE (AC – SC)

The **total** material variance is calculated as the difference between the actual cost (actual quantity of material consumed at the actual price) and the standard cost allowed (standard quantity allowed for actual production at the standard price).

Please note again that we refer to the **standard quantity of material allowed.** This concept is extremely important in standard costing. The term **allowed** means the **standard quantity allowed for units actually produced**. The standard price of the material is also the **allowed price** of the material.

The following is a schematic representation of the calculation of the total material variance:



When:

AC > SC, the variance is negative or **unfavourable**.

AC < SC, the variance is positive or **favourable**.

Activity 24.1

Sekwash Ltd manufactures squash balls. The standard price of the rubber required to manufacture the squash balls is R20 per kilogram. Sekwash needs two kilograms of rubber to manufacture 100 squash balls. The actual data for May 20X1 showed that 192 kilograms of rubber, which had been purchased at R21 per kilogram, was used to produce 10 000 squash balls.

You may assume that purchases of raw material are equal to issues to production.

REQUIRED

Calculate the total material variance.

Solution to Activity 24.1

Total material variance

Actual costs (AQ x AP)	Standard quantity allowed at standard price for actual production (SQ x SP)
= 192 kg x R21 per kg	= (10 000 units / 100 x 2 kg) x R20 per kg
= R4 032	= R4 000

Total variance is R32 (u)

NOTE

Variances should always be clearly described as favourable (f) or unfavourable (u).

Since the actual material cost (R4 032) is more than the standard material cost allowed (R4 000) for the production of 10 000 units, the variance of R32 is unfavourable.

This variance can now be subjected to further analysis to determine whether the variance can be attributed to the quantity of material consumed or the price paid for the material or both.

The total material variance can thus be divided into two sub-variances:

- The material price variance
- The material quantity variance

4.1 Material price variance

MATERIAL PRICE VARIANCE (SP – AP) x AQ

The material purchase price variance is calculated as the difference between the actual quantity purchased (or issued/consumed) at the actual purchase price and the actual quantity purchased (or issued/consumed) at the standard price.

NOTE

We will assume that the quantity purchased equals the quantity issued to and consumed in the production process. Refer to section 4.3 on the recording of material transactions (two options) to see why it makes a difference when the quantity purchased is different from the quantity issued to production.

The purchasing division establishes the standard price that will be used to calculate the standard costs of the material required to manufacture a product. A standard purchase price must be judiciously estimated, taking into account bulk purchases, market conditions, rebates, and provision for possible inflation or price rises during the period (all regarded as normal).

The standard price serves as the norm.

When:

AP > SP, the variance is **unfavourable**.
AP < SP, the variance is **favourable**.

When the **material purchase price variance** has to be calculated, you will require the following information:

- The quantity of material actually purchased (or issued/used) to manufacture the completed units
- Actual price paid for the material
- Standard price per unit of input

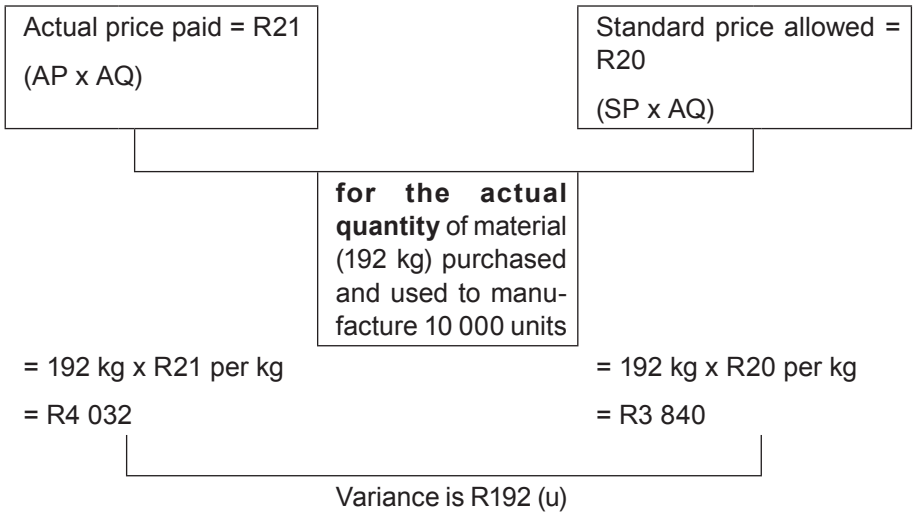
The constant factor is the actual quantity (AQ) of material purchased and used.

Activity 24.2

Use the information given in Activity 24.1 and calculate the material purchase price variance.

Solution to Activity 24.2

Material purchase price variance



This can also be calculated by simply taking the difference in the standard price and actual price (R20 – R21 = R1).

Difference in price (SP – AP) – paid more	R(1)
Actual quantity (kg) (AQ)	x192
Material price variance	(R192) (u)

Since the actual material cost (R4 032) is more than the standard allowed material costs (R3 840), the variance is unfavourable. In this case you can see that the constant factor is the quantity of material purchased and used, which enables us to calculate the difference in the material purchase price

4.2 Material quantity (usage) variance

MATERIAL QUANTITY VARIANCE (SQ – AQ) x SP

The material quantity or usage variance is calculated as the difference between the actual quantity of material consumed at standard price and the standard quantity of material allowed for actual production at standard price.

The standard quantity of material required for the manufacture of a unit of a product is usually determined from the standard material specification developed by the design department of an organisation, in cooperation with the divisional manager concerned with the production of the particular product in the factory.

NOTE

Provision has to be made for unavoidable scrap, wastage and normal losses which may arise in the course of production. Refer back to study unit 23 and topic 7 on process costing.

The standard quantity (SQ) serves as the norm.

When:

AQ > SQ, the variance is **unfavourable**.
AQ < SQ, the variance is **favourable**.

When the **material quantity variance** is calculated, you will require the following information:

- number of completed units actually manufactured
- quantity of material actually consumed to manufacture the completed units
- standard quantity of material allowed to manufacture the completed units
- standard price of material

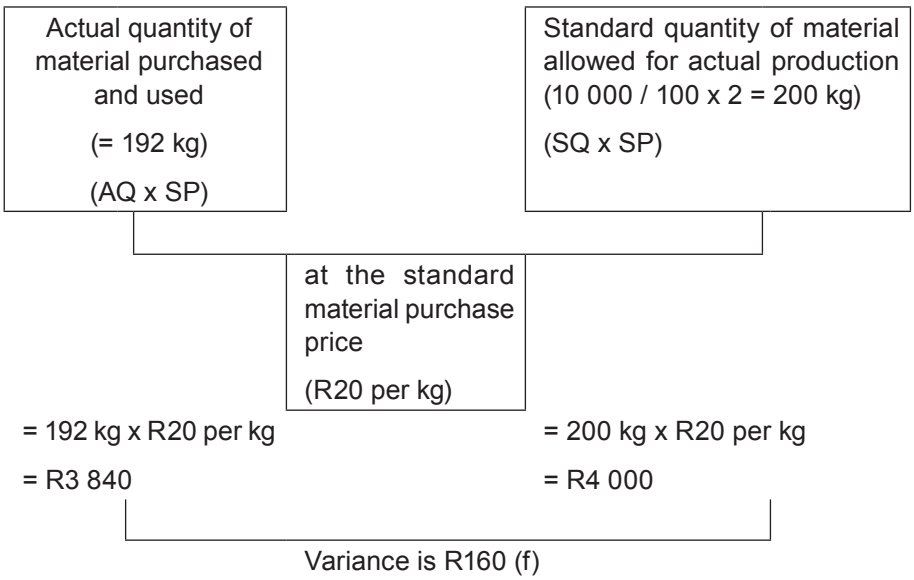
The actual material purchase price is therefore irrelevant in calculating the material quantity variance and the constant factor is the standard material price.

Activity 24.3

Use the information given in Activity 24.1 and calculate the material quantity variance.

Solution to Activity 24.3

Material quantity variance



This can also be calculated by simply taking the difference in the standard quantity and actual quantity (200 – 192 kg = 8 kg).

Difference in quantity (SQ – AQ) – used less	8 kg
Price (rand) (SP)	R 20
Variance	R160 (f)

The standard allowed quantity of material at the standard material price for actual production (R4 000) is more than the actual quantity of material purchased and used at the standard material price (R3 840); the variance is therefore favourable. The standard material price per unit is the constant factor in the calculation. The variance is the quantity difference between the actual quantity of material used and the standard quantity of material allowed for actual production at the standard material price.

The total material variance may be summarised as follows:

Material purchase price variance (Activity 24.2)	R192 (u)
Material quantity variance (Activity 24.3)	R160 (f)
Total or net variance (Activity 24.1)	R 32 (u)

You should now be able to calculate the total material variance, the material price variance and the material quantity variance

4.3 Recording of material transactions (two options)

In the previous three activities we assumed that the material purchased equalled the material issued to production. We will now discuss other ways of approaching this issue.

In the compilation of the standard cost card (see section 6) we have shown you how to calculate the standard cost per completed unit of manufactured inventory. However, we should not forget that the organisation **also keeps raw material and consumable inventories**.

An organisation can decide:

to keep (value) its raw material and consumable inventories **at a standard price**; or

2 to keep/(value) this inventory at **actual price, and use FIFO or** the **weighted average method** to 'cost' the issues to production (see topic 3).

The policy adopted by the organisation has implications for the stage/timing where the material price variance is calculated and expensed. If raw material and consumable inventories are kept/valued at:

1. the standard price, the material purchase price variance is calculated based on the **quantity purchased** and expensed as a period cost immediately at the time of the **purchase**.
2. the actual price, the material price variance is only calculated based on **quantity issued** and expensed when material is **issued** from the stores.

The recording of transactions with suppliers, the transfer of the material placed into the manufacturing process, and the transfer of completed units from the manufacturing process to completed inventory are illustrated in the following activity.

Activity 24.4

Using the information and calculations in Activity 24.1, 24.2 and 24.3, these transactions are recorded in the general ledger as follows, if

(1) raw material inventory is kept at standard price, or
(2) raw material inventory is kept at actual price.

1. Inventory is shown at standard price

Dr		Cr	
Creditors			
	R		**R**
		(Actual quantity x actual price) = 192 kg x R21 per kg = R4 032 (1)	

Dr		Cr	
Raw material inventory account at standard price			
	R		**R**
(Actual quantity x standard price) = 192 kg x R20 per kg = R3 840 (1)		(Actual quantity x standard price) = 192 kg x R20 per kg = R3 840 (2)	

Dr		Cr	
Production account			
	R		**R**
(Actual quantity x standard price) = 192 kg x R20 per kg = R3 840 (2)		(Standard quantity x standard price) = 200 kg x R20 per kg = R 4 000 (3)	
(Quantity difference at standard price) = R20 x (200 kg - 192 kg) = R160 favourable (4)			

Dr		Cr	
Material purchase price variance (at time of purchase)			
	R		**R**
(Price difference x actual quantity purchased) = 192 kg (R21 - R20) = R192 unfavourable (1)			

Dr		Cr	
Completed units			
	R		**R**
(Standard quantity x standard price) = 200 kg x R20 per kg = R 4 000 (3)			

Dr		Cr	
Material quantity variance			
	R		**R**
		(Quantity difference at standard price) = R20 x (200 kg - 192 kg) = R160 favourable (4)	

The flow of transactions is illustrated by numbering them 1-4.

2. Inventory is shown at actual price

Dr		Cr	
Creditors			
	R		**R**
		(Actual quantity x actual price) = 192 kg x R21 per kg = R4 032 (1)	

Dr		Cr	
Raw Material Inventory account at actual price			
	R		**R**
(Actual quantity x standard price) = 192 kg x R21 per kg = R4 032 (1)		(Actual quantity x standard price) = 192 kg x R20 per kg = R3 840 (2) (Price difference for actual quantity **issued**) = 192 kg x (R21 - R20) = R192 unfavourable (3)	

Dr		Cr	
Production account			
	R		**R**
(Actual quantity x standard price) = 192 kg x R20 per kg = R3 840 (2) (Quantity difference at standard price) = R20 x (200 kg - 192 kg) = R160 favourable (4)		(Standard quantity x standard price) = 200 kg x R20 per kg = R 4 000 (5)	

Dr		Cr	
Material price variance (at time of issue)			
	R		**R**
(Price difference x actual quantity issued) = 192 kg (R21 - R20) = R192 unfavourable (3)			

Dr		Cr	
Completed units			
	R		**R**
(Standard quantity x standard price) = 200 kg x R20 per kg = R 4 000 (5)			

Dr		Cr	
Material quantity variance			
	R		**R**
		(Quantity difference at standard price) = R20 x (200 kg - 192 kg) = R160 favourable (4)	

The material purchase price variance is unfavourable (see calculations in Activity 24.2), and the account was therefore debited. The material quantity variance is favourable (see calculations in Activity 24.3), and the account was therefore credited

You should now be able to do all the general ledger entries for materials: external transactions (mainly with suppliers and service organisations) and internal transactions (eg between the warehouse and production).

NOTE

For the purposes of MAC2601, we will assume that raw material and consumable inventory purchases are equal to issues (no movement in inventories). When the variance arises is therefore an irrelevant issue.

5 Labour variances

As in the case of material, direct labour costs have two basic elements:

- the **rate (or tariff)** which is paid for each class of labour per hour
- the **time (number of hours)** required to manufacture the product

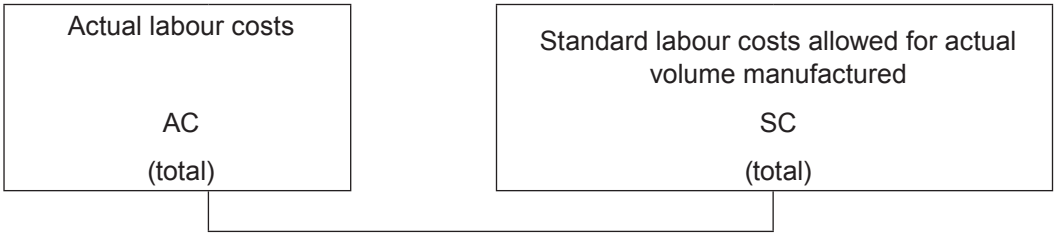
The total variance is therefore caused by a variance in one of these two elements or both.

TOTAL LABOUR VARIANCE (AC – SC)

The **total** labour variance is the difference between the actual cost (actual hours worked at the actual labour rate per hour) and the standard cost (standard number of hours allowed for actual production at the standard labour rate per hour).

Please note again that we refer to the **standard number of hours allowed.** This concept is extremely important in standard costing. The term **allowed** means the **standard number of hours allowed for units actually produced**. The standard hourly rate is also the **allowed rate/tariff**.

The total labour variance is shown in a manner similar to the material variances. The following is a schematic representation:



The difference (SC – AC) is the total variance.

When:

AC > SC, the variance is negative or **unfavourable**.

AC < SC, the variance is positive or **favourable**.

Activity 24.5

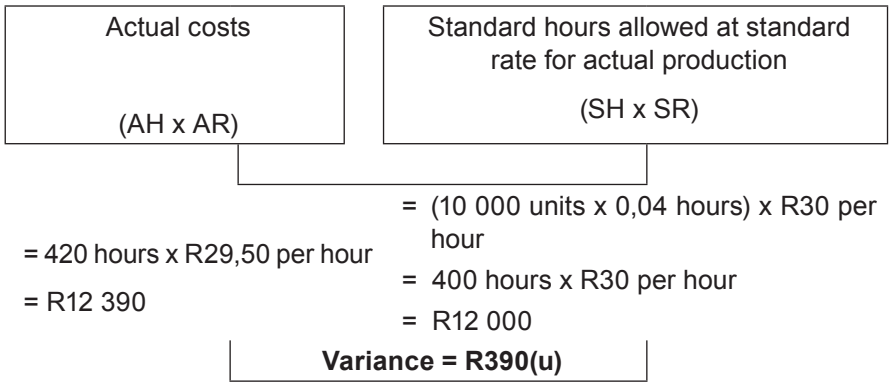
We will use Sekwash Ltd again. The standard quantity (number of hours) needed to manufacture a squash ball is 0,04 hours. The standard rate/tariff per hour is R30 per hour. The wage records for May 20X1 indicate that it took 420 hours at R29,50 per hour to produce 10 000 squash balls.

REQUIRED

Calculate the total labour variance.

Solution to Activity 24.5

Total labour variance



Since the actual labour cost (R12 390) is more than the standard labour cost allowed (R12 000) for the production of 10 000 units, the R390 variance is unfavourable.

This variance can now be analysed further to determine whether it is due to the time spent or the labour rate paid, or both.

The total labour variance can therefore be divided into two sub-variances:

- the labour rate variance
- the labour efficiency variance

5.1 Labour rate/tariff variances

LABOUR RATE/TARIFF VARIANCE (SR – AR) x AH

The labour rate/tariff variance is calculated as the difference between the actual hours worked at the actual rate/tariff and the actual hours worked at the standard rate/tariff.

The human resources department determines the standard labour rates in conjunction with the relevant parties (refer back to topic 2 if you want to revisit how the hourly recovery rate is calculated). These rates are based on salary scales for specific labour skills in each cost centre.

The standard rate serves as the norm.

When:

AR > SR, the variance is negative or **unfavourable**.

AR < SR, the variance is positive or **favourable**.

When calculating the **labour rate variance**, you will need the following information:

- actual number of labour hours worked to manufacture the completed units

- actual labour rate paid for the actual labour hours worked
- standard labour rate per hour

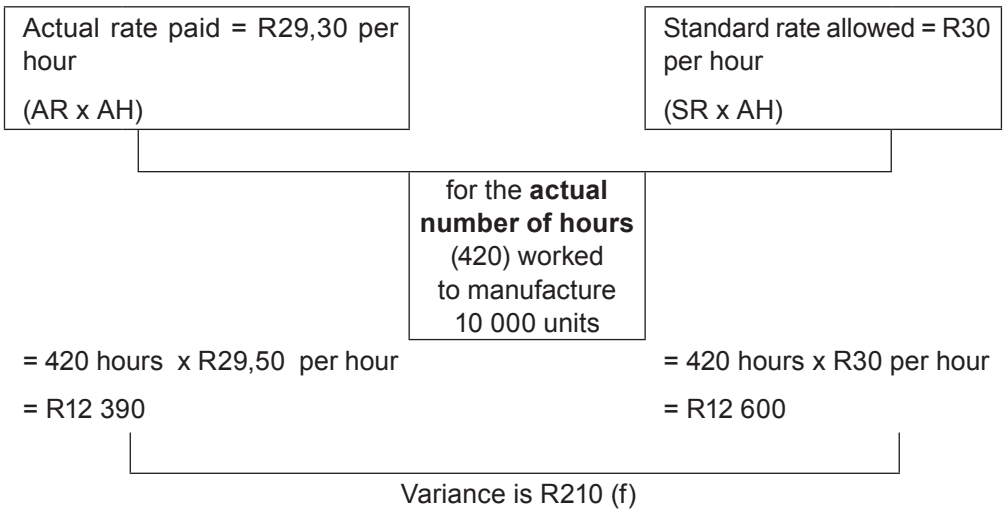
The constant factor is the actual number of hours worked (AH) to deliver the actual production.

Activity 24.6

Use the information given in Activity 24.5 and calculate the labour rate variance

Solution to Activity 24.6

Labour rate variance



This can also be calculated by simply taking the difference in the actual rate and standard rate (R30 – R29,50 = R0,50).

Difference in rate (SR – AR) – paid less	R0,50
Hours (AH)	420
Variance	210 (f)

Since the actual labour cost (R12 390) is less than the standard labour cost (R12 600), the variance is favourable. The constant factor in this calculation is the actual number of hours worked to manufacture the units.

The most important reason for calculating the variances is so that necessary adjustments or control measures can be implemented. The organisation may have control over the factors that cause variances, and thus be able to correct them.

5.2 Labour efficiency variance

LABOUR EFFICIENCY VARIANCE (AH – SH) x SR

The **labour efficiency variance** is calculated as the difference between the actual time worked (usually in hours) at the standard labour rate and the standard time (hours) allowed for actual production at the standard labour rate.

The time required for each type of labour skill at each cost centre in order to manufacture an article is determined by the work study department (by means of time and motion studies). The standard time which is determined, taking all the above issues into account, is based on the time within which the task can be performed in the most effective manner.

When more or fewer hours are worked than the standard time allowed, therefore, we are dealing with the **inefficiency** or **efficiency** of labour.

NOTE

When the standard time is calculated, provision should be made for unavoidable idle time. In MAC3701 you will learn more about calculating idle time variances.

The standard time (SH) serves as the norm for determining the labour efficiency variance.

When:

AH > SH, the variance is negative or **unfavourable**.

AH < SH, the variance is positive or **favourable**.

When the **labour efficiency variance** has to be calculated, you will require the following information:

- number of completed units manufactured (output)
- actual labour hours worked to manufacture the completed units
- standard labour hours allowed for the manufacturing of these units
- standard labour rate per hour

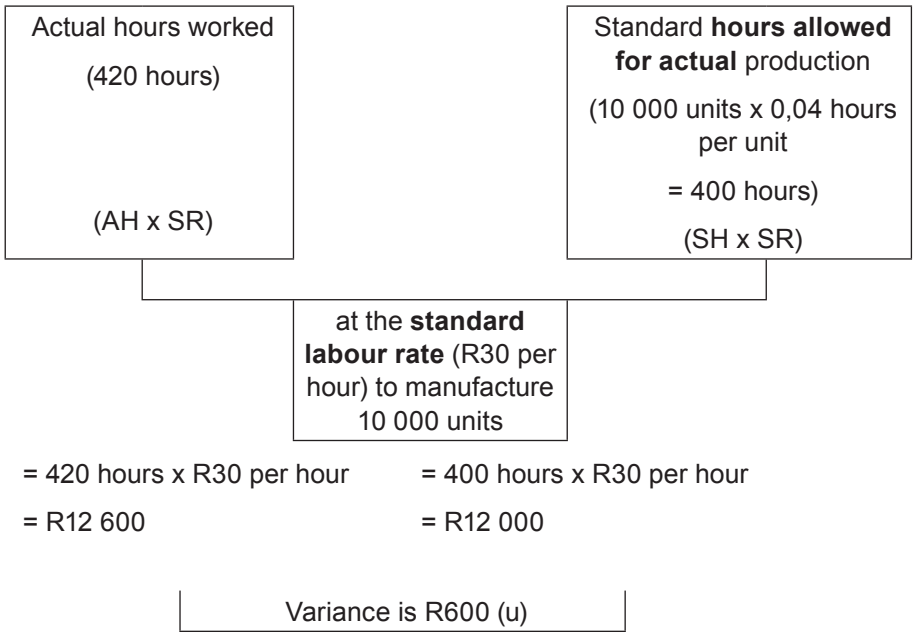
The constant factor is the standard labour rate.

Activity 24.7

Use the information given in Activity 24.5 to calculate the labour efficiency variance.

Solution to Activity 24.7

Labour efficiency variance



This can also be calculated by simply taking the difference in the actual hours (time worked) and standard hours (420 – 400 = 20).

Difference in hours (SH – AH) – more hours used	20
Rate (SR)	R30
Variance	600 (u)

Since the actual number of hours worked (420) at the standard labour rate to manufacture 10 000 units (R12 600) is more than the standard labour hours allowed (400) at the standard labour rate for manufacturing these 10 000 units (R12 000), the variance is unfavourable. The constant factor in this calculation is the standard labour rate, so the variance can be calculated as the difference between the actual hours worked and the hours allowed at the standard labour rate.

The total labour variance can also be summarised as follows:		
Labour rate variance (Activity 24.6)	R210	(f)
Labour efficiency variance (Activity 24.7)	R600	(u)
Total or net variance (Activity 24.5)	R390	(u)

You should now be able to calculate the total labour cost variance, the labour rate variance and the labour efficiency variance.

5.3 Recording of labour cost variances

See below for the recording of labour costs and the labour cost allocation required to manufacture and complete the units.

Activity 24.8

Using the information and calculations in Activity 24.5, 24.6 and 24.7, these transactions are recorded in the ledger as follows.

Solution to Activity 24.8

Dr		Cr	
Wages and contributions payable			
	R		**R**
		(Actual number of hours worked x actual rate) = 420 hours x R29,50 per hour = R12 390 (1)	

Dr		Cr	
Wages control account			
	R		**R**
(Actual number of hours worked x actual rate) = 420 hours x R29,50 per hour = R12 390 (1) (Difference in rates for actual hours worked) = 420 hours x (R30 - R29,50) = R210 favourable (4)		(Actual number of hours worked x standard rate) = 420 hours x R30 per hour = R12 600 (2)	

Dr		Cr	
Production account			
	R		**R**
Actual number of hours worked x standard rate) = 420 hours x R30 per hour = R12 600 (2)		(Standard number of hours allowed x standard rate) = 400 hours x R30 per hour = R12 000 (3) (Difference in the number of hours for actual production at standard rate) = R30 per hour x (420 hours - 400 hours) = R600 (5)	

Dr		Cr	
Completed units			
	R		**R**
(Standard number of hours allowed x standard rate) = 400 hours x R30 per hour = R12 000 (3)			

Dr		Cr	
Labour rate variance			
	R		**R**
		(Difference in rates for actual hours worked) = 420 hours x (R30 - R29,50) = R210 favourable (4)	

Dr		Cr	
Labour efficiency variance			
	R		**R**
(Difference in the number of hours for actual production at standard rate) = R30 per hour x (420 hours - 400 hours) = R600 unfavourable (5)			

The labour rate variance is favourable (see calculations in Activity 24.5); the account has therefore been credited. The labour efficiency variance is unfavourable (see calculations in Activity 24.6); the account has therefore been debited.

You should now be able to do all the general ledger entries for labour (ie for employees and internal allocations to the production account).

6 Manufacturing overheads

Since the characteristics of **fixed** and **variable** manufacturing overheads differ significantly, it is important to calculate a standard manufacturing overhead recovery rate for each category separately. When the allocation base is selected, management should ensure that there is a good correlation or cause-effect relationship between the costs incurred and the proposed allocation base. Refer back to topic 2 to revise allocation principles.

We will start with the variable manufacturing overheads first. For the purposes of this topic, we will allocate variable manufacturing overheads using **two bases**:

- variable manufacturing overheads that **vary with hours worked**
- variable manufacturing overheads that **vary with units produced**

6.1 Variable manufacturing overheads that vary with hours

We will now demonstrate how to calculate the total variance and then the rate and efficiency variances (as we did with labour).

The total cost of variable overheads consumed during the manufacturing process is determined by two basic elements:

- the variable overhead **recovery rate**
- the **quantity or number of hours** used for allocations

The total variance is therefore caused by a variance in one of these two elements, or both.

NOTE

The calculation of the variable overhead variances is demonstrated with *labour* hours as the allocation base. The same principles will apply if we used machine hours or kilograms of raw material as the basis for allocating the variable overheads. Note that this only applies when we use an **input resource** as the allocation base. Where units produced are the allocation base, the approach is different. See section 6.2 – Variable manufacturing overheads that vary with units produced.

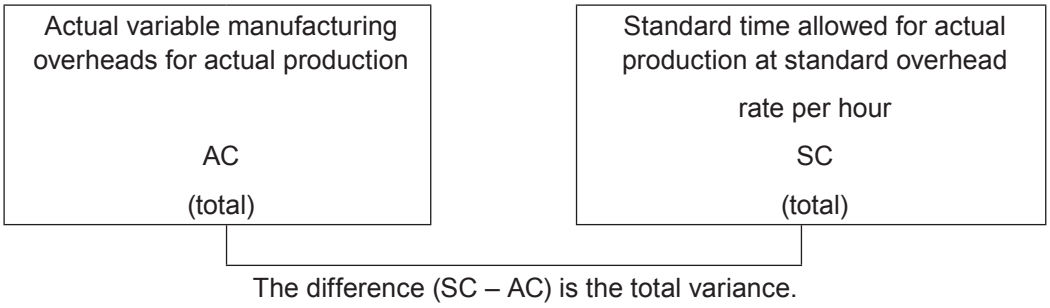
TOTAL VARIABLE OVERHEAD VARIANCE (AC – SC)

The **total** variable manufacturing overheads variance is calculated as follows:

It is the difference between the actual variable manufacturing overheads incurred and the standard hours allowed for actual production at the standard variable manufacturing overheads rate per hour.

Please note again that we refer to the **standard hours allowed.** This concept is extremely important in standard costing. The term **allowed** means the **standard hours allowed for units actually produced**. The standard rate of the overheads is also the **allowed overhead rate.**

This variance can be represented as follows:



When:

AC > SC, the variance is negative or **unfavourable**.

AC < SC, the variance is positive or **favourable**.

Activity 24.9

STC Ltd.'s results for its overheads in May are as follows:

Budgeted

Variable manufacturing overheads that vary with **hours** worked	R10 000
Labour hours	400 hours
Production	500 units

Actual results

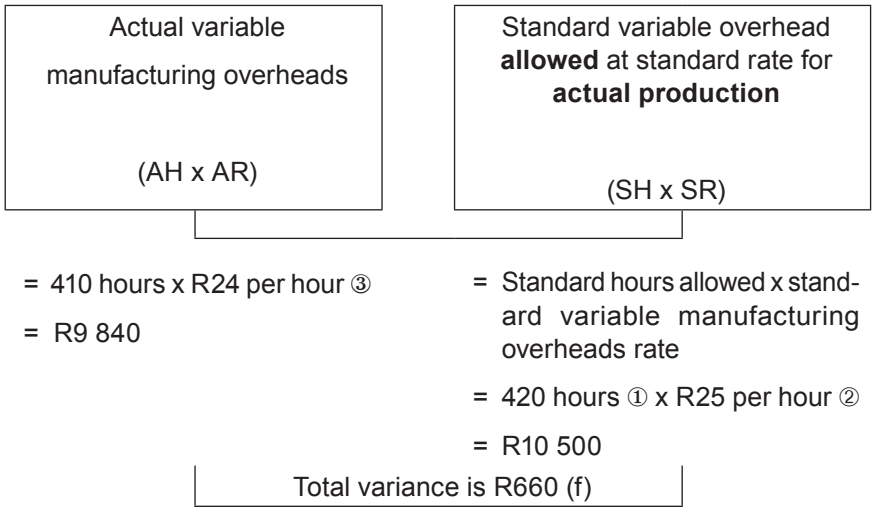
Variable manufacturing overheads that vary with **hours** worked	R 9 840
Labour hours	410 hours
Production	525 units

REQUIRED

Calculate the total variable manufacturing overheads variance for the period for overheads that vary with hours worked.

Solution to Activity 24.9

Total variable manufacturing overhead variance for overheads that vary with hours worked



Calculations

① Standard hours:

The budgeted labour hours given are based on the budgeted production of 500 units. The standard labour hours per unit which are allowed are therefore:

400 hours per 500 units = 0,8 hours per unit

When this standard is applied to actual production, that is, 525 x 0,8 hours per unit, the standard time allowed is 420 hours.

② Standard recovery rate:

The standard labour rate is not given, but all the information required to calculate it is given, and the calculation is as follows:

$$\frac{\text{Budgeted variable manufacturing overheads for hours worked}}{\text{Budgeted labour hours}}$$

= R10 000 / 400 hours

= R25

③ "Actual rate":

Although overheads are **never** allocated based on an actual rate (refer to topic 2 for reasons why we use a budgeted rate), for standard costing purposes, we can calculate an "actual rate" in order to see if there were increases/decreases in the expenditure.

The information required to calculate an "actual rate" is available, and the calculation is as follows:

$$\frac{\text{Actual variable manufacturing overheads for actual hours worked}}{\text{Actual labour hours}}$$

= R9 840 / 410 hours

= R24

Since the actual variable manufacturing overheads (R9 840) are less than the standard variable overheads allowed (R10 500) for the actual production, the variance of R660 is favourable.

We will now, once again, divide the total variable manufacturing overheads into **two sub-variances**:

- the variable manufacturing overhead **rate** variance
- the variable manufacturing overhead **efficiency** variance

NOTE

The variable manufacturing overhead rate variance is also known as any of the following:

- variable manufacturing overhead **expenditure** variance
- variable manufacturing overhead **price or tariff** variance
- variable manufacturing overhead **budget** variance
- variable manufacturing overhead **spending** variance

6.1.1 Variable manufacturing overhead rate variance for overheads that vary with hours

VARIABLE OVERHEAD RATE VARIANCE (AR – SR) X AH

The variable manufacturing overheads rate variance is determined by measuring the difference between the actual variable manufacturing overheads incurred and the actual hours worked at the standard variable manufacturing overheads rate.

This standard is determined from the estimated use of indirect materials and labour and from other variable overheads. An analysis has indicated that these expenses vary with labour hours spent.

The standard recovery rate (SR) serves as the norm.

When:

"Actual rate" > SR, the variance is negative or **unfavourable**.

"Actual rate" < SR, the variance is positive or **favourable**.

When the **variable manufacturing overheads rate variance (variable with hours worked)** is calculated, you require the following information:

- actual labour hours worked to manufacture the completed units
- actual variable manufacturing overheads incurred
- standard variable manufacturing overheads rate per hour

The constant factor is the actual hours worked.

Activity 24.10

Use the information supplied in Activity 24.9 and calculate the variable manufacturing overheads rate variance for overheads that vary with hours worked for the period in question. Note that the constant factor is the actual number of hours worked.

Solution to Activity 24.10

Variable manufacturing overhead rate variance for overheads that vary with hours worked

Actual variable manufacturing overheads ("Actual rate" x AH)		Standard variable manufacturing overheads (SR x AH)
	for the actual hours worked (410) to manufacture 525 units	
= ③ R24 x 410 hours		= ② R25 x 410
= R9 840		= R10 250

Variance is R410 (f)

For ② and ③ see Activity 24.9.

This can also be calculated by simply taking the difference in the "actual rate" of R24 and standard rate of R25 (R25 – R24 = R1).

Difference in rate – less expensive	R1
Number of actual hours	410
Variance	410 (f)

The variance is favourable because the actual variable manufacturing overheads (R9 840) are less than the standard variable manufacturing overheads allowed for 410 hours worked (R10 250). Because the actual hours are used for both calculations, the variance can only be ascribed to the rate at which the variable manufacturing overheads were calculated.

6.1.2 Variable manufacturing overhead efficiency variance for overheads that vary with hours

VARIABLE OVERHEAD EFFICIENCY VARIANCE (AH – SH) X SR

The variable manufacturing overheads efficiency variance is calculated as follows:

It is the difference between the actual hours at the standard variable manufacturing overheads rate and the standard hours allowed for actual production at the standard variable manufacturing overheads rate.

The standard hours (SH) serves as the norm.

When:

AH > SH, the variance is negative or **unfavourable**.

AH < SH, the variance is positive or **favourable**.

When the **variable manufacturing overheads efficiency variance** has to be calculated, you will require the following information:

- number of completed units actually manufactured
- actual hours worked to manufacture the completed units
- standard number of hours allowed to manufacture these units
- standard variable manufacturing overheads rate per hour

NOTE

Note that the emphasis falls on efficiency. Since the overheads are allocated on the basis of labour hours, we will use the same hours as that used in labour variances.

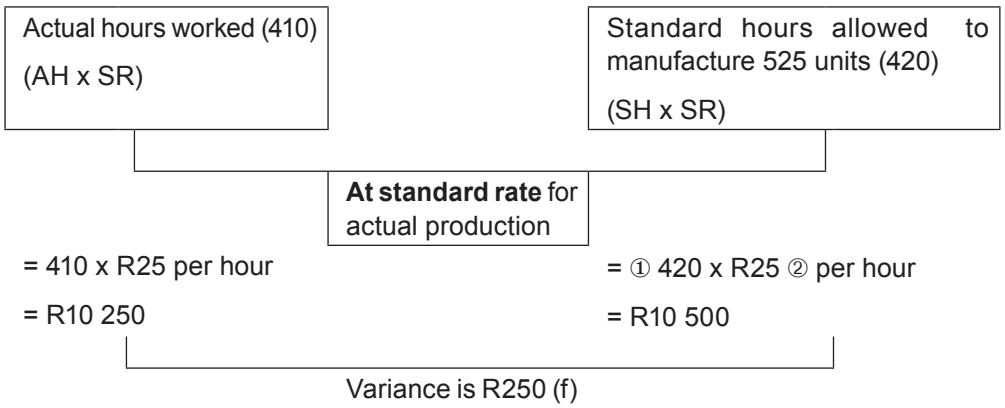
The constant factor is the standard variable manufacturing overhead rate (SR).

Activity 24.11

Use the same information as for Activity 24.9 and calculate the variable manufacturing overheads efficiency variance for overheads that vary with hours worked.

Solution to Activity 24.11

Variable manufacturing overhead efficiency variance for overheads that vary with hours worked



For ① and ② see Activity 24.9.

This can also be calculated by simply taking the difference in the actual and standard hours. (410 – 400 = 10 hours).

Difference in hours (SH – AH) – less hours use	10
Rate (SR)	R 25
Variance	R250 (f)

The variance is favourable because the time actually spent on the production of 525 units is less than the time allowed to manufacture this number of units.

The total variable manufacturing overhead variances for overheads that vary with hours worked can be summarised as follows:

Rate variance (Activity 24.10)	410	(f)
Efficiency variance (Activity 24.11)	250	(f)
Total variance (Activity 24.9)	660	(f)

6.1.3 Recording of variable manufacturing overheads that vary with hours

Use the information and calculations in Activity 24.9, 24.10 and 24.11 and show how you would record these transactions in the ledger.

Dr		Cr	
Variable manufacturing overhead control			
	R		**R**
Actual variable manufacturing Overheads (bank & creditors) = 410 hours x 'R24' (Amount actually incurred) = R9 840		(Actual hours x standard variable manufacturing overhead rate) = 410 hours x R25 = R10 250 *(1)*	
(Difference between the standard variable manufacturing overheads rate and the actual rate for actual hours worked) = (R25 - R24) x 410 hours = R410 favourable *(2)*			

Dr		Cr	
Production account			
	R		**R**
(Actual hours x standard variable manufacturing overheads rate) = 410 hours x R25 = R10 250 *(1)*		(Standard hours x standard variable manufacturing overheads rate for actual production) = 420 hours x R25 per hour = R10 500 *(3)*	
(Difference between standard hours and actual hours at standard variable manufacturing overheads rate) = (420 - 410) hours x R25 per hour = R250 favourable *(4)*			

Dr		Cr	
Completed units			
	R		**R**
(Standard hours x standard variable manufacturing overheads rate for actual production) = 420 hours x R25 per hour = R10 500 *(3)*			

Dr		Cr	
Efficiency variance			
	R		**R**
		(Difference between standard hours and actual hours at standard variable manufacturing overheads rate) = (420 – 410) hours x R25 per hour = R250 favourable *(4)*	

Dr		Cr	
Rate variance			
	R		**R**
		(Difference between the standard variable manufacturing overheads rate and the actual rate for actual hours worked) = (R25 – R24) x 410 hours = R410 favourable *(2)*	

You should now be able to process the transactions relating to variable overhead variances in cases where the variable manufacturing overheads vary with hours. We will now discuss how to treat these overheads when they vary with units produced.

6.2 Variable manufacturing overheads that vary with units produced

The total cost of variable overheads consumed during the manufacturing process is determined by two basic elements:

- the overhead **recovery rate based on units manufactured**
- the **volume of units** used for allocations

TOTAL VARIABLE OVERHEAD VARIANCE (AC – SC)

The **total** variable manufacturing overheads variance is calculated as the difference between the **actual** variable manufacturing overheads incurred and the variable manufacturing overheads **allowed** for the **actual production** during the period.

VARIABLE OVERHEAD RATE VARIANCE ("Actual rate" – SR) x AV

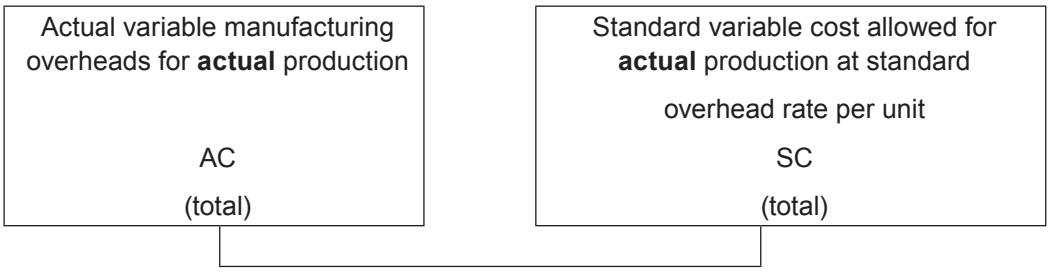
The variable manufacturing overheads **rate variance** is calculated as follows:

It is the difference between the **actual** variable manufacturing overheads ("actual rate" x actual production) and the standard variable manufacturing overhead rate for actual production.

NOTE

In this case, the total variance is only caused by a variance in the rate. There can be **NO** efficiency variance because the overheads are not allocated on a resource basis (labour hours, machine hours, material input), all of which are subject to efficiency.

This variance can be represented as follows:



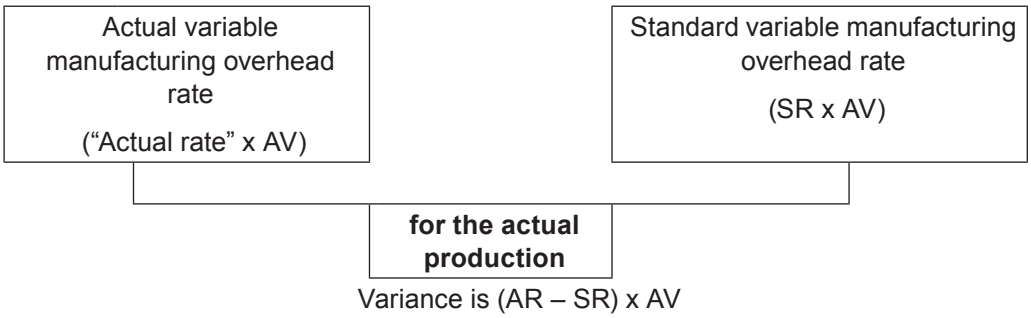
The difference (SC – AC) is the total variance, which also represents the rate variance.

When:

AC > SC, the variance is negative or **unfavourable**.

AC < SC, the variance is positive or **favourable**.

OR the variable manufacturing overhead rate variance



The standard rate (SR) serves as the norm.

When:

"Actual rate" > SR, the variance is negative or **unfavourable**.
"Actual rate" < SR, the variance is positive or **favourable**.

In order to calculate the **variable manufacturing overhead rate variance for overheads that vary with production**, you will require the following information:

- actual number of units manufactured
- variable manufacturing overheads incurred
- standard variable manufacturing overheads rate per unit

The constant factor is the actual volume (AV) of units manufactured.

Again, we refer to the **standard variable cost per unit allowed.** This concept is extremely important here. The term **allowed** means the **standard costs allowed for units actually produced**. The standard cost per unit of the overheads is also the **allowed cost per unit** of the overheads.

Activity 24.12

STA Ltd.'s results concerning its overheads for the month of May are as follows:

Budgeted results:

Variable manufacturing overheads that vary with **production**	R80 000
Normal capacity (and also budgeted production)	32 000 units

Actual results:

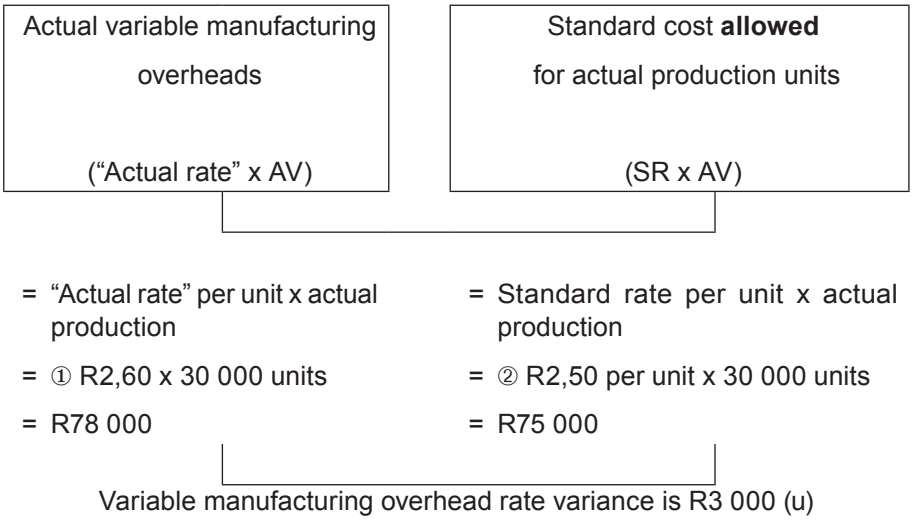
Variable manufacturing overheads that vary with **production**	R78 000
Actual production	30 000 units

REQUIRED

Calculate the variable manufacturing overhead rate variance (which is equal to the total variable manufacturing variance) for the period for overheads that vary with production.

Solution to Activity 24.12

Variable manufacturing overhead rate variance for overheads that vary with production



① Although the variable overheads are **never** allocated using an "actual rate", we can calculate one for standard costing purposes in order to establish whether the expenditure increased or decreased.

'Actual' variable overhead rate:

$$\frac{\text{Actual variable manufacturing overheads}}{\text{Actual units manufactured}}$$

= R78 000 / 30 000 units

= R2,60 per unit

② The standard variable manufacturing overheads rate is not given, but can be calculated as follows:

$$\frac{\text{Budgeted variable manufacturing overheads}}{\text{Normal capacity}}$$

= R80 000 / 32 000 units

= R2,50 per unit

The actual variable manufacturing overheads (R78 000) are more than the standard variable manufacturing overheads allowed (R75 000); the variance is therefore unfavourable.

This can also be calculated by simply taking the difference in the actual and standard rates (R2,60 – R2,50 = R0,10).

Difference in rates (SR – AR) – more expensive	R 0,10
Actual production	30 000
Variance	R3 000 (u)

The actual variable manufacturing overheads (R78 000) are more than the standard variable manufacturing overheads that are allowed (R75 000) for a production level of 30 000 units; the variance is therefore unfavourable.

NOTE

An efficiency variance is intended to indicate the **variance in input quantities or hours** actually used and that which should have been used under efficient operating conditions to achieve the actual output units. However, in this case, we are working directly with the output units (volume); this means that there can be no efficiency variance (input = output), and **the variance is always zero.**

This would mean the following:

The total variable manufacturing overheads variance for overheads that vary with production can be summarised as follows:	
= Rate variance (Activity 24.12)	R3 000 (u)
= Efficiency variance (always zero)	0
= Total variance	3 000 (u)

6.2.1 Recording of variable manufacturing overheads that vary with production

Activity 24.13

Use the same information and calculations as in Activity 24.12.

Solution to Activity 24.13

Dr		**Cr**	
Variable manufacturing overheads control			
	R		**R**
Actual variable manufacturing overheads (bank and creditors) = R78 000		Actual units x standard variable overhead recovery rate (30 000 x R2,50) = R75 000 *(1)*	
		("Actual rate" – standard rate) x actual units produced (R2,60 – 2,50) x 30 000 units = R3 000 *(2)*	

Dr		Cr	
Production account			
	R		**R**
Actual units x standard variable overhead recovery rate (30 000 x R2,50) = R75 000 *(1)* Actual units x standard variable overhead recovery rate (30 000 x R2,50)		Completed units (30 000 x R2,50) = R75 000 *(3)*	

Dr		Cr	
Completed units			
Production account (30 000 x R2,50) = R75 000 *(3)*	**R**		**R**

Dr		Cr	
Rate variance			
	R		**R**
("Actual rate" – standard rate) x actual units produced (R2,60 – 2,50) x 30 000 units = R3 000 *(2)*			

You should now be able to calculate the total variable manufacturing overhead variances, the variable manufacturing overhead rate variance and the variable manufacturing overhead efficiency variance that varies with the number of hours worked and production. You should also be able to do all the general ledger entries for external transactions and internal allocations (to the production account) that relate to the variable manufacturing overheads.

6.3 Fixed manufacturing overheads

A standard fixed manufacturing overhead rate may be calculated for the fixed manufacturing overheads by taking the normal capacity as the basis. Refer to topic 2 for the discussion on how the overhead recovery rates are determined per department. Differences between

the actual and budgeted volumes manufactured lead to a variety of fixed manufacturing overhead variances.

NOTE

For the purposes of MAC2601, we will only calculate the expenditure variance. We will not go into the detail about all the different fixed manufacturing overhead variances, because we shall only report results on the direct costing approach (see topic 4). For MAC2601 the actual and budgeted (standard) volumes are irrelevant for determining the fixed manufacturing overhead expenditure variance. The rest of the fixed manufacturing overhead variances will be covered by MAC3701, which deals with absorption as the basis.

FIXED MANUFACTURING OVERHEAD EXPENDITURE VARIANCE

This is the difference between the actual fixed manufacturing expenditure and the standard or budgeted fixed manufacturing overhead expenditure.

Fixed costs, by their very nature, should neither change nor vary over the short term. Fixed manufacturing overheads, for example supervisors' salaries, factory rent etcetera are therefore usually constant over the budget period.

In order to calculate the fixed manufacturing overhead expenditure variance, you will require the following information:

- actual expenditure
- budgeted or standard expenditure

Activity 24.14

Let's use Sekwash Ltd. as an example again. The following information is available:

Budgeted fixed overheads	R85 000
Actual fixed overheads	R90 000

REQUIRED

Calculate the fixed overhead expenditure variance.

Solution to Activity 24.14

R85 000 – R90 000 = R5 000 unfavourable

7 Variable sales and distribution cost variances

Examples of these costs are sales persons' commissions, fuel for delivery vehicles, insurance based on kilometres travelled, etcetera. These costs vary according to the sales volume (number of units sold) and other bases, such as kilometres, weight delivered, etcetera.

The total variable sales and distribution cost variance consists of:

- a rate (or expenditure, spending or tariff) variance
- a volume variance

NOTE

As mentioned before, we will not cover volume variances in MAC2601. In other words, we assume that the budgeted volume sold is equal to the actual volume sold, leaving a zero volume variance. As far as selling and distribution costs are concerned, therefore, we will only calculate an expenditure/rate variance.

Sales and distribution department overheads can also include fixed expenses. The analysis of any fixed selling and distribution costs will be limited to an expenditure variance (see fixed manufacturing overhead expenditure variance).

VARIABLE SALES AND DISTRIBUTION COST RATE VARIANCE

The variable sales and distribution cost rate (or expenditure/spending) 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.

The standard variable selling and distribution cost rate serves as the norm.

When:

AR > SR, the variance is negative or **unfavourable**.

AR < SR, the variance is positive or **favourable**.

When the **variable sales and distribution cost rate variance** has to be calculated, you will require the following information:

- the number of units actually sold
- the actual variable sales and distribution rate per unit
- the standard variable sales and distribution rate per unit

The constant factor is the number of units actually sold.

Activity 24.15

Sekwash Ltd. sold 32 000 squash balls for a certain period, which was equal to the budgeted sales for the period. The variable sales and distribution overheads

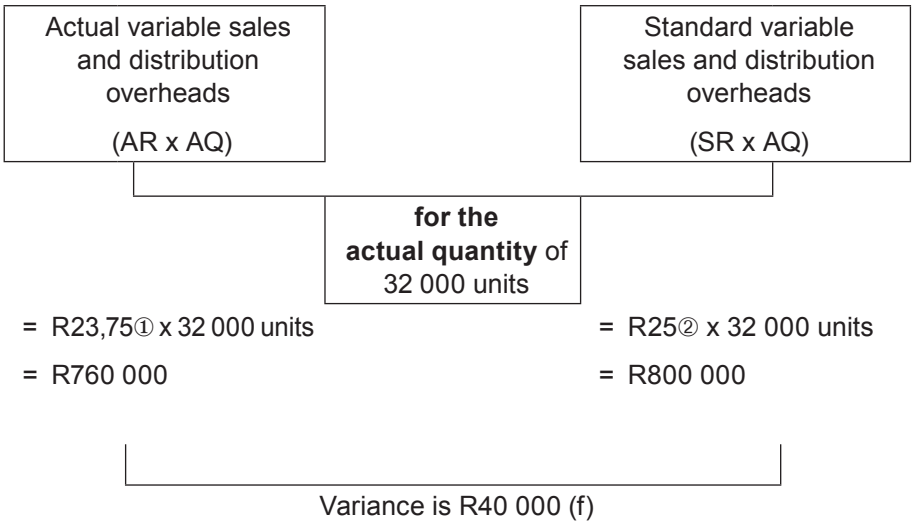
budget for 32 000 units amounted to R800 000. The actual variable sales and distribution overheads for the period amounted to R760 000.

REQUIRED

Calculate the variable sales and distribution overhead rate variance.

Solution to Activity 24.15

Total variable sales and distribution overheads rate variance



Calculations

① Actual variable selling and distribution rate:

$$\frac{\text{Actual variable selling and distribution overheads}}{\text{Actual units sold}}$$

= R760 000 / 32 000 units

= R23,75 per unit

② The standard variable selling and distribution rate is not given, but can be calculated as follows:

$$\frac{\text{Budgeted variable selling and distribution overheads}}{\text{Budgeted units sold}}$$

= R800 000 / 32 000 units

= R25 per unit

This can also be calculated by simply taking the difference in the actual and standard rates (R25 – R23,75 = R1,25).

Difference in rates (SR – AR) – less expensive	R 1,25
Actual units sold	32 000
Variance	R40 000 (f)

The total actual variable sales and distribution overheads (R760 000) were lower than the standard variable sales and distribution overheads allowed (R800 000); the variance is therefore R40 000 (favourable).

For the purposes of MAC2601, the volume variance is always zero since there is no difference in budgeted and actual sales volumes (x standard rate = nil). In MAC3701 you will learn how to calculate the volume variance for selling and distribution costs.

This would mean the following:

The total variable sales and distribution overheads variance may be summarised as follows:	
= Expenditure variance (Activity 24.15)	R40 000 (f)
= Volume variance (always zero in MAC2601)	0
= Total	R40 000 (f)

8 Selling price variance

When only one type of product is manufactured and sold, only two variances are usually calculated:

- the selling price variance and
- the sales volume variance.

When more than one product is manufactured, we can also calculate a sales mix variance. You will learn how to do this in MAC3701.

NOTE

In MAC2601 we deal with the **selling price variance** only. As mentioned before, we also assume that the budgeted sales volumes are realised (ie budgeted sales units = actual sales units). Consequently, no volume variance is calculated.

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.

The following is a schematic representation of the calculation of the selling price variance:

The difference is the variance

The standard selling price (SP) serves as the norm.

When:

AP < SP, the variance is negative or **unfavourable**.

AP > SP, the variance is positive or **favourable**.

NOTE

Note that the variance direction is opposite to that for costs. When the actual price is lower than the standard price it is unfavourable and vice versa.

When the selling price variance has to be calculated, you will require the following information:

- actual selling price per unit
- standard selling price per unit
- actual units sold

The constant factor is the actual number of units (AV) sold.

Activity 24.16

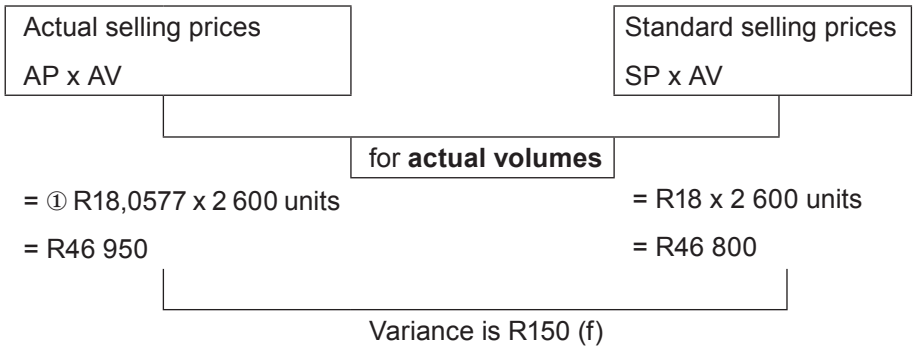
Sekwash Ltd. sold 2 600 squash balls for R46 950. The standard selling price per ball is R18.

REQUIRED

Calculate the selling price variance.

Solution to Activity 24.16

Sales price variance



① The actual selling price is calculated as:

$$\frac{\text{Actual sales}}{\text{Actual units sold}}$$

= R46 950 / 2 600

= R18,0577

This can also be calculated by simply taking the difference in the actual and standard selling prices (R18,0577 – R18 = R0,0577).

Difference in rates (AR – SR) – more income	R0,0577
Actual units sold	2 600
Variance	R 150 (f)

The variance is favourable because the actual income (R46 950) is more than the standard expected income (R46 800).

For the purposes of MAC2601, the volume variance is always zero since there is no difference in budgeted and actual sales volumes (x standard price = nil).

This would mean the following:

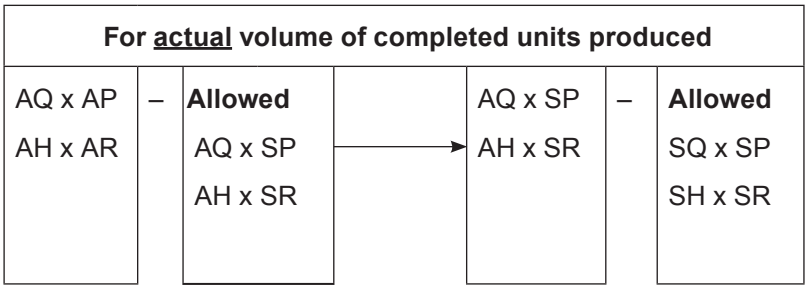
The total sales variance may be summarised as follows:	
= Selling price variance (Activity 24.16)	R150 (f)
= Volume variance (always zero in MAC2601)	0
= Total	R150 (f)

We can now calculate all the variances relevant to this module. In the next study unit we will analyse the variances and reconcile the budgeted profit with actual profit.

9 Summary

In this study unit, we demonstrated how to calculate a selected range of variances. We demonstrated various ways in which a variance can be presented and we discussed the information required to calculate each variance.

Cost variances are calculated in the following groups:



Price / rate variance

AQ x (SP – AP)
AH x (SR – AR)

Usage / efficiency variance

(AQ – SQ) x SP
(AH – SH) x SR

In the next study unit, we will investigate possible reasons for the variances and learn how to reconcile the budgeted profit with the actual profit using all the calculated variances.

Self-assessment activity

Rally Omyo! manufactures cars and uses a standard costing system:

The standard cost per Rally Omyo! Spider (a luxury sports car)

		R
Direct material: plastic	(320 kg @ R90 per kg)	28 800
Direct material: metal	(1 100 kg @ R158 per kg)	173 800
Direct labour:	(900 hours @ R149 per hour)	134 100
Variable manufacturing overheads varying with hours worked (900 hours @ R62 per hour)		55 800
Variable selling costs		23 800
Budgeted selling price per product		520 375

The following are the actual results for November 20X1, in which 21 units were manufactured and sold per vehicle:

		R
Cost of direct material: plastic	310 kg @ R95 per kg	618 450
Cost of direct material: metal	1 150 kg @ R154 per kg	3 719 100
Cost of direct labour	910 hours @ R145 per hour	2 770 950
Variable manufacturing overheads		1 146 600
Variable selling costs		532 350
Sales revenue		10 717 938

REQUIRED

a. What is the total variance for the direct material plastic?
b. If the actual material purchase price variance for plastic is R32 550 unfavourable, what is the material (plastic) quantity variance?
c. Calculate the actual material (metal) purchase price variance.
d. Calculate the labour rate variance.
e. Calculate the labour efficiency variance.
f. Calculate the variable overhead spending variance for overheads that vary with hours worked.
g. Calculate the variable overhead efficiency variance for overheads that vary with hours worked.
h. Calculate the selling price variance.
i. Calculate the variable selling costs spending variance.
j. Calculate the material quantity (metal) variance.

Solution to Self-assessment activity

a. Total variance direct material plastic

	R	
Standard cost for 21 cars (21 x R28 800)	604 800	
Actual cost (given)	618 450	
Total variance	(13 650)	Unfavourable

b. Material (plastic) quantity variance

	R	
Total variance	(13 650)	Unfavourable
Less: Purchase price variance	(32 550)	Unfavourable
Quantity variance:	18 900	Favourable

OR

Actual quantity at standard price	Standard quantity at standard price
310 kg x R90 x 21 cars 585 900	320 kg x R90 x 21 cars 604 800

Variance R18 900 Favourable

OR

Difference in quantities	(SQ – AQ)	
	(320 kg – 310 kg)	10 kg
Standard price (SP)		R90
Difference for 21 units (R900 x 21)		R 18 900 (f)

c. Material (metal) purchase price variance

Actual quantity at actual price	Actual quantity at standard price
1 150 kg x R154 x 21 cars	1 150 kg x R158 x 21 cars
3 719 100	3 815 700

Variance R96 600 Favourable

OR

Difference in price	(AP – SP)	
	(R158 – R154)	R4
Actual quantity (AQ)		1 150 kg
Variance for 21 units (4 600 x 21)		R96 600 (f)

d. Labour rate variance

Actual hours at actual rate	Actual hours at standard rate
910 hours x R145 x 21 cars	910 hours x R149 x 21 cars
2 770 950	2 847 390

Variance R76 440 (f) Favourable

OR

Difference in price	(SR – AR)	
	(R149 – R154)	R4
Actual quantity (AH)		910
Variance for 21 units (3 600 x 21)		R76 440 (f)

e. Labour efficiency variance

Actual hours at standard rate	Standard hours at standard rate
910 hours x R149 x 21 cars	900 hours x R149 x 21 cars
2 847 390	2 816 100

Variance R(31 290) Unfavourable

OR

Difference in price	(SH – AH)	
	900 hours – 910 hours	(10)
Actual rate (AR)		R149
Variance for 21 units (R1 490 x 21)		R(31 290) (u)

f. Variable overhead spending variance for overheads that vary with hours worked

Actual hours at actual rate	Actual hours at Standard rate
910 hours x R60 x 21 cars	910 hours x R62 x 21 cars
1 146 600	1 184 820

Variance R38 220 Favourable

OR

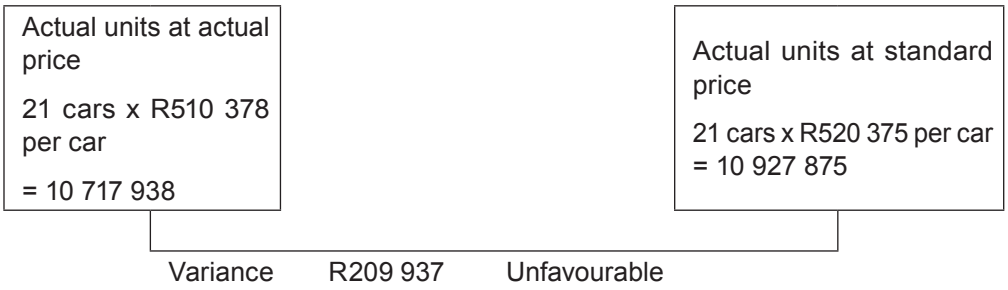
Difference in overhead spending	(SR – AR)	
	(R62 – R60)	R2
Actual hours		910
Variance for 21 units (1 820 x 21)		R38 220 (f)

g. Variable overhead efficiency variance for overheads that vary with hours worked

OR

Difference in hours	(SH – AH)	
	(900 – 910)	(10)
Standard rate		R62
Variance for 21 cars (620 x 21)		R13 020 (u)

h. Selling price variance



OR

Difference in selling price	(AP – SP)	
	(R510 378 – R520 375)	(R9 997)
Actual number of cars		21
Variance for 21 cars		R(209 937) (u)

i. Variable selling costs spending variance

Actual quantity at actual rate	Actual quantity at standard rate
21 cars x R25 350	21 cars x R23 800
532 350	499 800

Variance R(32 550) Unfavourable

OR

Difference in rate	(SR – AR)	
	(R23 800 – R25 350)	R(1 550)
Actual units sold/Standard rate		21
Variance for 21 cars (1 550 x 21)		R(32 550) (u)

j. Material quantity (metal) variance

Actual quantity at standard price	Standard quantity at standard price
1 150 kg x R158 x 21 cars	1 100 kg x R158 x 21 cars
3 815 700	3 649 800

Variance R(165 900) Favourable

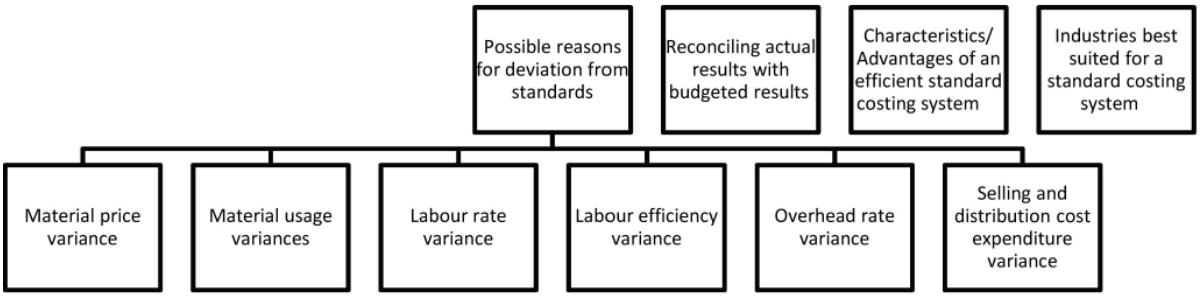
OR

Difference in quantity	(SQ – AQ)	
	(1 100 kg – 1 150 kg)	50 kg
Standard price		R158
Variance for 21 units (7 900 x 21)		R165 900 (u)

STUDY UNIT 25

Reconciliation and analysis of variances

In this study unit



1 Introduction

In the previous study unit you learnt that a standard costing system is widely used because it provides cost information for a number of different purposes:

- It helps to predict future costs.
- It sets targets that individuals can achieve.
- It helps to set a budget and evaluate managerial performance.
- It acts as a control device by highlighting any areas of deviance.

If a standard costing system is implemented and maintained properly, variances are identified, calculated and analysed. We have already learnt how the standards are determined and how to calculate variances.

In this study unit we are going to analyse variances and discuss possible reasons for these variances. We will also use the variances identified to reconcile the budgeted profit with the actual profit.

NOTE

It is possible to compute variances simply by committing to memory a series of variance formulae. However, if you adopt this approach, it will not help you to understand what the variance is actually about and to evaluate whether the reasons advanced for the variance are valid.

Remember: as a management accountant you are responsible for the integrity of the results reported. If variances are not properly managed, you are not fulfilling your controlling function properly.

2 Possible reasons for deviation from standards

So far, we have calculated price/rate/expenditure and quantity/efficiency variances for direct material, direct labour, variable overheads, fixed overheads and variable selling and distribution costs. You will have noted the similarities between the calculations for each. Most have two types of variances, namely, variations in the *quantity of resources* used and variations in the *price paid for the resources*.

Variances can be broken down into two 'responsibility' areas. One person (manager) is held accountable for the **quantity** element and another person (manager) for the **price** element. Refer to topic 9 for the discussion on controllability of costs and responsibility centres.

We will now describe some possible reasons for variances. Note that this is not an extensive list, because any variance very much depends on the type of product, production environment etcetera in an organisation. If a specific reason applies to an unfavourable variance, the opposite action should result in a favourable variance!

Material price variance

There are a number of possible reasons for material purchase price variances. The purchasing department is usually responsible for sourcing materials. Some of the factors that lead to variances are under the organisation's control:

- failure to take advantage of quantity rebates on bulk purchases
- poor planning leading to last minute purchases (speed orders), which usually come with a higher price tag

Factors over which the organisation has no control include the following:

- price rises as a result of higher than expected inflation, changes in the exchange rate and an increase in fuel prices
- unforeseen material shortages as a result of fire damage, floods or strikes, leading to orders having to be processed more quickly – at higher price

NOTE

In your postgraduate MAC modules you will learn more about using hedging instruments to 'fix' the price of your input materials.

Material usage (quantity) variances

There are a number of possible reasons for material usage variances. These variances can usually be controlled by the production manager. Common causes/ reasons are:

- careless handling of materials

- inferior material purchased, requiring reworking etc (should correlate with a positive price variance)
- stricter quality controls
- change in production process (workers not yet familiar with the process)

NOTE

You will see that some variances are linked to other variances. If you purchase cheaper raw materials, you will have a positive purchase price variance. However, this cheaper (lower quality) material might cause usage problems in the production process (eg breaking, splintering, getting stuck in the machines etc). This, in turn, will lead to an unfavourable usage variance because more raw material will have to be requisitioned from the stores to replace breakages, splintering etcetera. It may also impact on the labour and machine hour efficiencies because more time will be spent on stoppages.

When discussing reasons for variances, make sure that your answer does not contain contradictions.

Labour rate variance

There are a number of possible causes for labour rate variances. This variance is probably the variance over which an organisation has the least control. The most common reason for this variance is wage negotiations concluded at rates that differ from those budgeted for when the standard rate was determined. The human resource department is usually responsible for this variance.

Another reason for labour rate variance is if the organisation is employing different grades of workers. A more or less skilled employee will have a higher or lower remuneration rate. Note that, again, this will impact on the efficiency variance.

NOTE

In MAC3701 you will learn how to split this variance further into a labour mix variance, depending on the grade/classification of the employee.

Labour efficiency variance

There are a number of possible causes of labour efficiency variances. These variances can normally be controlled by the production line manager or supervisor. The reasons for these variances are very similar to the reasons for material usage variance:

- Use of poor quality material
- Unskilled labour personnel
- Change in production methods/technology (workers not yet familiar with new technique/process)

- Poor production scheduling causing delays etcetera (idle time when waiting for products or materials)
- Change in quality standards (spending more or less time on products to ensure quality)

Overhead rate (expenditure) variance (variable and fixed)

There are a number of reasons for overhead rate variance. Since overheads consist of different cost items, one has to investigate this variance in more depth. Overhead rate variance may be the result of increases in electricity, rates and taxes, IT costs, rent etcetera, all of which is linked to inflation (which is obviously outside the organisation's control).

NOTE

The overhead efficiency variance will be linked to whatever is used as the allocation base. For example: if labour hours are used to allocate manufacturing overheads, the reasons for the labour efficiency variance would also apply to the overhead efficiency variance.

Selling and distribution cost expenditure variance

These costs are the responsibility of the marketing manager and the distribution manager. It may be that more/fewer commissions were paid in order to maintain sales in the face of increased competition. This claim should be verified by examining market conditions and any changes in the number of units sold.

Higher than expected changes in fuel or other transport costs would also cause a negative distribution expenditure variance. Changes in delivery methods (eg from road to air) would also lead to cost changes.

3 Reconciling actual results with budgeted results

Once we have calculated the variances, we can start reconciling the budgeted profit with the actual profit. We will demonstrate this in the next activity.

Activity 25.1

Fatties & Thinnies Ltd. manufactures a single product: a ready-made lasagne which can feed six people.

The standard variable cost per unit is as follows:

		R
Direct materials	: 1,6 kg @ R25 per kg	40
Direct labour	: 0,8 hours @ R40 per hour	32
Variable manufacturing overheads – vary with hours worked	: 0,8 hours @ R7,50 per hour	6
Variable selling and distribution cost		14
Standard selling price per unit		**140**

Actual results for Fatties & Thinnies Ltd.

Material purchased and consumed	10 000 kg	@	R 22,50 per kg
Direct labour	3 000 hours	@	R 50 per hour
Variable manufacturing overheads			R 25 000
Variable selling and distribution costs			R 75 000
Sales			R725 000
Units manufactured and completed			5 000 units
Units sold			5 000 units

Additional information

(1) There was no inventory on hand at the beginning or end of the period.
(2) Fixed manufacturing cost amounted to R40 400 (R38 400 budgeted).
(3) Fixed administration overheads amounted to R32 000, which was in line with the budget.

REQUIRED

a. Draft a budgeted statement of profit or loss and other comprehensive income based on the standards provided. Assume actual volumes and budgeted volumes are identical.
b. Draft a stement of profit or loss and other comprehensive income based on the actual results.
c. Calculate and analyse the following variances:
    i. Total material variance
    ii. Material purchase price variance
    iii. Material quantity variance
    iv. Illustrate that (ii) + (iii) = (i)
    v. Total labour variance
    vi. Labour rate variance
    vii. Labour efficiency variance
    viii. Illustrate that (vi) + (vii) = (v)
    ix. Total variable manufacturing overhead variance
    x. Variable manufacturing overhead rate variance
    xi. Variable manufacturing overhead efficiency variance

xii. Illustrate that (x) + (xi) = (ix)

xiii. Variable selling and distribution cost expenditure variance

xiv. Selling price variance

d. Reconcile the actual results with the budgeted results.

Solution to Activity 25.1

a. **Fatties & Thinnies Ltd.**

Budgeted Statement of Profit or Loss and Other Comprehensive Income

Sales – units		5 000
		R
Sales (5 000 x R140)		700 000
Less: Variable manufacturing costs		390 000
– Direct material	(5 000 x R40)	200 000
– Direct labour	(5 000 x R32)	160 000
– Factory overheads	(5 000 x R 6)	30 000
Less:		
– Variable sales and distribution costs	(5 000 x R14)	70 000
Contribution		240 000
Less: Fixed costs		70 400
– Manufacturing		38 400
– Administration		32 000
Net profit		169 600

b. **Fatties & Thinnies Ltd.**

Actual Statement of Profit or loss and Other Comprehensive Income

Sales – units		5 000
		R
Sales – given		725 000
Less: Variable manufacturing costs		400 000
– Direct material	(10 000 kg x R22,50)	225 000
– Direct labour	(3 000 x R50)	150 000
– Factory overheads (given)		25 000
Less:		
– Variable sales and distribution costs (given)		75 000
Contribution		250 000
Less: Fixed costs		72 400
– Manufacturing		40 400
– Administration		32 000
Net profit		177 600

c. Variances

i. Total material variance

Actual costs (AQ x AP)	Standard quantity allowed at standard price (SQ x SP)
for actual production	
= 10 000 kg x R22,50 per kg	= (5 000 units x 1,6 kg) x R25
= R225 000	= R200 000

Total variance is R(25 000) (u)

The variance is unfavourable because the actual costs are more than the standard costs. We now need to investigate the two elements (price and quantity) to fully understand the reasons for the variance.

ii. Material purchase price variance

Actual price paid = R22,50 (AP x AQ)	Standard price allowed = R25 (SP x AQ)
for the actual quantity of material of 10 000 kg purchased and used to manufacture 5 000 units	
= 10 000 kg x R22,50 per kg = R225 000	= 10 000 kg x R25 per kg = R250 000
Variance is R25 000 (f)	

Difference in price	R2,50
Actual quantity	10 000
Variance	R25 000 (f)

The variance is favourable as the actual price is less than the standard price. The person responsible for obtaining the favourable price of R22,50 could have utilised "bulk" orders or switched to cheaper suppliers. The quality of the material must be investigated because this might have an impact on the next variance: the quantity or usage variance.

iii. Material quantity variance

Actual quantity of material purchased and used (10 000 kg) (AQ x SP)	Standard quantity of material allowed for actual production (5 000 units x 1,6 kg) (SQ x SP)
at the standard material purchase price	
= 10 000 kg x R25 per kg = R250 000	= 8 000 kg x R25 per kg = R200 000
Variance is (R50 000) (u)	

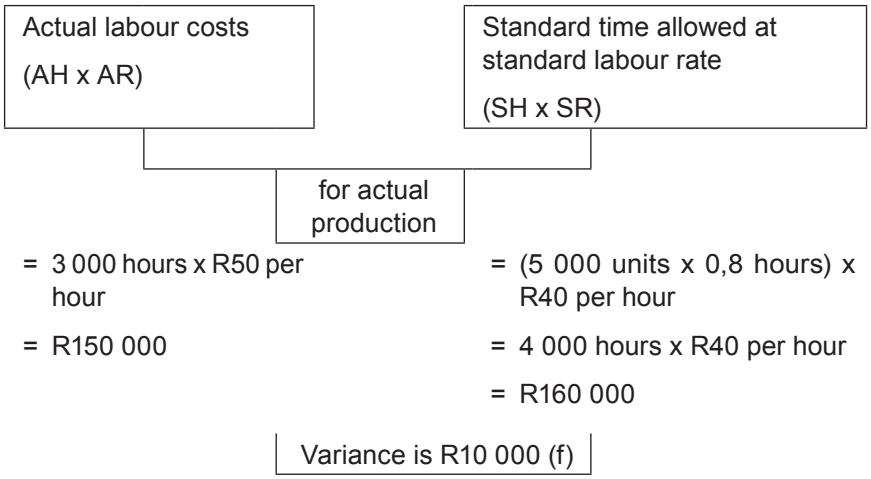
Difference in quantity	(2 000) kg
Standard price (rand)	R 25
Variance	R50 000 (u)

The variance is unfavourable because the actual quantity is more than the standard quantity. 2 000 kg did not reflect in the final output. The reason for this must be investigated, because there might be something wrong with the quality of the raw material that was sourced, or the work might have been carried out by inexperienced workers, thus leading to more wastage. This does correlate with the cheaper price argument put forward when the favourable price variance was interpreted.

iv. Reconciliation

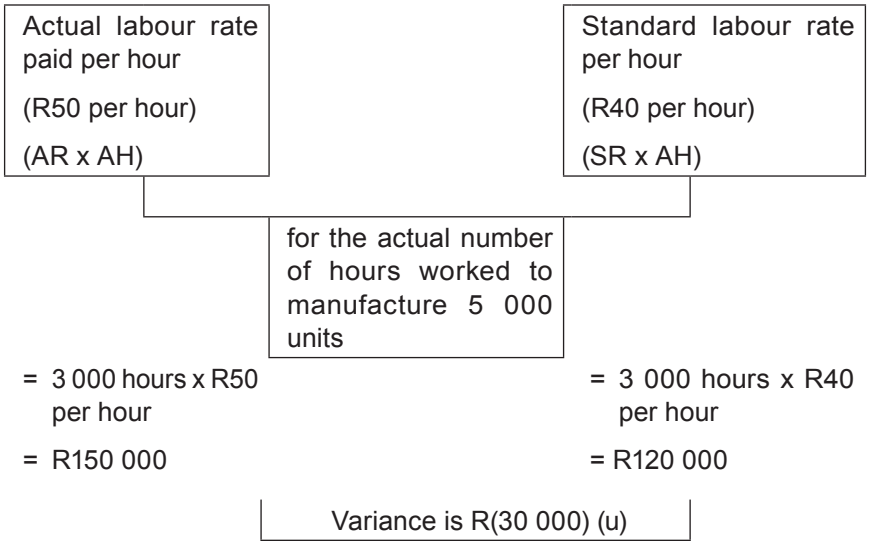
(ii) + (iii) = (i)R25 000 (f) + R50 000 (u) = R25 000 (u)

v. Total labour variance



The variance is favourable because the actual costs are lower than the standard costs. We will now investigate the two elements (rate and efficiency) to fully understand the reasons for the variance.

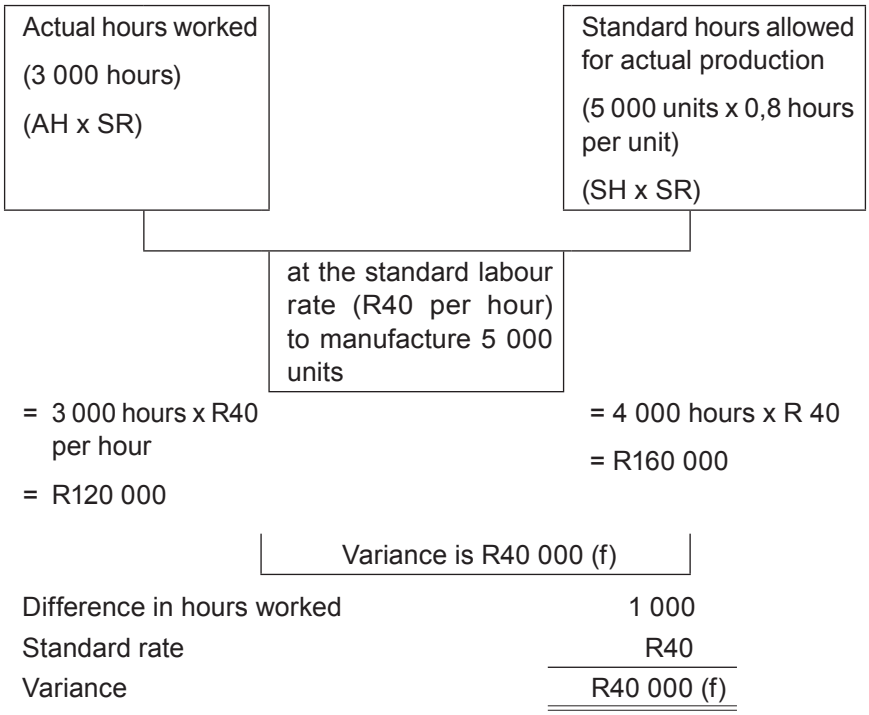
vi. Labour rate variance



Difference in rate	R(10)
Quantity	3 000
Variance	R30 000 (u)

The variance is unfavourable because the actual rate is higher than the standard rate. This may be the result of negotiations with unions being concluded at a higher than budgeted rate of increase or employees upgrading their skills (which means that they will be paid higher salaries). We will have to see if this has an impact on the labour efficiency variance.

vii. Labour efficiency variance



Difference in hours worked	1 000
Standard rate	R40
Variance	R40 000 (f)

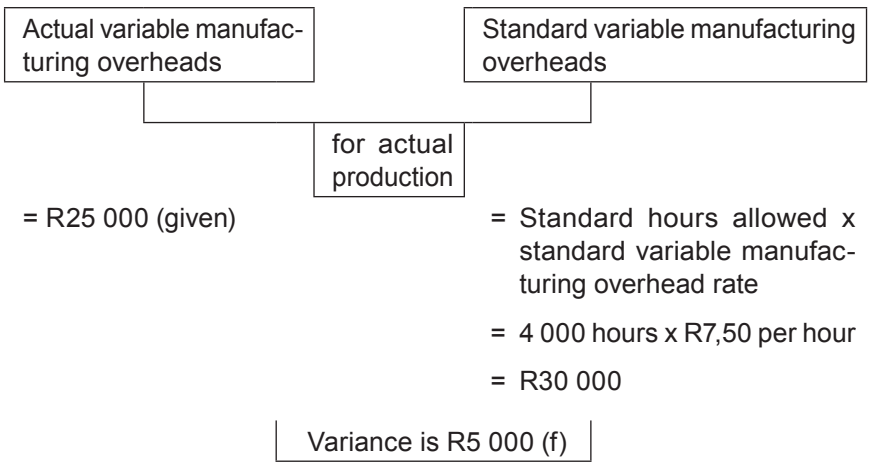
The variance is favourable because the actual hours worked are fewer than the standard hours. The higher skilled workers were able to work more quickly. This may also be the result of better working conditions.

viii. Reconciliation

(vi) + (vii) = (v)

R30 000 (u) + R40 000 (f) = R10 000 (f)

ix. Total variable manufacturing overheads variance



The variance is favourable because actual overheads are less than the standard overheads. This can be broken down into rate and efficiency variances.

x. Variable manufacturing overheads rate variance

Actual variable manufacturing overheads	Standard variable manufacturing overheads
for actual hours worked	
Actual hours at actual rate	= Actual hours x standard rate
= 3 000 hours x R8,3333	= 3 000 hours x R7,50 per hour
= R25 000 (given)	= R22 500
Variance is R(2 500) (u)	

Difference in rate (8,3333 – 7,50)	R0,8333
Actual hours	3 000
Variance	R(2 500) (u)

The variance is unfavourable as the actual variable overhead rate was more than the standard. An investigation should be launched into the expenses making up the overhead costs to determine which expense was over budget and why.

xi. Variable manufacturing overheads efficiency variance

Actual hours worked	Standard hours allowed for actual production (5 000 units x 0,8 hours)
at standard rate	
= 3 000 hours x R7,50	= 4 000 hours x R7,50
= R22 500	= R30 000
Variance is R7 500 (f)	

Difference in hours (4 000 – 3 000)	1 000
Standard overhead rate	R7,50
Variance	R7 500 (f)

xii. Reconciliation

(x) + (xi) = (ix)

R2 500 (u) + R7 500 (f) = R5 000 (f)

Since Fatties & Thinnies Ltd. uses labour hours as their overhead allocation basis, the labour hour savings in terms of standard hours is explained by the same reasons as that which were given for the labour efficiency variance. No further explanation is warranted.

xiii. Variable selling and distribution cost expenditure variance

Actual variable selling and distribution overheads	Standard variable selling and distribution overheads
for actual units sold	
Actual variable selling and distribution overhead rate	= Standard variable sales and distribution overheads rate
x actual units	x actual units sold
= R15 x 5 000 units	= R14 per unit x 5 000 units
= R75 000 (given)	= R70 000
Variance is R5 000 (u)	

Difference in rate (R14 – R15)	R(1)
Actual units sold	5 000
Variance	R(5 000) (u)

The variance is unfavourable because the actual rate paid per unit was more than the standard allowed. This might be due to higher commissions being paid to sales persons or higher delivery charges. Further investigation is required.

Since the only other variance is volume (not covered in MAC2601), the total variance will always equal the expenditure variance (in MAC2601).

xiv. Selling price variance

Actual sales price R145	Standard sales price R140
for actual sales	
= 5 000 units x R145 per unit	= 5 000 units x R140 per unit
= R725 000 (given)	= R700 000
Variance is R25 000 (f)	

Difference in price (R145 – R140)	R5
Actual units sold	5 000
Variance for	R25 000 (f)

The variance is favourable as the actual selling price of R145 (725 000/5 000) is more than the standard price of R140. Fatties & Thinnies Ltd. probably felt they can charge R145 for their lasagne without compromising on the number of lasagnes sold.

d. **Reconciliation of actual results and budgeted results**

The difference between the net profit according to the budgeted results and the net profit according to the actual results is R169 600 – R177 600 = R8 000 (favourable).

This is explained as follows:

Variances	**Favourable**	**Unfavourable**
Material:	**R**	**R**
Purchase price variance	25 000	
Quantity variance		50 000
Labour:		
Rate variance		30 000
Efficiency variance	40 000	
Variable manufacturing overheads:		
Rate variance		2 500
Efficiency variance	7 500	
Variable sales and distribution costs:		
Expenditure variance		5 000
Sales:		
Price variance	25 000	
Fixed cost:		
Expenditure variance (R38 400 – R40 400)		2 000
	97 500	89 500
Net favourable variance		8 000
	97 500	97 500
Reconciliation:	**R**	
Budgeted net profit	169 600	
Plus: Net favourable variance	8 000	
Actual net profit	177 600	

4 Characteristics/Advantages of an efficient standard costing system

The general characteristics of an efficient standard costing system may be summarised as follows:

- The standards which are set are realistic and attainable.
- There is room for normal variances.
- Employees are thoroughly informed about the purpose and application of the system and feel motivated to achieve and maintain the standard.
- The standard is based on realistic future costs, results and operating conditions.

- The information (standards or variances) that is made available is useful for setting the budget and other planning exercises.
- The standards that are made available are useful for valuing material and production inventories.
- The standards serve as a point of measurement against which actual costs can be measured.
- It may lead to cost reduction policies, since more control is exercised.

5 Industries best suited for a standard costing system

Standard costing is most suited to an organisation whose operations are of a repetitive nature and which have a well-defined input-output relationship (eg volume-driven manufacturing). This enables management to set performance standards for efficient operating conditions over a period. The organisation therefore has the opportunity to carefully plan and calculate the standards and related costs and incomes.

Organisations that deliver custom-made products or services should use a job costing system (as described in topic 6). Note, though, that a standard costing system is not limited to one product; it can be applied to many different products as long as production consists of a series of common operations. Standard costing systems integrate well with process costing (topic 7) and joint and byproduct costing (topic 8).

6 Summary

In this study unit, you learnt how to reconcile the difference between standard, budgeted and actual results. You also learnt how to analyse variances and find valid reasons for them. We concluded with a discussion on the benefits of implementing a standard costing system and the type of organisations that should use this costing system.

Comprehensive Self-assessment Activity

QUESTION 1

Springbok Leather Ltd. purchases leather from which they cut strips. These strips are then sewn together to make car seat covers.

The standard *variable* cost per seat cover is as follows:

	R
Leather (2 m @ R28 per meter)	56
Labour (3 hours @ R18 per hour)	54
Overheads	30
Total variable cost per unit	140

Additional information

- The company budgeted to manufacture 9 960 units in May 20X4.
- Overheads are allocated based on the number (quantity) of leather metres used.

Actual results for May 20X4 were as follows:

	Total R
Leather cost (20 580 m @ R32 per metre)	658 560,00
Labour cost (30 285 hrs @ R17,50 per hour)	529 987,50
Variable overheads	300 522,00
	1 489 069,50
Actual variable cost per unit	R149,50

REQUIRED

a. How many units were actually manufactured in May 20X4?
b. Calculate the total, price and quantity variances for materials.
c. Calculate the total, rate and efficiency variances for labour.
d. Calculate the total, rate and efficiency variances for overheads.
e. Provide two possible reasons for each variance.
f. Briefly discuss two of the main purposes of a standard costing system.

QUESTION 2

Mrs Mabathle operates a standard costing system for her business, Fishy Fries Ltd., which sells hake fillets to franchised takeaway outlets.

The standard cost and contribution per hake fillet is as follows:

	R
Selling price	19,10
Variable cost	13,30
Material	
Hake (0,75 kg @ R16/kg)	12,00
Spices (10 g @ R45/kg)	0,45
Plastic wrapper (1 plastic wrapper @ 10 c)	0,10
Labour (5 min @ R9 per hour)	0,75
Standard contribution per hake fillet	5,80

Mrs Mabathle budgeted for a profit of R15 000 for the period after fixed overheads of R1 240.

Actual results for the period were as follows:

- Number of hake fillets sold 2 800
- Actual selling price per hake fillet R 20,36
- Material purchased and used
  - Hake (2 500 kg) R38 750
  - Spices (25 kg) R 1 250
  - Plastic wrappers (3 100) R 310
- Labour (270 hours) R 2 295
- Actual fixed overheads R 1 350

REQUIRED

a. Calculate the actual profit for Fishy Fries Ltd. for the period.
b. Calculate the following variances:
    i. Selling price variance
    ii. Material price variance for each material used
    iii. Material quantity variance for each material used
    iv. Labour rate variance
    v. Labour efficiency variance
c. Reconcile the actual profit with the budgeted profit.
d. Provide three possible reasons for the labour efficiency variance.

You may assume there was no opening or closing inventories of raw material or completed units of hake fillets.

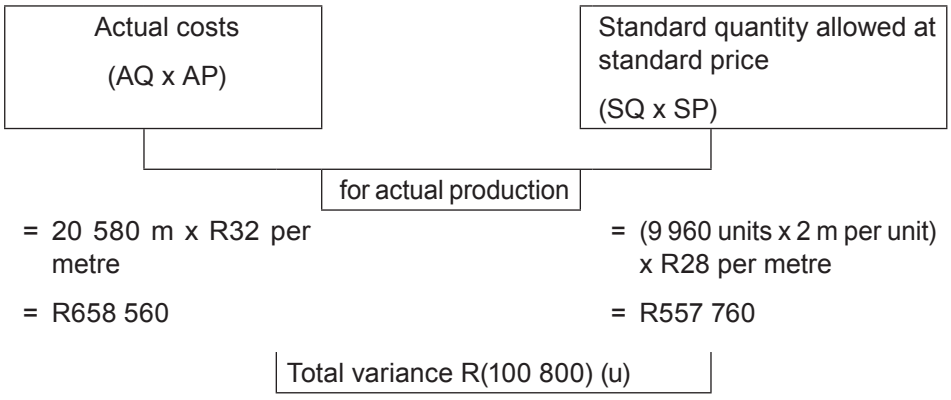
Solution to Self-assessment Activity

QUESTION 1

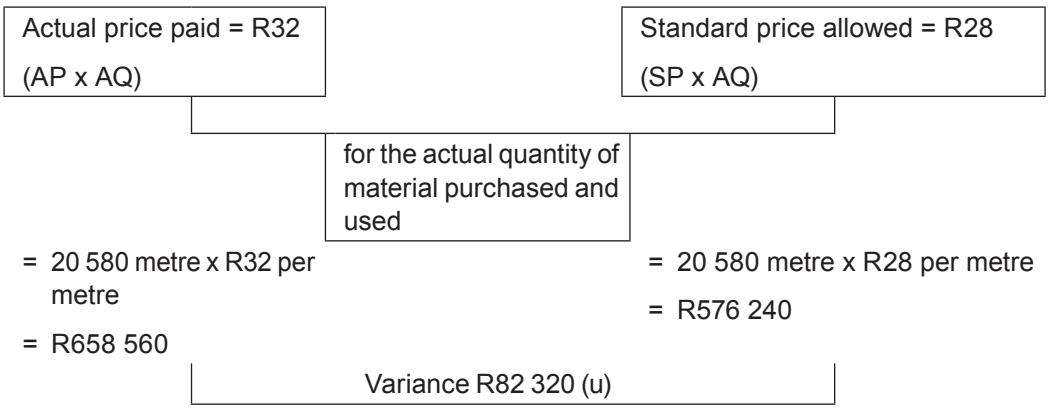
a. Units manufactured

R1 489 069,50 / R149,50
= 9 960 units (rounded off)

b. Total material variance

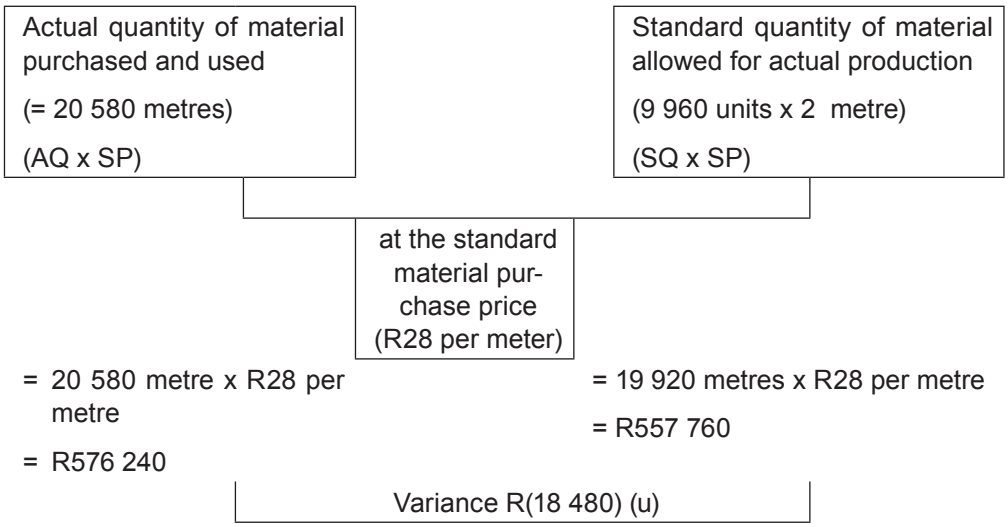


Material price variance



Difference in price (R28 – R32)	R(4)
Actual quantity (metre)	20 580
Variance	R(82 320) (u)

Material quantity variance



Difference in quantity (19 920 m – 20 580 m)	(660)
Standard price per metre	R28
Variance	R(18 480) (u)

Check:

Price variance	R82 320 (u)
Quantity	18 480 (u)
Total	100 800 (u)

c. Total labour variance

Actual labour costs (AH x AR)	Standard time allowed at standard labour rate (SH x SR)
for actual production	
= 30 285 hours x R17,50 per hour = R529 987,50	= (9 960 x 3) x R18 per hour = 29 880 hours x R18 per hour = R537 840
Variance R7 852,50 (f)	

Labour rate variance

Actual labour rate paid per hour (R17,50 per hour) (AR x AH)	Standard labour rate per hour (R18 per hour) (SR x AH)
for the actual number of hours (30 285) worked to manufacture 9 960 units	
= 30 285 hours x R17,50 per hour = R529 987,50	= 30 285 hours x R18 per hour = R545 130
Variance R15 142,50 (f)	

Difference in rate (R18 – R17,50)	R0,50
Actual hours	30 285
Variance	R15 142,50 (f)

Labour efficiency variance

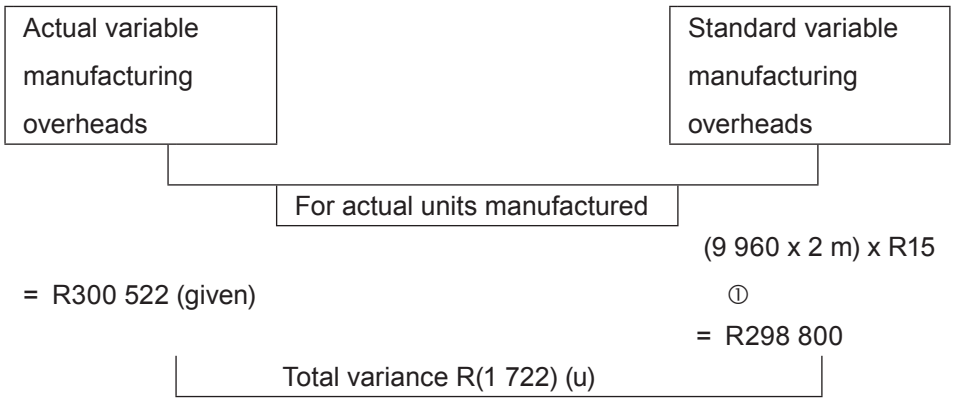
Actual hours worked (30 285 hours) (AH x SR)	Standard hours allowed for actual production (9 960 units x 3 hours per unit) (SH x SR)
at the standard labour rate (R3 per hour) to manufacture 9 960 units	
= 30 285 hours x R18 per hour = R545 130	= 29 880 x R18 per hour = R537 840
Variance = R(7 290) (u)	

Difference in hours (30 285 – 29 880)	(405)
Standard rate	R18
Variance	R(7 290) (u)

Check:

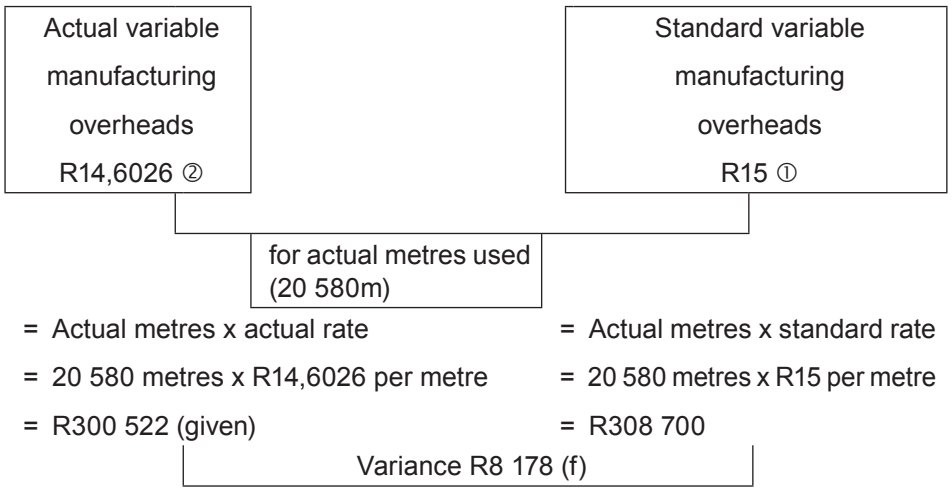
Rate variance	R15 142,50 (f)
Efficiency variance	(7 290,00) (u)
Total	7 852,50 (f)

d. Total overhead variance



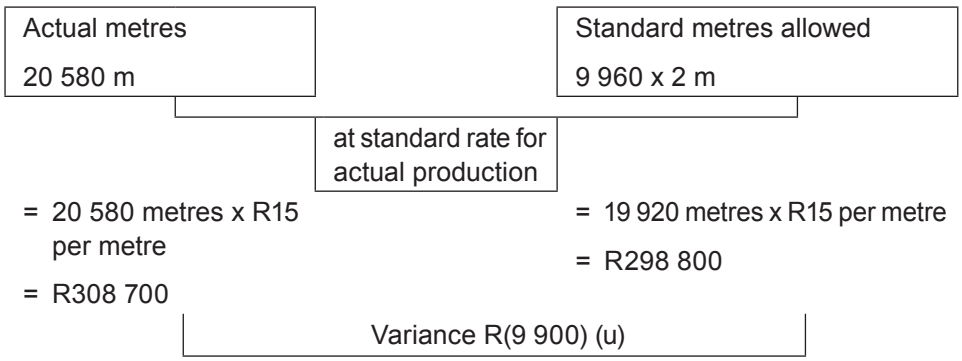
① Variable overheads are allocated based on metres of leather used. Each seat cover uses two metres of leather. The total variable overhead per unit is R30 (given). Therefore the recovery rate is R30 / 2 m = R15 per metre.

Overhead rate variance



② R300 522 / 20 580 m = R14,6026 per metre

Overhead efficiency variance



Difference in metre (19 920 m – 20 580 m)	(660)
Standard rate per metre	R15
Variance	R(9 900) (u)

Check:

Rate variance	R8 178 (f)
Efficiency variance	(9 900) (u)
Total	R(1 722) (u)

e. Reasons for variances

Unfavourable material price variances:

- higher than expected rate of inflation
- limited availability of material – available only at a premium price
- market conditions – higher than expected increase in prices from supplier
- better quality material purchased at a higher price
- faulty standards

Unfavourable material quantity variance

i. higher spoilage/losses than expected (lower quality materials used)

ii. poorly trained workers, hence material wastage

iii. poor control/supervision resulting in theft, misuse etcetera

iv. standards that are inappropriate or too stringent

Favourable labour rate variance

v. utilisation of unskilled labour (cheaper than skilled)

vi. favourable negotiations with labour unions resulting in lower than expected increases

vii. faulty standards (rate incorrect – too high)

Unfavourable labour efficiency variances

viii. new labour used (inexperienced)

ix. poor control/supervision

x. strikes

xi. poor quality material (more difficult to work with)

xii. standards that are inappropriate or too stringent

Favourable variable overhead spending variance

xiii. avourable negotiations with suppliers

xiv. cheaper suppliers used

xv. faulty standards (standards based on too high prices)

Unfavourable variable overhead efficiency variance

NOTE

Since overheads are allocated based on metres used, the same reasons would apply as those for the unfavourable material quantity variance.

f. Purposes of a standard costing system

- The main aim is to set a standard against which actual costs can be evaluated and controlled.
- To pinpoint responsibility for variances.
- To assist with initial organisational planning (ie compiling the budget) and follow-up (corrective action in order to address unfavourable variances)
- To assist in valuing material and manufactured inventories.

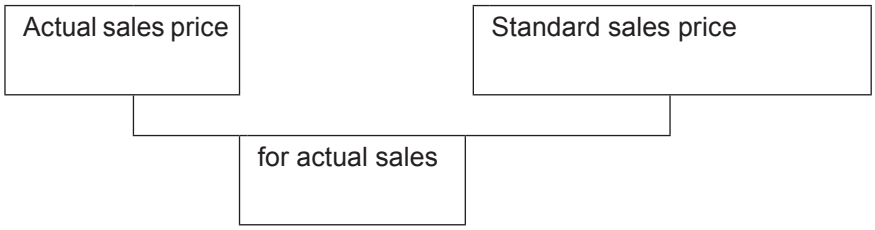
QUESTION 2

a. Actual profit

	R
Sales (R20,36 x 2 800 hake fillets)	57 008
Less: Cost of sales	
Material	
– Hake fillets	38 750
– Spices	1 250
– Plastic wrappers	310
Labour	2 295
Fixed overheads	1 350
Profit	13 053

b. Variances

i. **Selling price variance**



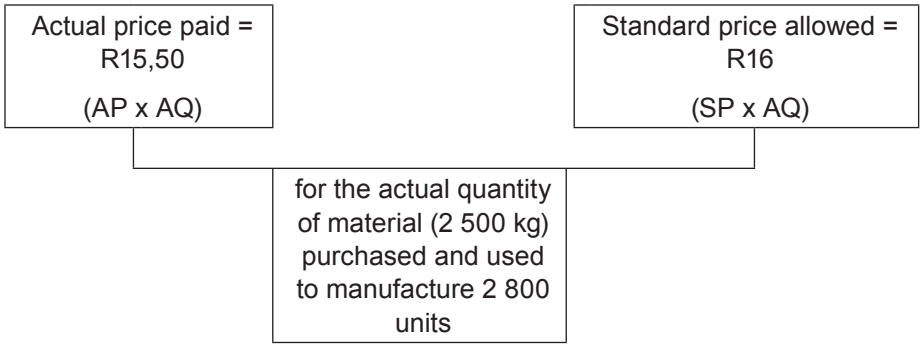
= 2 800 units x R 20,36 per unit
= R57 008

= 2 800 units x R19,10 per unit
= R53 480

Variance R3 528 (f)

Difference in price (R20,36 – R19,10)	R1,25
Actual units sold	2 800
Variance	R3 528 (f)

ii. **Material price variance hake fillet**



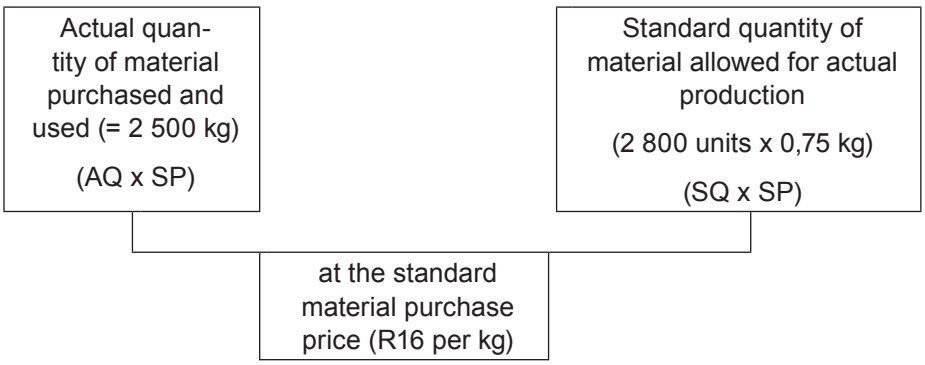
= 2 500 kg x R15,50 per kg
= R38 750

= 2 500 kg x R16 per metre
= R40 000

Variance R1 250 (f)

Difference in price (R16 – R15,50)	R0,50
Actual quantity	2 500 kg
Variance	R1 250 (f)

iii. **Material quantity variance of hake fillet**



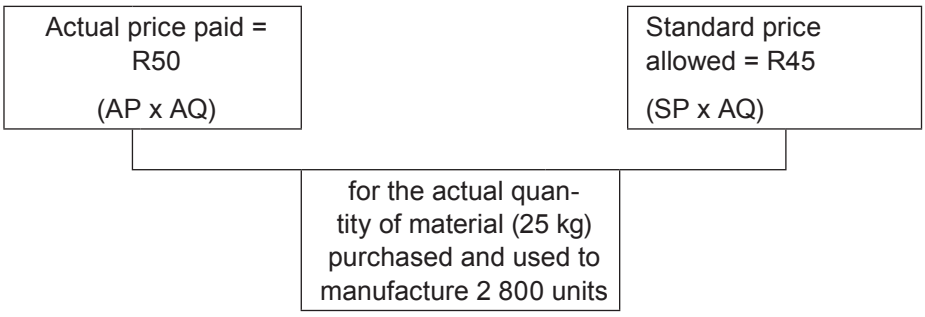
= 2 500 kg x R16 per metre = 2 100 kg x R16 per metre

= R40 000 = R33 600

Variance R6 400 (u)

Difference in quantity (2 100 kg – 2 500 kg)	(400) kg
Standard price	R16
Variance	R(6 400) (u)

iv. **Material price variance of spices**



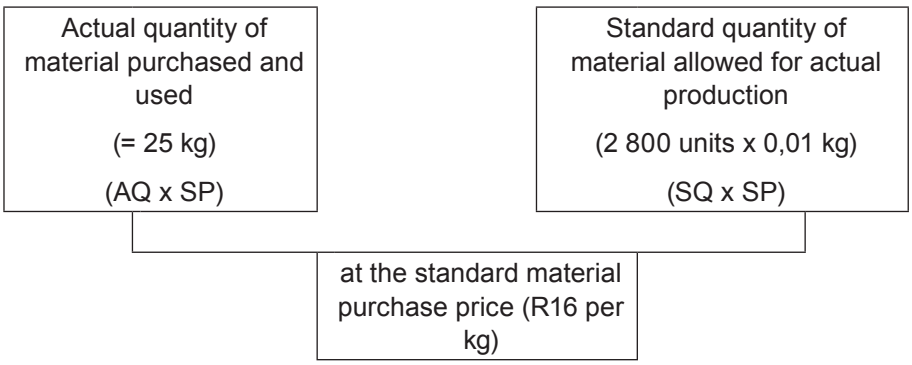
= 25 kg x R50 per kg = 25 kg x R45 per kg

= R1 250 = R1 125

Variance R(125) (u)

Difference in price (R45 – R50)	R(5)
Actual quantity	25 kg
Variance	R(125) (u)

v. **Material quantity variance of spices**



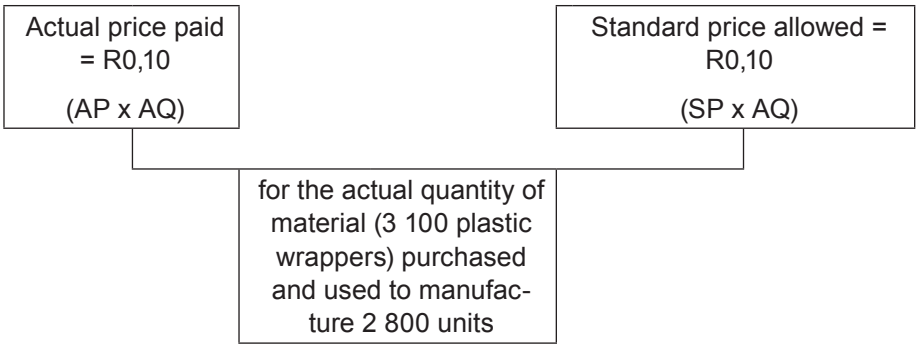
= 25 kg x R45 per kg = 28 kg x R45 per kg

= R1 125 = R1 260

Variance R135 (f)

Difference in quantity (28 kg – 25 kg)	3 kg
Standard price	R45
Variance	R135 (f)

vi. **Material price variance of plastic wrappers**



= 3 100 plastic wrappers x R0,10 per plastic wrapper

= R310

Variance R0

Difference in price (R0,10 – R0,10)	R0
Actual quantity	3 100
Variance	R0

vii. **Material quantity variance of plastic wrappers**

Actual quantity of material purchased and used (= 3 100 plastic wrappers) (AQ x SP)	Standard quantity of material allowed for actual production (2 800 units x 1) (SQ x SP)
At the standard material purchase price (R0,10 per plastic wrapper)	
= 3 100 plastic wrappers x R0,10 per plastic wrapper	= 2 800 plastic wrappers x R0,10 per plastic wrapper
= R310	= R280
Variance R(30) (u)	

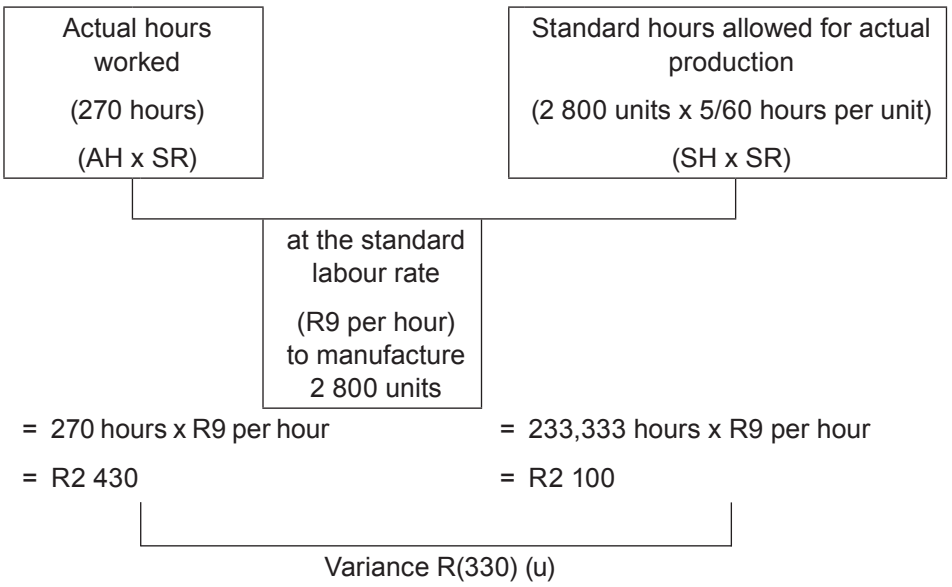
Difference in quantity (2 800 – 3 100)	300
Standard price	R0,10
Variance	R(30) (u)

viii. **Labour rate variance**

Actual labour rate per hour (R8,50 per hour) (AR x AH)	Standard labour rate per hour (R9 per hour) (SR x AH)
for the actual number of hours (270) worked to manufacture 2 800 units	
= 270 hours x R8,50 per hour	= 270 hours x R9 per hour
= R2 295	= R 2 430
Variance R135 (f)	

Difference in rate (R9 – R8,50)	R0,50
Actual hours	270
Variance	R135 (f)

ix. **Labour efficiency variance**



Difference in hours (233,333 – 270)	(36,667)
Standard rate	R9
Variance	R(330) (u)

c. Reconciliation of actual with budget profit

	R
Difference in profit	(1 947)
Budgeted profit	15 000
Actual profit	13 053
Explained by:	
Total of variances	1 947
Selling price variance	3 528
Hake price variance	1 250
Hake quantity variance	(6 400)
Spices price variance	(125)
Spices quantity variance	135
Plastic wrappers price variance	0
Plastic wrappers quantity variance	(30)
Labour rate variance	135
Labour efficiency variance	(330)
Fixed overhead expenditure variance (1 240 – 1 350)	(110)

d. Reasons for possible labour efficiency variance

- appointment of unschooled labour
- poor supervision
- poor quality of material – rework required
- strikes
- faulty standards – standards too stringent

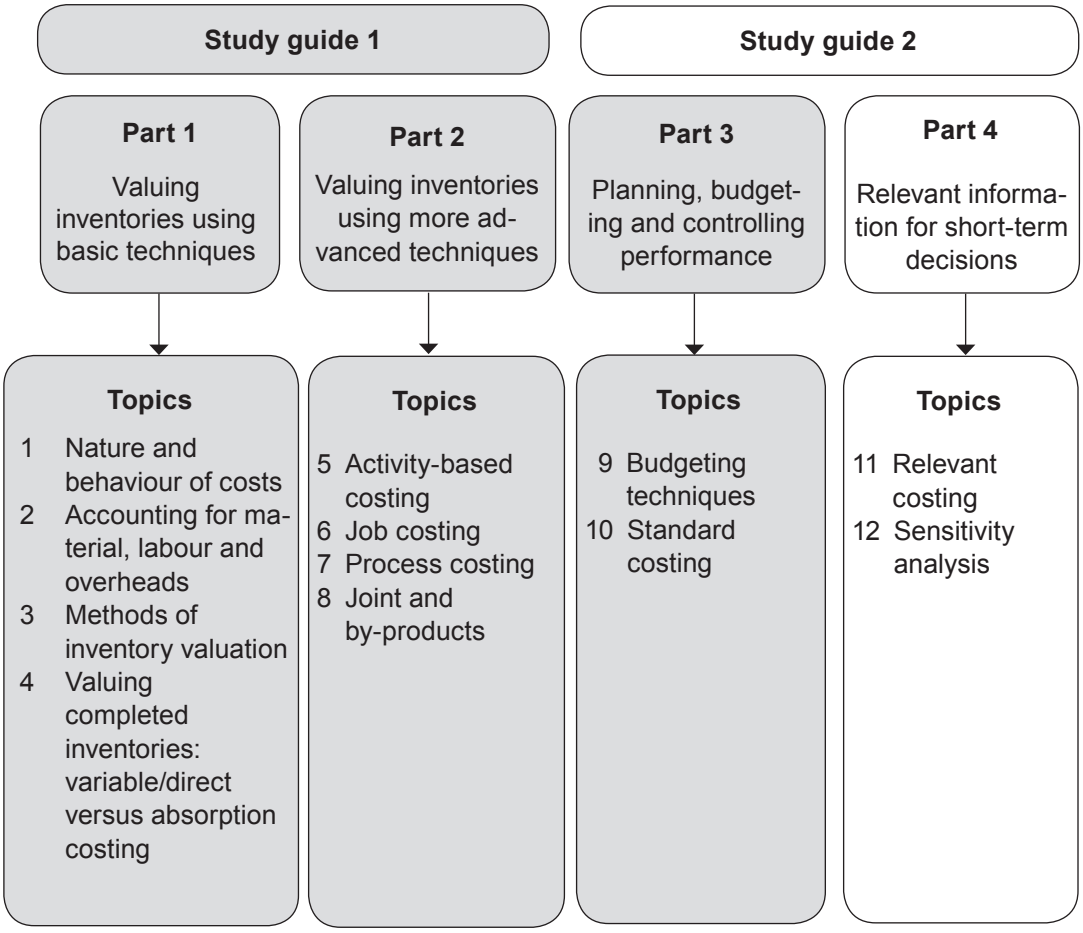
Relevant information for short-term decisions

PURPOSE

In part 4, we shall discuss information relevant to decision-making in the context of relevant costing principles and the sensitivity of profit and cash flows to decisions and probable events.

TOPIC 11 – RELEVANT COSTING

TOPIC 12 – SENSITIVITY ANALYSIS



NOTE

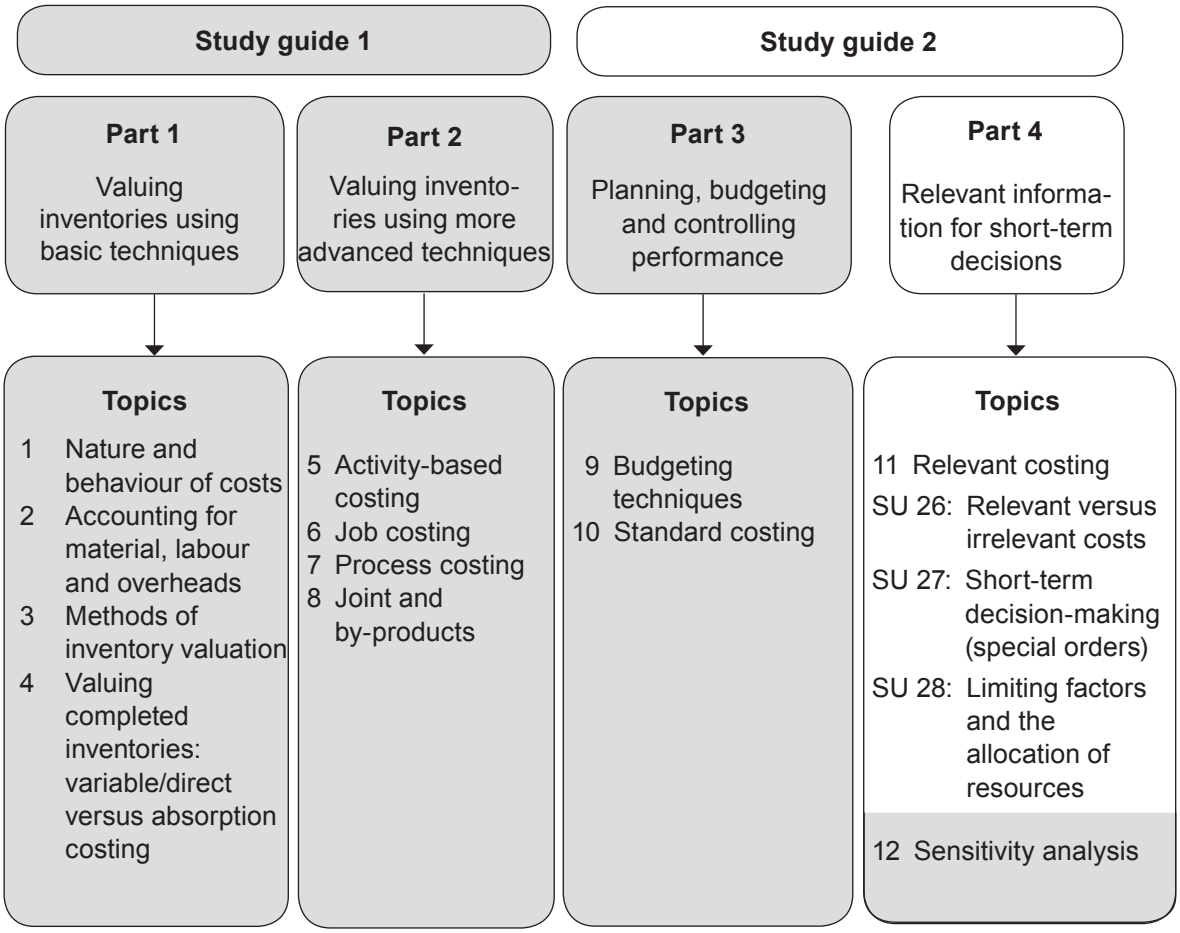
In part 4, you will also have to apply some of the principles that you learnt about in parts 1 to 3 (eg principles relating to cost-volume-profit analysis, cost behaviour and direct and absorption costing).

TOPIC 11
Relevant costing

LEARNING OUTCOMES

After studying this topic, you should be able to:

- identify the characteristics that make information relevant
- distinguish between relevant and irrelevant information with regard to a specific decision
- identify qualitative factors that may influence decision-making in a specific scenario
- calculate relevant incremental cash flows in a given scenario
- identify the preconditions for a special price
- determine an appropriate price for a special order
- define limiting factors and identify limiting factors in a given scenario
- identify the need for calculating contribution per unit of the limiting factor
- calculate contribution per unit of the limiting factor in a given scenario
- determine the optimal allocation of available resources and the optimal product mix



STUDY UNIT	TITLE
Study unit 26	RELEVANT VERSUS IRRELEVANT COSTS
Study unit 27	SHORT-TERM DECISION-MAKING (SPECIAL ORDERS)
Study unit 28	LIMITING FACTORS AND THE ALLOCATION OF RESOURCES

Introduction

In topic 9, you learnt about planning and budgeting, which usually covers a twelve-month period in advance. When finalising the budget, management must decide on the allocation of scarce resources and the optimum product mix. Circumstances may sometimes require that management makes a short-term (immediate) decision that was not necessarily planned or budgeted for. This decision may influence the performance of the organisation as a whole.

For example: the organisation's machine capacity is 480 hours per month. The sales manager claims that she can sell 2 000 units of product A (requiring 400 machine hours to produce) and 3 000 units of product B (requiring 150 machine hours to produce). The information per unit for each product is as follows:

	A	B
Selling price	100	80
Raw material	20	20
Variable conversion costs	30	30
Fixed conversion costs (excl. depreciation)	15	8
Depreciation	10	15
Absorption profit per unit	25	7

The total machine hours required to satisfy the total demand is 550 hours, but the organisation only has 480 hours available. What sales mix of product A and B should be used to compile the budget?

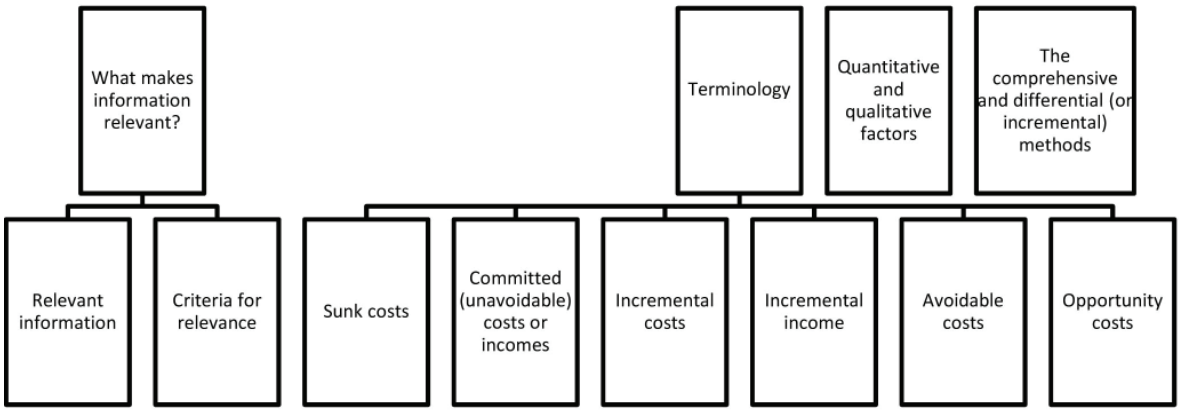
During the year, the organisation is approached by a potential new customer who requires 200 units of product B. This customer is prepared to pay R70 per unit for a one-time order. Should the organisation accept this order?

The principles of relevant cash flows and limiting factors will help us with these decisions.

STUDY UNIT 26

Relevant versus irrelevant costs

In this study unit



1 Introduction

Organisations strive to optimise long-term sustainable shareholder/owner value. In order to do this, they set certain objectives and goals and devise action plans to reach these goals and objectives (refer topic 9 on budgeting). An organisation's strategic plan includes these goals and objectives for the business as a whole. (You will learn more about strategy development in your MAC2602 module.)

From topic 9, you will remember that the sales and production budgets are key inputs into the budgeting process. The organisation should establish what products customers want and in what quantities. This should be matched to the available production capacity. A problem arises if there is insufficient capacity. In this case, management has to decide what products should take precedence over others. The management accountant has to provide the relevant information that will enable management to make this decision. Only then can the rest of the budget be compiled.

Although organisations may invest a lot of time in planning activities, situations may arise which require managerial decisions on issues that were not included in the *original* plans or budgets, but that could influence the organisation and its performance. This is referred to as *short-term or operating* decision-making.

In such a situation, management will have to **collect suitable information** to enable them to **make an appropriate decision**.

In this study unit, we will learn how to *distinguish* between costs and income that are relevant to the decision to be made and those costs and income that are irrelevant (ie will not influence the decision). These basic concepts will then be applied in the following study units, where we discuss short-term decision-making and the optimisation of product mix.

2 What makes information relevant?

We will now explore the various characteristics that make information relevant for financial decision-making. These are important concepts which we will refer to repeatedly: please make sure that you have a solid grasp of them.

NOTE

We use the term 'product' in the explanations below and the rest of the topic, but this term can also be replaced by 'service', because the principles relate to both.

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).

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 – refer to key term in section 3 below).
- 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.**

From the above, we can deduce that a cost or an income that:

- arose in the past or that will arise in the future as result of a decision already taken, and/or
- does not differ between the available alternatives

is *irrelevant*.

Using the criteria above, we should be able to determine whether specific information is relevant or irrelevant to a specific decision.

Some costs or income may be relevant to one decision, but irrelevant to another decision. Reflect why this is the case.

3 Terminology

Certain terms are often used in short-term decision-making. You will come across these terms throughout part 4 of this study guide (topics 11–12) and it is therefore important that you understand the various terms defined and discussed below.

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.

All costs incurred in the past (sunk costs) are **irrelevant**. We cannot avoid these costs by selecting a different alternative/course of action.

The following are examples of sunk costs in specified scenarios:

Scenario	Example of sunk cost	Why this is a sunk cost
Durban Nuts & Bolts (Pty) Ltd. has to decide whether a new product line should be added.	Research costs already incurred with regard to the potential new product line of Durban Nuts & Bolts (Pty) Ltd.	The research costs were incurred in the past and the company cannot change or avoid these by deciding not to add a new product line.
A friend asks if you would like to drive with him to Cape Town, but you have already bought a non-refundable plane ticket.	Cost of the plane ticket already incurred (in this case, only the additional costs of driving with the friend will be relevant).	You have already spent the money on the plane ticket. You cannot get your money back if you do not use the ticket.
Piecemaker (Pty) Ltd. needs to decide whether to replace its old machine with a new machine that makes chess pieces of a better quality (ignore the time value of money).	Book value of the old machine (based on the cost price of the old machine that was acquired in the past).	The historical cost price represents a cash outflow that has already occurred. Whether the old machine is replaced or not, its book value will eventually have to be debited to the income statement. (Either once-off when the old machine is scrapped or sold, or gradually in the form of depreciation.)

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 alternatives.

Although all costs incurred in the past (sunk costs) are irrelevant, some future cash flows can also be **irrelevant** (if they will be incurred no matter what decision is made, or if they will not change if a different alternative is selected). Prior committed costs or incomes are irrelevant for decision-making.

For example, the monthly rental paid on the factory premises will be paid (cash outflow into the future until the contract expires) regardless of whether or not a new product is added to the product mix, whether or not a machine is replaced, etc.

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 costs are **relevant** for decision-making. An example of an incremental cost is the variable production costs that will have to be incurred if an organisation decides to manufacture its inventory internally rather than to buy it from an outside supplier.

For example, Spencer's Studio (Pty) Ltd. is a hairdresser that is considering mixing its own hair colour products instead of buying them from the current supplier. If Spencer's Studio (Pty) Ltd. manufactures its inventory internally, this will lead to variable production costs in terms of the ingredients for the hair colour products, possible variable labour costs for mixing the products, and overheads (eg the additional electricity required to heat some of the ingredients). These costs will not have to be incurred if Spencer's Studio (Pty) Ltd. chooses the alternative of staying with the current supplier. These costs will be an additional cost if the manufacturing option is selected and they will lead to a future cash outflow when the suppliers of the ingredients, the labourers mixing the ingredients, the municipality providing the electricity, etcetera all have to be paid.

A non-cash flow item such as depreciation will *not* qualify as an incremental cost even if it differs between alternatives and is charged/written off in the future over the life of the asset. It is **not** a cash outflow.

An incremental cost can also be referred to as a **differential** cost.

NOTE

Incremental costs and *marginal* costs are two different concepts: a marginal cost indicates by how much costs in total will increase if a ***single*** *additional unit* is produced. This is a term usually used by economists. We will be using the term 'incremental costs', because we plan to produce more than one additional unit.

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.

Incremental income is **relevant** for decision-making. For example: assume an organisation currently manufactures its own inventory. If the organisation now decides to buy its inventory rather than to manufacture it, it may end up selling its manufacturing equipment. In this case, the selling price (net proceeds) of the manufacturing equipment will be incremental income.

Activity 26.1

The following information applies to Grapes 'n Vines (Pty) Ltd., a company that produces grapes for seed and sells the grape seeds to wine farms in the Cape Town area. The harvest has been better than expected and the company now has additional seeds available to sell.

The company has to choose between selling the additional produce to its existing customer base at normal price (alternative 1) or selling the additional produce to a once-off customer in the Upington area at a higher price (alternative 2).

Regular sales (ie excluding the additional seeds) to the existing customer base amount to R700 000. Below are the total sales values (inclusive of regular sales) that will be realised if a specific alternative is selected:

	Alternative 1	**Alternative 2**
Total sales for the period	R740 000	R900 000

REQUIRED

a. Calculate the incremental income associated with each alternative and make a preliminary recommendation.

b. What other costs would you also consider before making a final selection?

Solution to Activity 26.1

a. Incremental income:

Incremental income (alternative 1) = R740 000 – R700 000
= R40 000

Incremental income (alternative 2) = R900 000 – R700 000
= R200 000

Alternative 2 should be selected because it results in the highest incremental income.

NOTE

Can you see that we ignore (deduct) the income generated by the existing customers, even though this income constitutes future cash inflows? This is firstly because the income will not change as a result of the decision (it is the same for both alternatives) and, secondly, it was already 'committed' as a result of a prior decision taken.

b. Before we recommend an alternative, we will also have to consider whether there are any other relevant costs, apart from the incremental income, associated with the two alternatives.

Examples of such relevant costs could include the following:

- Additional transport costs that may have to be incurred because the once-off customer is located in a different province from existing customers.
- The transport may also necessitate different packaging for the seeds, or the customer in Upington may specify different packaging (eg packing in 1 kg bags instead of 500 g bags).
- Selling to the existing customer base may result in certain expenses being saved; these savings may not be available if the company sells to the Upington customer.

NOTE

Qualitative (non-financial) factors also need to be considered: for example, the effect that choosing to sell to the once-off customer might have on existing customers' perception of the company's loyalty to them. See section 4 for more on this.

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*.

Avoidable costs are **relevant** to a decision.

For example, if we can avoid paying rent by buying a flat instead of renting it, the rent will be an avoidable (and therefore relevant) cost in the decision as to whether we should buy the flat or continue renting it. However, the rent can only be taken into consideration for one of the two options; in other words, it is either a cash outflow for the renting option, or a saving for the buying option.

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.

For example, if you decide to stay alone in your two-bedroom flat rather than renting out one bedroom to another person, the opportunity cost will be the amount of rent that you forfeit (reduced by the costs that you will save by not having to pay the rental agency fees).

In Financial Accounting, opportunity costs are not accounted for because they do not involve an actual expense and will never lead to a payment being made. They are, however, very important in Management Accounting and need to be considered when a decision is made. If we have to choose between alternatives, we need to take into account whether selecting a specific alternative will result in the organisation losing some of the net cash inflow that could have been earned if another alternative was selected.

NOTE

Specific applications of the principles of opportunity costs and incremental costs to materials, labour and overheads are discussed in study unit 27.

Activity 26.2

Beautify (Pty) Ltd. manufactures a limited range of organic beauty products. It has been approached by a new customer to produce a small quantity of facial creams that have been endorsed by a celebrity. The celebrity requires that a specific frangipani fragrance be used. There is only a limited quantity of the specific frangipani essential oil available that generates this specific fragrance. It is currently used in the production of a hand cream. The branded facial cream

requires five litres of the frangipani essential oil. 2 000 tubes of hand cream will not be manufactured and sold if the five litres of essential oil are redirected to the branded facial cream production process. The tubes of hand cream would have generated a contribution of R5 per tube.

The production of the branded facial cream will be done on equipment that currently has spare capacity. The cost accountant estimates the following:

	R
Raw material (excluding frangipani oil)	230 000
Other variable costs	50 000
Pro rate share of existing fixed costs allocated	80 000
Depreciation	10 000

REQUIRED

Calculate the minimum price that should be charged for the total order.

Solution to Activity 26.2

Incremental cash costs:	R
Raw material	230 000
Other variable costs	50 000
Pro rata share of existing fixed costs – not incremental	–
Depreciation – not cash flow	–
Opportunity cost (R5 x 2 000 tubes of hand cream)	10 000
Total costs to be covered (minimum price for total order)	290 000

The new customer has to compensate Beautify for the fact that it will lose the cash contribution on the 2 000 tubes of hand cream that can no longer be sold.

NOTE

The **minimum price** merely represents the point where the organisation's overall cash position will not be jeopardised by the decision. After the minimum price is paid by the new customer for the special order, the organisation is in the same cash position as before the transaction (it is not worse off). Every rand that is received that is more than the minimum price puts the organisation in a better position than it was before.

3.1 Guidelines: Relevant cash flows for decision-making

1. Incremental costs should be *deducted* from incremental income. The nature of the costs will determine what is incremental. Fixed costs do not usually change over the short-term. However, the scenario may indicate that a specific fixed cost will be

incurred. In that case, it should be included as an incremental cash outflow. If there are differences between alternatives as far as total fixed costs are concerned, these differences will result in relevant costs and will also have to be taken into account.

2. Variable costs will always be incremental if there is a change in volume (number of units).
3. Most of the short-term changes in profit will therefore be attributable to changes in contribution (sales less variable costs), but watch out for specific fixed cost increments.
4. Remember to add any opportunity costs before arriving at the final net answer for each alternative.
5. If you are comparing costs, select the alternative (option) with the lowest net cash outflow. If you are comparing profits, select the alternative with the highest net cash inflow. Again, note that it is only cash flow that is considered.

4 Quantitative and qualitative factors

When management makes a decision, they should consider both quantitative (numerical) and qualitative (non-numerical) factors.

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.

Quantitative factors (based on amounts) will be mainly about which alternative will render the highest net cash inflow, whereas qualitative factors (based on circumstances) may well include a variety of issues, all of which could influence which decision will be the most appropriate.

Examples of qualitative factors include:

- Organisational goals and objectives (long-term and budgeted).
- The organisation's responsibility to the public, environment, its employees, etcetera.
- The effect of a decision on future profits. (For example, will accepting an order at a lower price than usual create the expectation that these lower prices will apply to future orders also? Or will these lower prices create the impression that product quality has been compromised?)
- Relationships with customers/suppliers.
- The consideration of potential alternatives to the decision under consideration.

As financial managers and management accountants we need to realise that organisations should no longer take decisions purely on the basis of financial considerations. Requirements such as those contained in the *King III* report require companies and other entities to also consider the impact of their actions on other stakeholders, the wider community and the environment. This means that a profit company's overall goal should be the pursuit of long-term, *sustainable* wealth creation and not short-term optimisation only.

NOTE

In MAC2601 our focus will be on the calculations (the quantitative factors). However, you do need to be able to identify qualitative factors that may influence decision-making in a given scenario. If we provide you with some background information about the effect (on the business, the public, etcetera) of different options, we usually expect you to comment on these different options.

You will learn more about stakeholders and risk management in your MAC2602 module.

5 The comprehensive and differential (or incremental) methods

Many decisions can be made by adopting either of the following approaches:

- A **comprehensive** approach (calculating the total income and costs **of each alternative** and comparing the net cash inflow or outflow associated with the different alternatives). When we use the comprehensive approach, we can determine which alternative will render the highest net cash inflow by calculating the total net inflows for each alternative and comparing the results.
- A **differential (or incremental)** approach (taking into consideration only income and costs that are **different from one alternative (the base alternative)**).

DIFFERENTIAL (INCREMENTAL) APPROACH TO RELEVANT COSTING

When we use the *differential (or incremental) 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).

For the purposes of MAC2601, the differential approach is the more important approach because, in some instances, not all income and expenses relating to a specific alternative will be given in a question. This means that you will have to be able to identify to what extent incomes and costs will change if a different option is selected.

Net relevant income/(cost) associated with selecting a specific alternative rather than another can be calculated as follows:

Net differential relevant income/(costs) = difference in all items of relevant income – difference in all items of relevant costs

NOTE

Remember that leaving things as they are (ie doing nothing) could also be an alternative (eg if I have to decide whether or not to add a new product to my existing product range). One alternative will be to add the new product, whereas the other alternative will be to keep things just as they are (remain with the current range of products).

In Activity 26.3 below, we will see that the decision in itself should not be influenced by whether the comprehensive or incremental approach is followed.

Activity 26.3

By changing suppliers, Tricycles and Bicycles (Pty) Ltd. can buy the same brand of mountain bike at R100 per bicycle less than previously.

In an attempt to retain Tricycles and Bicycles (Pty) Ltd. as a customer, the existing supplier has offered a 15% discount to Tricycles and Bicycles (Pty) Ltd.

Tricycles and Bicycles (Pty) Ltd. has estimated that the demand for mountain bikes in April 20X4 will be 120 bicycles and plans on buying 120 mountain bikes from a single supplier on 1 April 20X4. The company has calculated that it could buy the 120 mountain bikes for April 20X4 from the existing supplier at a total cost of R127 500 (after discount).

Tricycles and Bicycles (Pty) Ltd. sells mountain bikes at R2 500 each. There was no opening or closing inventory for April 20X4.

REQUIRED

a. Calculate the net relevant cash flows associated with each of the following two alternatives:
   i. Continue buying mountain bikes from the existing supplier
   ii. Buy the mountain bikes from the new supplier

b. Based on your answer in a, recommend to the management of the company whether they should buy the 120 mountain bikes from the existing supplier or from the new supplier.

c. Calculate the differential cash flow that results from the change in suppliers.

d. Based on your answer in c, recommend to management whether they should buy the 120 mountain bikes from the existing supplier or from the new supplier.

Solution to Activity 26.3

a. Net relevant cash flow (comprehensive approach) associated with the two alternatives:

	i.	**ii.**
	R	**R**
Total income irrelevant	–	–
Purchase expenses,	(127 500)	(138 000)
Net cash flow	(127 500)	(138 000)

b. Alternative i. – remaining with the existing supplier – will render a net cash outflow that is 127 500 – 138 000 = R10 500 less than alternative ii. – changing suppliers. The recommendation, therefore, is that the company continues to buy mountain bikes from the existing supplier.

c. The differential cash flow involved with selecting alternative ii. can be calculated as follows:

		R
Savings of R100 per bicycle	120 x R100	12 000
Less:		
Opportunity costs		
(forfeiture of the 15% discount) ③	120 x 0,15 x R1 250②	22 500
Net cash disadvantage if alternative ii. selected		(10 500)

d. Selecting alternative ii. – changing suppliers – will result in a net incremental cash outflow of R10 500. We therefore recommend (from a quantitative perspective only) that the company selects alternative i.

Explanatory notes

① Income

Sales if mountain bikes are bought from	
existing supplier	= 120 x 2 500
	= R 300 000
Sales if mountain bikes are bought	
from new supplier	= 120 x 2 500
	= R 300 000

NOTE

Since there is no difference in the selling price or quantity sold between the two alternatives, the sales constitute an irrelevant cash flow and can be ignored.

② Expenses

i. Cost of purchases if mountain bikes are bought from **existing supplier**

= R127 500 (given – already after 15% discount)

ii. Cost of purchases if mountain bikes are bought from **new supplier**:

First calculate the cost of the bicycles before the discount was offered:

Cost of 120 bicycles if bought from existing supplier (before discount)

= R127 500 x 100/85

= R150 000

This amounts to 150 000 / 120 = R1 250 per bicycle.

The bicycles can thus be bought from the new supplier at R1 250 – R100 = R1 150 each.

The cost of purchases if the mountain bikes are bought from the new supplier will thus be R1 150 x 120 = R138 000.

Neither of the alternatives resulted in any other expenses being incurred.

③ The differential approach is based on changing suppliers. Therefore the discount which would have been received if alternative i. was selected will be forfeited. This represents a cash inflow which is given up because another alternative is selected, and becomes an opportunity cost of alternative ii.

NOTE

Note that the difference in cash outflows are exactly the same whether we compare the total cash flows of each alternative, or whether we calculate the differential impact associated with selecting one alternative rather than another. In this case we were comparing costs, so you had to select the alternative with the lowest outflow.

The differential approach is shorter; it saves time, but the margin for error is greater. Before you decide to use the differential approach, you really do need to know what you are doing and what cash flows are subtracted from what. It is very easy to make a sign error (reflect a net outflow erroneously as a net inflow). Unless the question specifically asks for the differential approach, or it is impossible to use the comprehensive approach in the specific question, we recommend that you use the comprehensive approach in MAC2601. Once you have had more practice, you can attempt the differential approach.

6 Summary

In this study unit, you learnt the following:

- To be relevant, a cost or income should be paid or received in cash, should relate to the future, and should differ depending on the alternative chosen.
- Sunk costs are irrelevant costs.
- Opportunity costs are relevant costs.
- Decisions should be based on both quantitative and qualitative factors.
- The comprehensive approach can be used to determine which alternative will render the highest net cash inflow or the lowest net cash outflow.
- The incremental approach can be used to determine whether selecting a specific alternative will result in a net cash benefit (and therefore whether this alternative will render a higher cash inflow, or lower cash outflow than another alternative).

In the next study unit we are going to have a closer look at how to determine the relevant costs of material, labour and overheads in short-term decision-making scenarios.

QUESTION 1

Sticky Situation (Pty) Ltd. manufactures toothpicks and sosatie (kebab) sticks. The company uses the same type of wood for manufacturing both products and could only acquire 500 kg of this type of wood as input for manufacturing during March 20X6. There was no opening inventory at the beginning of March 20X6.

The March 20X6 demand and selling prices for the company's two products were estimated to be as follows:

Product	Quantity	Contribution per kg
Toothpicks	400 kg	R10
Sosatie sticks	600 kg	R8

It has been estimated that 10% of wood used in the production process will result in unusable sawdust no matter which product is being manufactured. The company's manufacturing equipment only has two settings – it can only be preset to manufacture toothpicks and sosatie sticks in the ratio of 2:1 or 2:3 (based on kilograms). Each month, only one or the other setting can be selected. In other words, the settings are not interchangeable during the month.

Whichever setting is selected will have no impact on the company's fixed costs or on the selling price per unit or variable cost per unit.

REQUIRED

Determine which setting should be selected by doing a comprehensive comparison and a differential comparison.

QUESTION 2

Bryan Havanah wants to start playing golf and has to decide whether to join Green Bear Golf Club or to play there as a non-member. Bryan plans to buy golf clubs to the value of R7 000.

Membership fees are R3 000 per year. Members' rates per round are R80 and non-members' rates R130. Bryan intends to play 40 rounds this year.

Tees and balls cost an average of R25 per round. At current oil price levels, fuel for driving to and from the course costs R20 per return trip.

REQUIRED

a. Identify all the variable costs in the scenario that are relevant to the decision whether or not Bryan should join the club.
b. Identify all the fixed costs in the scenario that are relevant to the decision whether or not Bryan should join the club.

c. Advise Bryan on the minimum number of rounds he has to play this year to make the investment in membership worthwhile.

d. Name a qualitative factor that may influence Bryan's decision about whether or not to join the club.

e. Provide an example of a related decision that Bryan might have to make and to which the cost of the golf clubs will be relevant.

Solution to Self-assessment Activity

QUESTION 1

- 500 kg of wood will render only (100 – 10)/100 x 500 = 90/100 x 500 = 450 kg of output owing to the 10% wastage that will occur.
- The company can therefore manufacture a total of 450 kg of product in one of the pre-determined ratios.
- If the 2:1 machine setting is used, production in March 20X6 will be as follows:

  Toothpicks: 2/3 x 450 = 300 kg

  Sosatie sticks: 1/3 x 450 = 150 kg

- If the 2:3 machine setting is used, production in March 20X6 will be as follows:

  Toothpicks: 2/5 x 450 = 180 kg

  Sosatie sticks: 3/5 x 450 = 270 kg

- Demand exceeds production for both toothpicks and sosatie sticks, which means that the company will not experience any difficulties in selling its output if either of the two machine settings are used.

  Comparing the two options:

	Comprehensive		**Differential**	
	2:1	**2:3**	**If 2:1 implemented**	**If 2:3**
	R	**R**	**R**	**R**
Contribution from toothpicks 2/3 x 450 = 300 kg x R10 2/5 x 450 = 180 kg x R10	3 000	1 800	1 200	(1 200)
Contribution from sosatie sticks 1/3 x 450 = 150 kg x R8 3/5 x 450 = 270 kg x R8	1 200	2 160	(960)	960
	4 200	3 960	240	(240)

Recommendation:

The 2:1 setting generates the highest net cash inflow based on contribution and this is therefore the setting that should be selected.

A differential comparison which was based on selecting the 2:1 setting indicated a net R240 **improvement** in net cash flow compared with the alternative. This confirms the 2:1 setting as the optimum. This represents R4 200 less R3 960.

A differential comparison which was based on selecting the 2:3 setting indicated a net R240 **deterioration** in cash flow compared with the alternative. This indicates that the 2:3 setting should be rejected in favour of the alternative (2:1).

QUESTION 2

a. Difference in variable course fees per round (R130 – R80) R50
40 rounds will therefore lead to a relevant cost of 40 x R50 R2 000

NOTE

The R25 per round for tees and balls and the R20 per round for fuel are irrelevant to the decision, because these costs will be incurred independent of whether Bryan joins the club or not.

b. Membership fees R3 000

NOTE

The R7 000 cost of the golf clubs is irrelevant to the decision, because this cost will be incurred independent of whether Bryan joins the club or not.

c. R3 000 / R50 = 60 rounds

60 rounds as non-member	(60 x R130)	R7 800
60 rounds as member (60 x R80) + membership fees	(R4 800 + R3 000)	R7 800

Alternatively:

Cash outflow if non-member for 40 rounds (40 x R130) =			R5 200
Cash outflow if member for 40 rounds (40 x R80) + R3 000 =			R6 200
Membership costs an incremental if only 40 rounds are played			R1 000
Incremental cost saved per round			R50
∴ Incremental rounds required to justify membership	(1 000 / 50)		20
∴ Minimum rounds to justify membership will be	40 + 20	=	**60**

d. Whether membership of the club will give Bryan exclusive rights that are not associated with non-membership – for example, the right to make bookings for busy Saturdays and the right to enter the club championships.

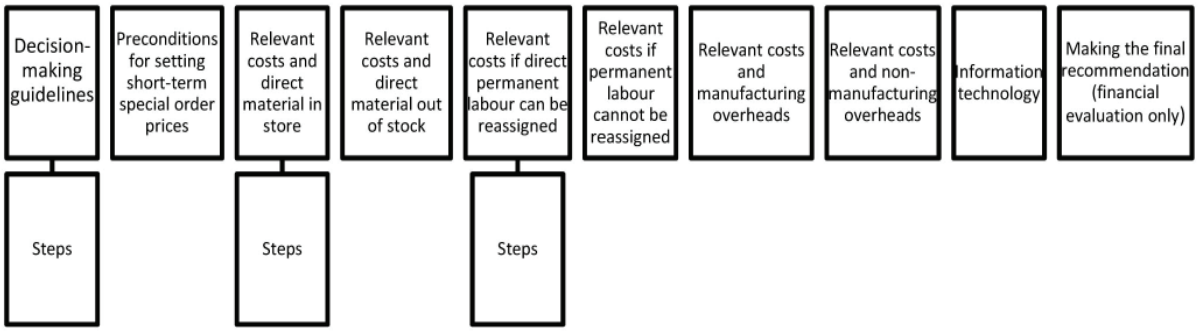
e. Bryan has to decide whether he should, in fact, start playing golf. If he decides not to take on the sport, he will not have to buy the clubs and will 'save' R7 000. All the other costs (membership, round fees, balls and tees, travelling cost) will also become relevant, because all these costs will be saved if he decides not to play golf at all.

   This option could also be compared with the option of taking up another sport (eg squash).

STUDY UNIT 27

Short-term decision-making (special orders)

In this study unit



1 Introduction

In Study unit 26, you learnt how to distinguish the information that is relevant to a specific decision from the information that is irrelevant to the decision.

Many day-to-day decisions need to be made as short-term opportunities or threats arise, and we refer to these decisions as short-term or operating decisions. For example, an organisation may have to decide whether to obtain additional, temporary labour to be able to manufacture enough additional units of its product to meet a once-off order of a customer. The organisation also has to determine a suitable price for the once-off order (also referred to as a special order).

In this study unit, we will provide you with some guidelines for making the final decision. We will then look into relevant costs in more detail, specifically with regard to direct material, direct labour and manufacturing overheads – the three elements of manufacturing costs – and how these influence the short-term decisions that need to be taken.

2 Decision-making guidelines

Management of a business obviously involves a great deal of decision-making and management accountants should be able to recommend appropriate decisions in circumstances characterised by risk and uncertainty (more on risk and uncertainty in topic 12).

When recommending a decision, one should generally ask the following questions (or follow the steps below):

1. What do I want to achieve by making the decision?

For example, I may want to achieve one or more of the following:

- increase profits
- improve the liquidity of the business over the next year
- gain market share in general
- win over a specific large client from a competitor

2. What options do I have?

For example, if I find that my product line of bottled water is not profitable, I could consider the following options, among other things:

- closing down the water bottling plant completely and selling the water rights
- using the available bottling plant and water resources to manufacture fizzy cool drinks instead of bottled water
- outsourcing the bottling of the water to a low-cost contractor

Innovation could be very important in this regard.

NOTE

It is important for a management accountant to be able to distinguish which information will be relevant to a specific decision. The financial comparison should be based on all relevant cash flows for all the options.

3. What are the advantages and disadvantages of each of my options?

Information needs to be collected about each of the options available to the organisation. For example, closing down a water bottling plant may lead to an obligation for the company to rehabilitate the environment it has polluted by its current production activities. However, the possibility of selling the water rights may present the company with a lucrative opportunity. We have discussed some of the qualitative factors that should be considered in section 4.

NOTE

Short-term decisions may also have long-term implications. For example, if the price of the once-off order is too low, this may create the illusion among customers that the company's products are usually overpriced and may lead to downward pressure on prices (and therefore profit margins) over the longer term.

4. Which option is the preferred one?

Taking into consideration all the relevant information, which option will meet my needs or objectives best? Are some of the options too risky for my business? Which option will bring in the highest contribution per unit of the limiting factor (refer to Study unit 28)?

NOTE

Remember: only those incomes and costs that differ between the options involved, and which will result in a future cash inflow or outflow will be relevant to the decision.

For example, an organisation that usually only sells medicine in the private market wants to respond to the government's call for tenders (say the government decided to purchase certain medication). To determine the optimal selling price over the short term, the organisation should be able to calculate the relevant costs associated with the offer. Cost information is very important in determining prices for special orders.

The absence/presence of production constraints will have the following effect:

- If no production constraints exist → Only the variable costs of producing and selling the special order units will be relevant to the short-term pricing decision.
- When a production constraint exists → The organisation will also have to take into account any opportunity costs associated with giving up some of its sales in the private market.

Since fixed costs are irrelevant in the short-term, we will usually not take fixed costs into consideration when determining the optimal selling price **unless** the scenario indicates that specific fixed costs increase or the total fixed costs increase as a result of the special order.

It is important to note that the organisation should not accept the government offer if the selling price to the government will influence selling prices in the private market in the future.

5. What actions should be taken for the decision to be carried out?

In practice this means what needs to be done when, where, by whom and how in order to apply the decision. How will this be communicated to all the parties involved?

3 Preconditions for setting short-term special order prices

Since special orders are usually only priced to cover short-term incremental costs, a special order is usually priced below the normal market price for the product. These 'lower' prices should only be quoted under the following conditions:

1. **Spare capacity exists**. If capacity has an alternative use, opportunity costs should be included. However, the organisation needs to make sure that long-term relationships with existing customers will not be damaged (ie owing to the organisation's inability to fulfil all orders from existing customers in order to meet the short-term order).

2. This is a **once-off price**. The customer should not expect repeat business at the same preferential price. If the customer buys more in the long-term, the customer should pay the higher 'normal' price that covers the cost of the fixed infrastructure (usually irrelevant for short-term pricing, resulting in the lower 'special' price).
3. The special order customer should ideally be **located in a different market** from the organisation's regular customers. This is because regular customers might be upset about the lower price and/or start to demand the product at the same lower price. This could obviously damage the organisation's long-term sustainability.
4. The spare capacity should only be **utilised for a short period** of time. The spare capacity should be filled with better priced long-term opportunities, or the decision should be taken to reduce capacity (by taking some machines out of commission, closing part of the plant, etc).

We will now look in more detail at how specific relevant costs that might arise as a result of the short-term decision (special order) under consideration are determined.

4 Relevant costs and direct material in store

If material has been bought in the past and is in store, the costs of the purchase will be a sunk cost and therefore irrelevant. However, there may be certain future income and/or costs related to these materials that may have to be taken into account when a decision is made.

For example, such decisions could involve:

- whether to use these materials in the production process and, if so, for which products
- whether to sell these materials as they are
- whether to discard these materials (get rid of them, sometimes incurring disposal costs)

If an organisation has to make a decision about whether a specific product or batch of products should be manufactured from the materials on hand, the steps below provide a starting point regarding relevant costs:

Step 1: Determine the costs of replacing the materials (if applicable)

If the materials *can and should be* replaced, calculate the costs at which these materials can **currently** be purchased. These will then be the relevant costs.

An indication that materials can and should be replaced is when they are used regularly in the manufacturing process. If an organisation uses a certain material for the project under consideration, this material will have to be replenished at current prices in order to satisfy the factory's existing demand for it (so that the factory can use it to meet the regular production requirements). There is therefore a cash outflow (at current market prices) as a result of the decision to execute the project/option.

Step 2: Determine whether there is an alternative use for the material in store

Scrutinise the information provided in a question to see whether there is any alternative use for the material. If there is an alternative use, there will be relevant costs (opportunity costs); if there is no alternative use, there will be no relevant costs involved.

For the purposes of this module, we will assume that the sale of *obsolescent* materials also represents an 'alternative use'.

Inventory that becomes out of date or useless is referred to as 'obsolescent'. This may be the result of changes in the technology (eg computer or cell phone parts), changes in fashion (eg clothing, interior decorating items), or ageing (eg food stuff or chemicals) etcetera. Sometimes, highly specialised material or parts are obtained in order to manufacture a specialised product for a specific customer. Any excess items not used become obsolescent for the simple reason that they cannot be utilised in the normal production process (of other products).

Step 3: Determine the amount of opportunity costs (if applicable)

If the materials *cannot* be replaced (scarce or limited supply available) or *do not have to* be replaced, calculate the opportunity costs associated with giving up the alternative use of the materials.

Make sure that you **adjust the opportunity cost for any savings** that could be made by giving up the alternative use. The net opportunity cost will then be the relevant costs.

For example: material X is not used regularly and excess material (not used) becomes toxic after two weeks. The material X currently in store has no other application. At this stage it has to be disposed of and removed from the premises by a specially authorised waste management company. This costs R2 000 per removal. An option now becomes available where material X will be utilised in the manufacture of a special once-off product. The relevant cost of material X for this product would be determined as:

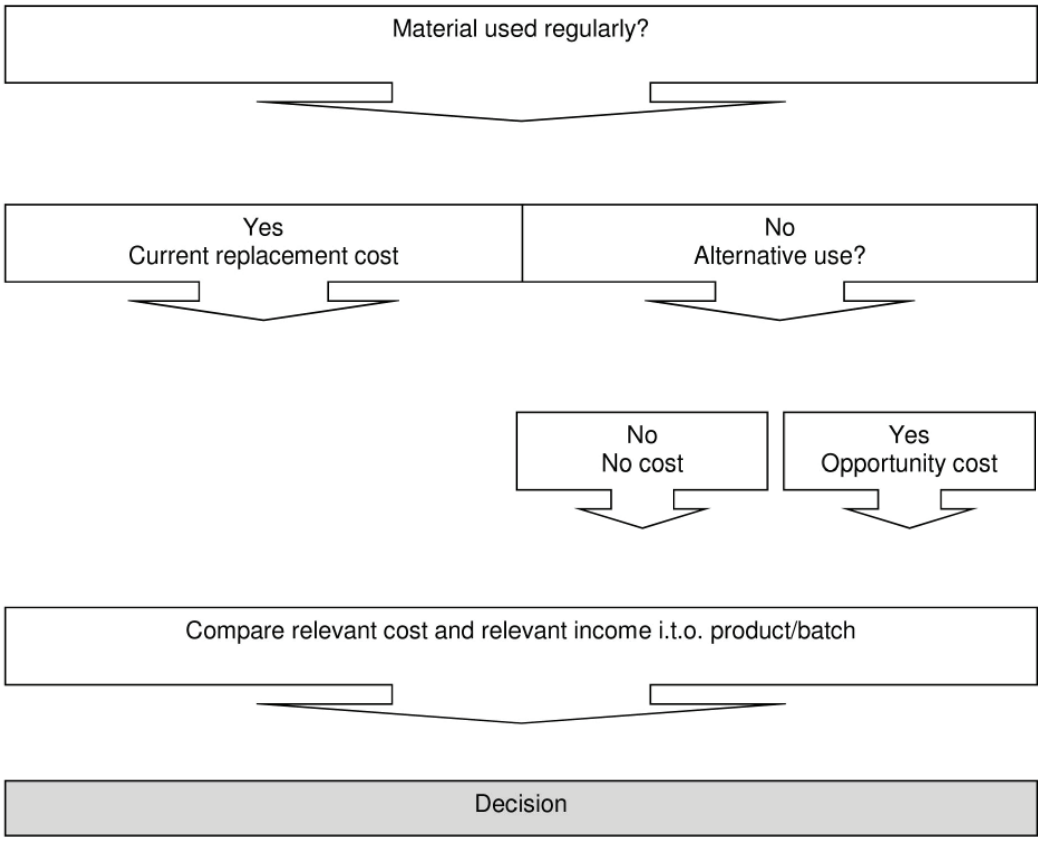
Opportunity cost – cash contribution from alternative application (none)	Rnil
Saving in disposal cost	R2 000
Net opportunity 'income'	R2 000

In this case, the company could reduce the contract price of the once-off order by R2 000 without compromising its cash position.

NOTE

The existence of an alternative use for the material determines *whether* there will be any relevant costs or not, whereas the availability of replacement material determines the *amount* of the relevant cost, if applicable.

Diagrammatically, the decision can be summarised as follows:



Source: Author, 2012

FIGURE 27.1: Material in inventory – suggested steps to arrive at a decision

5 Relevant costs and direct material out of stock

If the material required for the manufacturing of a specific product or batch of products is not on hand (out of stock), the organisation will have to buy these materials in order to make the manufacturing possible. The cost (purchase price) plus any transport costs of the material will be relevant to the decision whether to manufacture the product(s) or not, unless the materials will have to be purchased whether the specific product or batch is manufactured, or not. (In other words, there is no difference in the material requirements of the two alternatives.)

Activity 27.1

Rockets and Robots (Pty) Ltd. manufactures educational toys that teach children about science. An educational toy shop has enquired whether the company will be willing to manufacture a special batch of robot men for the shop's 10th birthday celebrations. The order will require a special type of part to be used, called a robot upper, which can be branded with the customer's name. The shop wants to order 100 robot men, each requiring one robot upper. The order must be completed in total.

Below are mutually exclusive scenarios that could be applicable to Rockets and Robots (Pty) Ltd. regarding the uses and availability of the robot uppers.

i. The company has 100 robot uppers on hand to meet the order. However, these 100 uppers were intended for use in the production of robot men for another customer, but the company can replace these uppers by buying them from a supplier at R8 each.

ii. There are 100 robot uppers on hand which will have to be discarded if they are not used for the shop's order: this is because robot men in general have been redesigned to use a more advanced upper body (as a result of certain improvements in the technology used). The toy shop is the only customer that is willing to still accept the old technology and only for this specific order.

iii. There are 100 robot uppers on hand which can be sold for scrap metal at 50c each. The company cannot use these uppers for other robot men than those ordered by the shop; this is because robot men in general have been redesigned to use a more advanced upper body (as a result of certain improvements in the technology used). The toy shop is the only customer that is willing to still accept the old technology and only for this specific order.

iv. The company has 100 robot uppers on hand to meet the order. However, these 100 uppers were intended for use in the production of robot men for another customer, but the company can replace some of these uppers by buying them from the only supplier of these items (at R8 each). Unfortunately, the supplier only has 40 robot uppers available. The other customer would have paid R80 per robot man and conversion costs and other materials would have cost the company R35 per robot man.

REQUIRED

a. Indicate for each of the above cases whether there will be relevant material costs involved and motivate each of your answers.

b. Calculate the total relevant cost of materials in each of the above cases.

Solution to Activity 27.1

a. i. Yes (alternative use exists)
   ii. No (no alternative use – obsolete due to technology change)
   iii. Yes (selling the material is also an alternative use)
   iv. Yes (alternative use exists)

b. i. R8 x 100 = R800
   ii. Not applicable
   iii. R0,50 x 100 = R50
   iv. 40 robot uppers can and should be replaced. The relevant cost associated with these 40 uppers will be R8 x 40 = R320. The remaining 60 robot uppers cannot be replaced. The relevant cost associated with these 60 uppers will be the lost contribution of (R80 – R35) x 60 = R2 700. This is the total contribution that will be forfeited for the robot men that the company will not be able to sell to the other (existing) customer if the shop's order is accepted. Total relevant cost for scenario (iv) = R320 + R2 700 = R3 020.

NOTE

Although we are only discussing the use of the robot uppers, the opportunity cost of the 60 robot men is based on the contribution generated by the completed product (ie the robot man). This is because the robot man cannot be completed without the robot upper. In the absence of an upper, the whole unit cannot be completed and a sale cannot be generated.

6 Relevant costs if direct permanent labour can be reassigned

In the short-term, the normal salary and wage costs of *permanent* labour will have to be incurred no matter what activities the employees spend their normal working hours on. These costs will therefore be irrelevant to a decision about whether or not to manufacture a specific product or batch of products. However, there may be certain future income and/or costs related to these employees that may have to be taken into account when a decision is made. For example, decisions regarding the following:

- whether to use the normal time of these employees in the production process and, if so, for which products
- whether to let these employees work overtime
- whether to make use of temporary (casual) labour in addition to the permanent labour

If a decision about whether a specific product or batch of products should be manufactured involves labour, the steps below could provide a starting point for determining the relevant cost of the labour:

Step 1: Determine whether there is idle time

Scrutinise the information provided in a question to see whether you can determine if the normal time of the permanent employees can be used for anything other than the manufacturing of the specific product (or batch of products). If there is an alternative use for the normal time required, there will be relevant costs; if there is no alternative use (they are idle), there will be no relevant costs involved.

For example, if employees are currently idle, their wages or salaries will still have to be paid. There would thus be no *incremental* cash outflow if they are now reassigned to the manufacturing of the specific product or batch.

Step 2: Determine the costs of replacing the labour where there is no idle time (if applicable)

If additional labour is required to replace the normal time used and it is possible for the organisation to let existing employees work overtime or to appoint casual (temporary) workers to do this work, calculate the costs at which the additional labour can be acquired. These costs will then be the relevant costs.

Step 3: Determine the amount of opportunity costs if no replacement available (if applicable)

If the organisation *cannot* acquire additional labour, calculate the opportunity costs associated with giving up the alternative use of the permanent labour. Make sure that you adjust

the opportunity cost for any savings that could be made by giving up the alternative use. The net opportunity cost will then be the relevant costs.

NOTE

The existence of an alternative use for the permanent labour determines whether or not there will be any relevant costs, whereas the availability of replacement labour (overtime/ casual labour) determines the amount of the relevant cost, if applicable.

7 Relevant costs if permanent labour cannot be reassigned

If the labour required for the manufacture of a specific product or batch of products cannot be obtained from the permanent labour available, the organisation will have to make use of overtime or employ casual workers to make the manufacturing possible.

The cost of the labour will be relevant to the decision whether or not to manufacture the product(s), unless the labour will have to be acquired anyway – that is, whether or not the specific product or batch is manufactured (i.e. if the same amount and type of additional labour will have to be acquired in the case of both alternatives.)

Activity 27.2

Paper and Pens (Pty) Ltd. manufactures and sells stationery and different types of paper. The company is considering whether to accept an order for 50 000 felt tip pens or not. Manufacturing these pens does not form part of the company's normal monthly activities. Permanent employees are paid a fixed salary per month. Overtime is paid as and when the need arises.

The order will require 30 hours of labour.

Below are mutually exclusive scenarios regarding uses and availability of permanent labour that could apply to Paper and Pens (Pty) Ltd.

i. The company can reassign 30 of the normal hours of its permanent employees to manufacture the 50 000 felt tip pens. However, these 30 hours were intended for the production of pencils for another customer. The company can replace the 30 hours with overtime at a total rate of R80 per hour.

ii. The company's permanent employees have enough idle capacity to produce the 50 000 felt tip pens in normal hours.

iii. The company can reassign 30 of the normal hours of its permanent employees to manufacture the 50 000 felt tip pens. However, if the 30 hours are not used for the production of pencils as originally planned, contribution of R7 500 will have to be forfeited.

iv. The company can only reassign 20 of the normal hours of its permanent employees to manufacture the 50 000 felt tip pens. If these 20 hours are not used in the production of pencil orders as originally planned, contribution of R5 000 will have to be forfeited. The remaining hours required can be acquired by means of casual labour at R60 per hour.

REQUIRED

a. Indicate whether there will be relevant labour costs involved in each of the above cases and motivate each of your answers.

b. Calculate the total relevant cost of labour in each of the above cases.

Solution to Activity 27.2

a. i. Yes (alternative use exists, replacement cost is incremental)
   ii. No (no alternative use)
   iii. Yes (alternative use exists, opportunity cost – no replacement)
   iv. Yes (alternative use exists, incremental cost plus opportunity cost)

b. i. 30 x R80 = R2 400
   ii. Not applicable
   iii. R7 500
   iv. R5 000 + [(30 – 20) x R60]
   = R5 000 + R600
   = R5 600

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8 Relevant costs and manufacturing overheads

In order to determine whether or not an item of manufacturing overheads is relevant to a decision, we will have to consider whether the cost would still be incurred if the specific alternative is not selected (as with other relevant costs).

The same overhead cost item may be relevant under certain circumstances, but irrelevant in another situation. For example, let us say an organisation needs to decide on whether to keep on manufacturing a specific product, or to rather buy it from an external supplier. The cost of renting a building for purposes of manufacturing the specific product will be relevant to the decision if:

- the rent can be avoided should the company decide to buy the specific product, or
- the building can be used for one of the other operations of the organisation should it not be used for manufacturing the specific product anymore.

Activity 27.3

Lots of Huts (Pty) Ltd. manufactures and sells pre-fabricated huts to its customers, who use these huts for residential and storage purposes. The company rents a building from another company at R40 000 per month. The rental contract is for the period 1 January 20X4 to 31 December 20X4 and it is currently 1 May 20X4. Manufacturing takes place in this building.

The company is currently investigating whether it will be more economical to buy the pre-fabricated huts from a low-cost competitor and fit proper windows instead of the poor quality windows fitted by the competitor.

Below are mutually exclusive scenarios for the rental contract (overheads) that could apply to Lots of Huts (Pty) Ltd:

i. The rental contract cannot be cancelled early, but the building can be used for administrative purposes. Other premises will have to be rented for fitting the windows, because the building is not suitable for this.

ii. The rental contract cannot be cancelled early, but the building can be used for the purposes of fitting the windows.

iii. The rental contract can be cancelled by giving 24 hours' notice.

iv. The rental contract can be cancelled by giving two months' notice.

REQUIRED

Indicate for each of the above scenarios whether the cost of **renting the building that is currently used for manufacturing** will be relevant to the decision to buy rather than manufacture the pre-fabricated huts. Explain your answer.

Solution to Activity 27.3

i. Irrelevant. The costs of the current rental will have to be incurred no matter which alternative is selected. It is a committed cost. The costs of renting other premises for fitting the windows will, however, be relevant.

ii. Irrelevant. The costs of the current rental will have to be incurred no matter which alternative is selected. It is a committed cost.

iii. Relevant. Rental costs will be avoided if the company decides to buy the pre-fabricated huts. It is an opportunity 'income' (cash inflow).

iv. Relevant after the notice period has passed. The cost incurred from 1 January to 1 May 20X4 (4 x R40 000 = R160 000) is a sunk cost and will therefore be irrelevant to the decision. Also, the costs associated with the two months before the rental contract can be stopped (2 x R40 000 = R80 000) cannot be avoided and therefore will be irrelevant to the decision. They are committed. By cancelling the contract, costs of 6 x R40 000 = R240 000 can be avoided if the company buys its inventory and is therefore relevant to the decision. These potential cost savings could be seen as an opportunity 'income' (cash inflow).

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9 Relevant costs and non-manufacturing overheads

Non-manufacturing overheads may also be relevant to a decision even though they are not included in inventory valuation. For example, if total head office administrative costs change as result of the decision (and result in a change in the amount allocated to a department), the change in non-manufacturing costs will also have to be considered when the specific department makes a decision.

NOTE

Be careful: there has to be a change in the amount paid to parties external to the organisation. **Simply changing the allocation** of the same amount of expenses between departments within an organisation is **not a relevant** cash flow.

For example, head office incurs R400 000 per month in the debtors' collection department. This is split equally between four departments, that is, R100 000 each. If a new line of products is implemented in one department, that department would then receive an allocation of R130 000 and the other R270 000 is split between the remaining three departments. The R30 000 increase in the head office allocation is irrelevant, because it does not constitute a change in the overall cash outflow for the organisation.

If, however, the new product line results in another collection clerk being appointed at a cost of R20 000 per month, this would constitute an incremental cash outflow and would be a relevant cost for the decision regarding the new product line.

10 Information technology

It is important that an organisation's information system enables relevant information to be isolated from irrelevant information when a decision needs to be made. For example, a system that only provides the totals of manufacturing and non-manufacturing overheads is inadequate, because some of the items included in these totals may be *individually* relevant to a specific decision and others not. Instead, reports with detailed information about different cost items should be available from the system.

NOTE

You will learn more about Management Information Systems (MIS) in your Accounting Information Systems (AIN) modules.

11 Making the final recommendation (financial evaluation only)

Once you have determined all the relevant cash flows and opportunity costs for each option or alternative, compare the net cash inflows (outflows).

If the relevant cash inflows exceed the relevant cash outflows associated with the specific option, the option is obviously worth considering. If more than one option has a net cash inflow, recommend the option with the highest net cash inflow.

NOTE

It is important that qualitative and long-term implications also be considered before a final decision is made.

Activity 27.4

Juice Extractors (Pty) Ltd. is the leader in the South African market for sparkling fruit juice production and sales. A juice producer in Namibia is experiencing temporary difficulties with its juice extractor equipment and has asked Juice Extractors (Pty) Ltd. to bid for the delivery of 100 000 bottles of fruit juice on its behalf over the month in which the equipment will be repaired.

The Namibian producer has also received a tender from a company in Botswana at R10 per bottle.

Each bottle of fruit juice produced by Juice Extractors (Pty) Ltd. requires fresh fruit at a cost of R3,50 and variable extractor machine time (at a cost of R12 per hour) of 10 minutes.

Three of the factory workers employed by the company have been reallocated to the bottling task, because otherwise they would have been idle. Each of these employees receives a gross monthly salary of R10 000 and can bottle 100 bottles of fruit juice per day.

Juice Extractors (Pty) Ltd. will be able to manufacture the 100 000 bottles of fruit juice without having to give up any of its production for the South African market.

REQUIRED

Indicate a suitable range of bid prices per bottle of fruit juice for Juice Extractors (Pty) Ltd.

Solution to Activity 27.4

Since the special order is for purposes of a **once-off** customer **outside of the local market**, future selling prices are unlikely to be influenced and Juice Extractors (Pty) Ltd. will **only have to cover the incremental costs** associated with the order.

The cost of the labour is irrelevant because it cannot be adjusted over the short-term (the idle workers cannot be laid off). The salaries will have to be paid independently of the number of bottles filled. The labourers are currently idle. There is **no incremental labour** cost.

Total **variable (incremental) costs** per bottle = R3,50 [material] + (10/60 x R12) [machine time]

= R3,50 + R2

= R5,50

There are **no opportunity costs** because the company has **sufficient capacity** to meet the Namibian order *and* all its South African orders.

The company has to bid at a price of **at least R5,50** because it needs to cover the relevant short-term costs. Since the competitor's offer is R10 per bottle, Juice Extractors can decide upon a price per bottle of **less than the competitor's R10** to make the tender attractive to the Namibian company, but no less than R5,50. The exact price to ask requires judgement, but we can say that R8 per bottle should be a reasonable selling price. A price of R8 per bottle enables Juice Extractors (Pty) Ltd. to make some profit and, at the same time, this price should be attractive for the Namibian company, given the competitor's bid price.

NOTE

- If Juice Extractors (Pty) Ltd. does not have enough capacity available for the manufacturing of the additional juice for the once-off order, it will have to give up some of its regular South African sales. This will lead to an opportunity cost (based on lost contribution) that should be built into the bid price.
- Since the event is only for a short period of time and will not be repeated, the company can make the sales if the short-term incremental costs (the variable costs per unit in this activity) are covered by the selling price.
- It is also important to note that, if accepting the order will influence the price of a bottle of juice in the South African market over the longer term, this effect would also need to be considered in the decision. Given that the sales are being made to a Namibian company, it is unlikely that the South African market will be influenced by the decision.
- After the order has been met, the spare capacity used for manufacturing the juice for the Namibian company will be free to use for potentially better priced, longer term opportunities.

12 Summary

In this study unit you learnt the following:

- Certain conditions need to be present for setting 'lower' bid prices for special orders.
- Qualitative and other long-term factors should also be considered before a final decision is made.
- If there is an alternative use for the materials required by a specific option and the materials are on hand, the relevant cost will be:
  - the replacement cost of the materials if they can and should be replaced
  - the opportunity cost associated with selecting the specific alternative if the materials cannot/does not have to be replaced
- If permanent labour will be used if a specific alternative is selected, but a different use for the labour also exists, the relevant costs will be:
  - the replacement cost of the labour if it can be replaced by casual labour or overtime work
  - the opportunity cost associated with selecting the specific alternative if replacement labour is not available
- If additional materials/labour will have to be acquired when a specific alternative is selected, the costs of the materials/labour will be relevant to the decision.
- Relevant costing principles also apply to overheads and non-manufacturing costs.

In the next study unit, we are going to look at decision-making in cases where the resources available to the organisation are limited.

QUESTION 1

Maritzburg Manufacturers (Pty) Ltd. manufactures two different products: Max and Mini. One unit of Max uses 1 kilogram of material A and 0,5 kilogram of material B. One unit of Mini uses 1 kilogram of material B and 0,5 kilogram of material C. The company usually sells 50 000 Maxs at a contribution of R30 each and 100 000 Minis at a contribution of R20 each in a month. (Assume the contribution in this case is before deduction of delivery costs.)

The company has to decide whether it should accept a once-off offer for 10 000 units of Max to be delivered in May 20X4. If the offer is accepted, the company will have to reallocate some of its available material B, intended for use in the current month's production of Minis, to the manufacturing of the once-off order of 10 000 units of Max, because all suppliers of material B are out of stock at the moment. It costs the company R0,50 per unit to deliver Max to its customers and R2 per unit to deliver Mini.

REQUIRED

Calculate the relevant cost for this once-off order from the information available.

QUESTION 2

Paper and Pens (Pty) Ltd. manufactures and sells stationery and different types of paper. The company delivered 10 000 erasers to a customer, but the customer defaulted on payment and eventually had to return the unused erasers to Paper and Pens (Pty) Ltd. The erasers cost Paper and Pens (Pty) Ltd. R3 500 to manufacture.

Some of the returned erasers can be used by Paper and Pens (Pty) Ltd. to meet an order of 5 000 stationery sets by a charity organisation that plans to distribute the sets at primary schools in the rural areas of the Free State. Each stationery set has to consist of a pencil bag with one eraser, two pencils, a pencil sharpener and a ruler.

An individual eraser can be sold for R2. The charity is prepared to pay R50 000 for the order of 5 000 stationery sets. This is 30% below the price usually charged to regular customers.

Costs of material, labour (excluding packing activities) and variable manufacturing overheads per set (excluding erasers) will usually amount to R3, R3 and R1 respectively if Paper and Pens (Pty) Ltd. manufactures the pencil bags, pencils, sharpeners and rulers themselves. However, Paper and Pens (Pty) Ltd. will have to buy the pencil bags, pencils, sharpeners and rulers from an outside supplier because its manufacturing equipment is out of order. Pencil bags cost R5 each, pencils 50c each, sharpeners 65c each and rulers R1 each.

Repairs of the equipment will cost R1 500 and will only be completed after the delivery of the stationery sets is due.

Normal time labour costs R44 per hour and casual labour R65 per hour. Overtime hours are paid at double the normal hourly rate.

Two permanent employees can be used to pack the stationery into pencil bags for the purposes of the order. Each of the two employees is expected to spend 15 normal hours packing pencil bags. One of these employees would have been idle for the full 15 hours, whereas the other employee will have to work overtime to do his part of the job.

Ignore the labour information that applied to Paper and Pens (Pty) Ltd. in Activity 27.2.

REQUIRED

a. Recommend to the management of Paper and Pens (Pty) Ltd. whether the order of 5 000 stationery sets should be accepted or not. Motivate the exclusion of any items from your calculations.
b. Briefly describe at least one other factor that should be considered.

QUESTION 3

Resorts and Sports (Pty) Ltd. is a market leader in the selling of stay-and-play packages to local tourists. Each package, priced at R1 200 per guest, offers the buyer two nights' accommodation at the Resorts and Sports Hotel, and two rounds of golf at the resort golf course.

For the first time ever, Resorts and Sports (Pty) Ltd. has been approached by an overseas tourist group with 50 members that are interested in staying and playing golf at the resort. The group has indicated that it has also approached similar resorts in South Africa and will base their decision about where to stay on the best (lowest) price offered.

Other information

Resorts and Sports (Pty) Ltd. has 100 single rooms and 50 double rooms. For the week-end that the overseas tourist group wants to come and visit, the resort has received local bookings for all 50 double rooms (two guests per room) and 60 of the single rooms. The tourist group requires single rooms for all its members.

The variable cost of a round of golf for the resort is R50 (caddy fee – included in the package) and the cost of breakfast per guest (which is also included in the package) is R30.

Greens and fairways of the golf course are maintained at a cost of R100 000 per month.

The resort has ten housekeeping employees who can each service 15 rooms (single or double) per day. The salary of each housekeeper amounts to R9 000 per month.

REQUIRED

Calculate the minimum price that the company should ask per member of the overseas tourist group. Explain the exclusion of any costs.

You may assume that local bookings may be cancelled by Resorts and Sports (ignore possible penalty costs involved in the cancellations).

Solution to Self-assessment Activity

QUESTION 1

The once-off order will result in the company not being able to sell all the Minis that it usually sells in the market. We therefore have to calculate the opportunity cost involved.

First we need to calculate how many kilograms of material B has to be reallocated to the special order. 10 000 Maxs will use 10 000 x 0,5 = 5 000 kg of material B. This material can be used to produce 5 000/1 = 5 000 units of Mini.

The total contribution associated with the sale of 5 000 units of Mini (ie contribution of

5 000 x (R20 – R2) = 5 000 x R18 = R90 000) will have to be forfeited to make the delivery possible.

However, additional delivery costs of 10 000 x R0,50 = R5 000 will have to be incurred if the short-term order is accepted.

The net relevant cost associated with the order will thus be R90 000 (forfeited contribution) plus R5 000 incremental costs, amounting to R95 000.

QUESTION 2

a. Net relevant cash inflow/(outflow)

	Relevant cost
	R
Sales of 5 000 stationery sets	50 000
Materials	(48 250)
Manufacturing cost of the erasers (R3 500 is sunk cost)	–
Opportunity cost of not selling 5 000 erasers at R2 each	10 000
Buy in costs – 5 000 pencil bags @ R5 each	25 000
– 10 000 pencils @ R0,50 each	5 000
– 5 000 sharpeners @ R0,65 each	3 250
– 5 000 rulers @ R1 each	5 000
Labour	(1 320)
– Labour not to be replaced (idle time – irrelevant)	–
– Labour to be replaced (15 hours @ R88 each)	1 320
Overheads ①	–
Net relevant cash inflow/(outflow)	430

Explanatory notes

① No relevant costs involved, because the R1 per set will not have to be incurred (variable overhead will not be incurred since the equipment is out of order and fixed overheads are not incremental in the short-run). The R1 500 repairs will have to be incurred independently of whether the order is accepted or not.

Accepting the order will lead to a R430 increase in the company's net cash flow. The order should therefore be accepted.

a. Other factors to consider:

i. Proceeding with this order would reflect well on the company's image as a socially responsible organisation.

ii. Will the charity be able to pay? Previous customer defaulted.

iii. Regular customers should not expect the same beneficial price.

iv. Delivery cost / implications of delivering to the rural areas of the Free State.

QUESTION 3

Although the packages offered to the overseas tourists will be unlikely to influence the prices which the regular clients of the resort would be willing to pay, the room capacity available is not sufficient for the entire tourist group. This means that some local bookings will have to be given up in order to free enough room capacity for the overseas tourist group. There will thus be an opportunity cost involved in meeting this special order, and this opportunity cost also needs to be taken into account when the minimum price is determined.

Only 100 – 60 = 40 single rooms have not been booked by local clients = spare capacity. The overseas tour group still needs 10 more single rooms.

The price charged will have to cover all the relevant costs (incremental costs of accommodation, breakfast and golf for the 50 tourists, as well as opportunity costs of giving up sales of 60 – 50 = 10 local packages).

The total relevant costs (using the differential approach) associated with accommodating the tourist group will be as follows:

Relevant costs for the booking	**Calculation**	**Amount**
		R
Variable cost	[R30 (breakfast) + R50 per round (golf)] x **50** guests x 2 days	8 000
Opportunity cost	Forfeit **contribution** on local sales of [R1 200 – R30 – R30 – R50 – R50] x **10**	10 400
Total relevant cost		18 400

OR

Relevant costs for the order	**Calculation**	**Amount**
		R
Increase in cost for 40 rooms	[R30 (breakfast) + R50 per round (golf)] x **40** guests x 2 days	(6 400)
Variable cost for 10 single rooms	[R30 (breakfast) + R50 per round (golf)] x 10 guests x 2 days = R1 600 This will be incurred anyway – whether on local tourists or overseas tourists – therefore **irrelevant**	–
Decrease in sales for 10 rooms	Reduction in local **sales value** of R1 200 x 10	(12 000)
Net relevant outflow		(18 400)

NOTE

The reason why we have used only 40 guests for calculating the incremental costs is that the variable costs for the remaining 50 – 40 = 10 overseas tourists will be incurred on 10 *local* tourists if the overseas tourists are not accommodated.

The following is an alternative layout for the calculations above:

Description	Calculation	Current situation (local tourists only)	Desired situation (accommodate overseas tourist group)	Difference
Sales	(160 ① x 1 200) (150 ② x 1 200)	192 000	 180 000	 (12 000)
Variable costs	(160 ① x 2 x [30 + 50]) (200 ③ x 2 x [30 + 50])	(25 600)	 (32 000)	 (6 400)
Total		166 400	148 000	18 400

① 50 x 2 = 100 guests in double rooms; 60 guests in single rooms; total local guests 160

② 50 x 2 = 100 guests in double rooms; 50 guests in single rooms; total local guests 150 (excl. the overseas guests)

③ 50 x 2 = 100 guests in double rooms; 100 guests in single rooms; total guests 200

The fixed costs associated with maintaining the golf course and the salaries of housekeepers will not be influenced by the short-term decision and are therefore irrelevant.

The approaches above are used to determine how much the resort should charge to be in the same position as before (ie contribution of R166 400). Charging the overseas tour group anything more than R18 400 will actually improve the company's current cash flow.

The minimum that Resorts and Sports (Pty) Ltd. could ask for the packages offered to the overseas tourist group is R18 400 in total. This amounts to 18 400 / 50 = R368 per guest. However, in order to still earn a profit, the company will probably ask more than R368 per guest.

NOTE

- A qualitative factor that may need to be considered in the situation is the likelihood that local tourists whose bookings are cancelled by the company may well be angry when they learn of the cancellation; this, in turn, may have a detrimental effect on the company's local business.
- In your answer to a relevant costing question you should mention which costs are irrelevant. If you do not refer to these costs anywhere in your answer, we may assume that you did not know how to treat these costs.

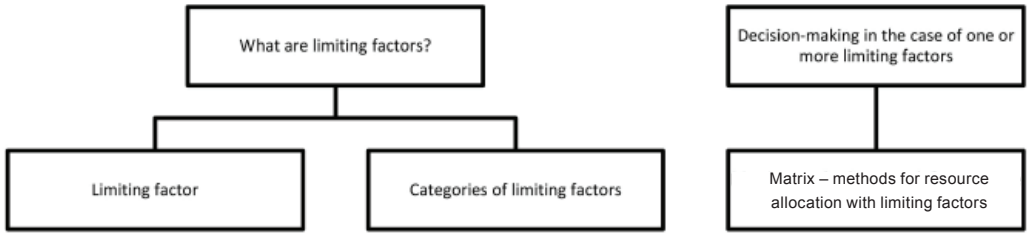
NOTE

More advanced short-term decisions and certain long-term decisions regarding normal pricing will be discussed in MAC3701.

STUDY UNIT 28

Limiting factors and the allocation of resources

In this study unit



1 Introduction

In study unit 26, we learnt about the basic principles of relevant costing as applied to short-term decision-making. In study unit 27, we have been introduced to different scenarios for determining the relevant cost of material, labour and overheads in pricing a special order.

In this study unit, we will be adding to our basis of relevant costing principles by looking in more depth at the situation where resources are scarce, especially in terms of production capacity, inventory supplies, etc. We will investigate how the organisation should allocate scarce resources where an organisation is manufacturing/selling more than one product.

2 What are limiting factors?

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 organisation from manufacturing (buying in the case of retailers) all the products it would be able to sell.

For the purposes of MAC2601, we will categorise a specific resource as one of the following:

- Inventory (units of raw materials on hand for a manufacturing organisation/goods on hand and available for sale in the case of an organisation that buys products and re-sells them at a profit)
- Human resources (labour)
- Infrastructure (machine capacity, storeroom capacity, distribution capacity)
- Capital (financial resources)

In practice, there are many constraints that relate to the above categories, all of which can limit an organisation's ability to manufacture/buy or sell products. Examples of constraints that could be experienced by a supplier of multiple products in each of the above categories include the following:

Category	Example of limiting factor
Inventory (raw material)	The organisation's suppliers have **insufficient units** on hand of one of the items that the company uses as production input for all of its products. The organisation cannot therefore meet the full market demand for all its products.
	The organisation is a retailer and its wholesale supplier limits the number of items that the organisation can buy in a specific period.
Labour	The organisation manufactures specialised products and requires **highly skilled labour** in the production processes. There are not enough appropriately qualified technicians available in the South African labour market for the organisation to meet the full demand for all its products.
	There are not enough labour hours available to complete all the production output required by customers.
Infrastructure	Water supply is limited owing to a drought. The organisation will not have sufficient water available to produce all the goods that it is able to sell in the market. (Water is used to cool down the machines – it is not a raw material input for this company.)
	The organisation manufactures and sells ice cream in different flavours and only has one machine available for mixing the ingredients. The number of litres of ice cream that the organisation can manufacture on a monthly basis is limited by the machine hours available.
	The sizes of the organisation's storerooms limit the quantity of either raw material or completed goods that can be held in store at any one time.
Capital	A retailer experiences cash flow problems and can only afford to buy a specific amount of inventory from its wholesale suppliers. The organisation has to decide which items to buy with the limited financial resources. (The same can apply to the purchase of raw material inventories for the production process.)

3 Decision-making in the case of one or more limiting factors

We have pointed out that the organisation's output may be restricted by one or more limiting factors. This prohibits the organisation from selling all the units that its customers demand. Resource allocation is therefore one of the most critical decisions that the management accountant can help to make.

The following matrix provides guidance about which approach to follow:

<table>
<tr><td colspan="5">Establish sales demand (units) of all products</td></tr>
<tr><td colspan="5">Establish extent of available resources (= feasible output)</td></tr>
<tr><td colspan="3">Feasible production output < demand</td><td colspan="2">Feasible production output > demand</td></tr>
<tr><td colspan="2">What are the factors/resources that are limiting the output?</td><td colspan="1"></td><td>Demand unlimited ①</td><td>Demand limited ②</td></tr>
<tr><td></td><td colspan="2">How extensive is the organisation’s product range?</td><td>Only produce product with highest contribution per unit</td><td>Produce products in descending order of contribution per unit</td></tr>
<tr><td>Number of limitations:</td><td>One product</td><td>Two products</td><td>Multiple products</td><td></td></tr>
<tr><td>One limitation</td><td>Limit output to resource supply ③</td><td>Rank according to contribution per limiting factor ⑤</td><td>*Rank according to contribution per limiting factor ⑤</td><td></td></tr>
<tr><td>More than one limitation</td><td>Limit output to resource with highest constraint ④</td><td>*Linear programming: ⑥
– Graphical approach
– Simultaneous equations</td><td>*Simplex tableau ⑦</td><td></td></tr>
</table>

* Please note – Shaded blocks fall outside the scope of MAC2601.

Source: Author, 2012.

Figure 28.1: Matrix – methods for resource allocation with limiting factors

NOTE

It is always important that you compare your required resources (based on total demand levels) with the resources that are actually available.

We will now discuss the various tools available that can help with this decision-making, from the simplest to the most complicated, based on the matrix above.

① Unlimited demand – no production constraints

If no market constraints exist (ie the organisation can sell as much as it can produce) the organisation should produce and sell as many units as possible of the product with the highest **contribution per unit** until the market is saturated.

Example 1: Mr Mabathle, a farmer, is able to produce both sunflowers and maize. He has to determine whether to use his land to grow sunflowers or maize.

Assume that the following information applies to Mr Mabathle:

	Sunflower seed	**Yellow maize**
	R	**R**
Market price per ton (for delivery March 20X2)	3 880	2 082
Variable costs per ton	3 000	1 000

It will not necessarily be more profitable for the farmer to produce sunflower seed rather than maize simply because sunflower seed has a higher selling price. The farmer will also have to take into account all the variable costs associated with producing, selling, distributing, etcetera the seeds and maize.

The contribution per ton of a product can thus be calculated and ranked from highest to lowest as follows:

	Sunflower seed	**Yellow maize**
Market price per ton (for delivery March 20X2)	R3 880	R2 082
Variable costs per ton	R3 000	R1 000
Contribution per ton	**R880**	**R1 082**
Rank	**2**	**1**

Therefore, if there is sufficient demand for all the farmer's yellow maize and there are no factors limiting his production of maize (eg size of land, quality of the soil, etc), it will be more profitable for him to farm only maize (ie no sunflowers).

Please note that, in practice, it is extremely unlikely that any farming operation would have no production constraints.

② **Limited demand – no production constraints**

When a demand constraint exists (ie the company can produce more of a product than it can sell), the company should first meet the demand for the product that has the highest **contribution per unit**, then the demand for the product with the second highest contribution per unit, and so on.

Assume that Mr Mabathle in **example 1** above is only allowed to supply the local Co-op with up to 10 000 tons of sunflower seed and 4 000 tons of yellow maize, limited to a total of 12 000 tons of produce.

The farmer can optimise his profit by supplying the maximum quantity of the product with the highest contribution per unit (thus 4 000 tons of yellow maize) and 8 000 tons of sunflower seed (maximum 10 000 tons, but limited to 12 000 – 4 000 = 8 000 tons).

When a manufacturing constraint exists (eg limited quantities of fertilizer available), the organisation will have to calculate the contribution per limiting factor in order to determine the optimal product mix (as discussed below).

③ One product – one limitation

Decision-making is simple, because all the resources are geared towards making the single product. No allocation between products is required. Output is determined by the maximum that can be produced (ie given the constraint).

Example 2: A company manufactures one product. Each completed unit requires 20 grams of scarce material X. The rest of the raw materials and other conversion costs are available in abundance. Customers are prepared to buy 2 000 completed units. Supply of material X is limited to 35 kg.

Number of units that can be manufactured with material X

= 35 x 1 000 / 20 = 1 750 units

Therefore production (and sales) will be limited to 1 750 units (even though demand was for 2 000 units).

④ One product – more than one constraint

Decision-making is still straightforward. Where there is one product and more than one constraint, production will be limited by the most constrictive constraint.

Take example 2 again: each completed unit now requires 20 grams of scarce material X **and** 200 ml of scarce liquid Y. The rest of the raw materials are available in abundance. Customers are prepared to buy 2 000 completed units. Supply of material X is limited to 35 kilogram and liquid Y to 340 litres.

Number of units that can be manufactured from material X

= 35 x 1 000 / 20 = 1 750 units

Number of units that can be manufactured from liquid Y

= 340 x 1 000 / 200 = 1 700 units ← Most constrictive constraint! 1 700 < 1 750

Therefore, production will be limited to 1 700 units. We cannot produce the extra 50 units because there is no liquid Y to complete them. We cannot sell 2 000 units because there are no resources to complete the additional 300 units.

⑤ Two or more products – one constraint

If an organisation is the supplier of two or more different products, limiting factors may also result in the organisation having to decide how many units of which product to manufacture/ buy and sell within the boundaries set by the availability of resources and the demand for each product. In this case, decision-making is somewhat more complex.

When a single limiting factor exists, an organisation with multiple products will have to decide how to allocate this limited resource to its different products in order to earn as much net cash inflow as possible. This decision can be based on the *contribution per unit of the limiting factor*.

By now you know that the contribution per unit is the selling price of the unit, less all variable costs (production and selling) associated with the unit. The organisation will therefore need information about the variable costs associated with its products. Since fixed costs are

irrelevant in the short-term, we will not take fixed costs into consideration when determining the optimal product mix.

Example 3: The company can sell 100 units of product A and 100 units of product B. The contribution of product A is R50 per unit and that of product B is R60 per unit. There are only 100 machine hours available. At first glance, one would automatically say that product B is more profitable and should be manufactured first. In fact, this is erroneous because we first have to calculate the contribution **per machine hour**. Product A uses 30 minutes and product B uses 45 minutes.

The contribution per hour for product A is R50 / 30 x 60 = R100 per machine hour.

The contribution per hour for product B is R60 / 45 x 60 = R80 per machine hour.

We should therefore first use the available machine hours to make product A because it 'yields' the most contribution per resource unit. That will take up 50 hours and generate 50 x R100 = R5 000. The remaining 50 hours is used for product B and generates 50 x R80 = R4 000. The total is R9 000.

Compare that with our first inclination, which was to give priority to product B because it has a higher contribution **per unit**. In this case the production of product B requires 100 x 45 / 60 = 75 hours. This will generate 75 x R80 = R6 000. The remaining hours (25) will be used to produce product A. This will generate 25 x R100 = R2 500. The total contribution is R8 500. This is a lower figure than if we allocate the scarce resource according to the contribution per limiting factor.

NOTE

It is important to make your decision based on contribution *per limiting factor/resource* and **not** based on contribution *per unit*.

We base the calculation on contribution and not profit because the assumption is that, in the period under consideration, the fixed production cost will not change; it is therefore irrelevant.

Products are therefore ranked according to contribution per limiting factor and the resource (limitation) is utilised in this order until the resource is exhausted.

⑥ **Two products – more than one constraint**

When more than one limiting factor exists, and only two products are manufactured, the organisation will have to decide how many units of each product have to be manufactured (bought in the case of a retailer) in order to maximise profits. In this case, decision-making is based on advanced concepts such as linear programming, which will be discussed in your MAC3701 module.

⑦ **More than two products – more than one constraint**

This scenario becomes very complicated and is solved using advanced mathematics and computer programming. The optimum production solution is presented in a simplex tableau, and this falls outside the scope of MAC2601 and MAC3701.

NOTE

Another short-term decision that an organisation may have to make is whether to sell a joint product just as it is (at the split-off point), or to process it further before selling. This will be covered in MAC3701.

Activity 28.1

Noisy Nick (Pty) Ltd. produces and sells vuvuzelas in the South African market. There is a constant monthly demand for the product. A large sporting event will be held in South Africa for the next two months and an unlimited demand for vuvuzelas is expected for the duration of this event. The company has enough spare capacity to manufacture the vuvuzelas without giving up any of its existing sales.

Noisy Nick (Pty) Ltd. will have to determine the optimal product mix between its red, blue and yellow vuvuzelas during this period. Each type of vuvuzela has unique features in addition to its colour and will therefore not have the same cost price to the company.

Noisy Nick reduced its selling prices drastically for this period. Selling prices and cost information are as follows:

	Red	**Blue**	**Yellow**
	R	**R**	**R**
Selling price per unit	10	6	4
Variable costs per unit	6	4	1

REQUIRED

Determine the optimal product mix for Noisy Nick (Pty) Ltd. for the duration of the sporting event.

Solution to Activity 28.1

Since there are no demand or production constraints, Noisy Nick (Pty) Ltd. should (for the duration of the event) only manufacture and sell the type of vuvuzela that renders the highest contribution per unit.

The contribution per vuvuzela and its rank from highest to lowest are:

	Red	Blue	Yellow
Selling price per unit	R10	R6	R4
Variable costs per unit	R6	R4	R1
Contribution per unit	**R4**	**R2**	**R3**
Rank	**1**	**3**	**2**

The highest contribution per unit is rendered by the **red** vuvuzela and therefore Noisy Nick (Pty) Ltd. should manufacture and sell only red vuvuzelas for the duration of the event.

NOTE

- If Noisy Nick (Pty) Ltd. does not have enough capacity available for the manufacturing of the additional vuvuzelas for the once-off event, it will have to give up some of the sales that it regularly makes in the market. This will result in an opportunity cost to the company.
- Since the event is only for a short period of time and will not be repeated, the company can make the sales because the short-term incremental costs (the variable costs per unit in this activity) are covered by the selling price. The cash contribution is positive.
- After the event, the spare capacity that has been used for manufacturing the vuvuzelas for the event will be available again to use for potential longer term, better priced opportunities.

Activity 28.2

Shavey (Pty) Ltd. manufactures and sells four different disposable razors. The following has been extracted from budgets and estimates for the year ended 30 April 20X7:

	Plain razor	Soothing razor	Moisturis-ing razor	Luxury razor
Expected monthly demand	15 000 units	4 000 units	8 000 units	5 000 units
Selling price per unit	R5,00	R8,00	R 10,00	R36,00
Production costs:	R3,00	R5,00	R 5,20	R 10,50
Variable (per unit)	R1,80	R3,80	R 4,00	R 9,30
Fixed (per unit, based on production capacity)	R1,20	R1,20	R 1,20	R 1,20
Variable selling costs	R1,00	R1,20	R 1,20	R 2,00

A maximum of 720 labour hours per month are available to the company. The respective rates at which razors can be produced are 100 plain razors per labour hour, 80 soothing razors per labour hour, 80 moisturising razors per labour hour or 10 luxury razors per labour hour. The labourers can split each hour of work between different razors as required.

REQUIRED

a. Identify the limitation.
b. Calculate the contribution per unit of the limiting factor.
c. Calculate the optimal allocation of labour hours to the different products.
d. Calculate the optimal production in number of units per product (the optimal product mix).
e. Calculate the total contribution derived from the optimal product mix.

Solution to activity 28.2

a. Identify the limiting factor:

	Plain razor	Soothing razor	Moisturising razor	Luxury razor
Demand	15 000	4 000	8 000	5 000
Production rate per labour hour	100	80	80	10
Hours required	150	50	100	500

Total hours required	800
Available	720
Shortfall/Limitation	80

b. Calculate the contribution per unit for each of the products:

	Plain razor R/unit	Soothing razor R/unit	Moisturising razor R/unit	Luxury razor R/unit
Selling price	5,00	8,00	10,00	36,00
Less: Variable costs	(2,80)	(5,00)	(5,20)	(11,30)
Contribution per unit	2,20	3,00	4,80	24,70

Calculate the contribution per limiting factor for each of the products:

	Plain razor	Soothing razor	Moisturising razor	Luxury razor
Contribution per unit (R)	2,20	3,00	4,80	24,70
Multiplied by: Output (units) per labour hour	100	80	80	10
Contribution per labour hour	220	240	384	247

c. i. Identify the order in which the labour hours should be used to manufacture products:

The order in which the company has to manufacture its products (from highest to lowest contribution per limiting factor) is:

1. Moisturising razor (R384/hour)
2. Luxury razor (R247/hour)
3. Soothing razor (R240/hour)
4. Plain razor (R220/hour)

ii. Allocate the labour hours to the products in the identified order until there are no labour hours left:

	Labour hours
Labour hours available	720
1. Moisturising razor	100
Remaining	620
2. Luxury razor	500
Remaining	120
3. Soothing razor	50
Remaining	70
4. Plain razor	70
	–

NOTE

Shavey can only allocate 70 hours to the manufacture of the plain razor, whilst 150 hours are required to satisfy the full demand for the plain razor. This shortfall is 80 hours, which was identified as the shortfall or limitation in part a. of the question. The shortfall is sacrificed by the product with the lowest contribution per limiting factor (labour hour).

d. Calculate the number of units that should be manufactured (per product)		e. Contribution	
1. Moisturising razor	100 x 80 = 8 000	x R4,80 =	R38 400
2. Luxury razor	500 x 10 = 5 000	x R24,70 =	R123 500
3. Soothing razor	50 x 80 = 4 000	x R3,00 =	R12 000
4. Plain razor	70 x 100 = 7 000	x R2,20 =	R15 400
		Total	R189 300

4 Summary

In this study unit you learnt the following:

- A scarce resource that prevents an organisation from manufacturing (buying in the case of a retailer) all the products it can sell is called a limiting factor or constraint.
- Limiting factors can involve inventory, human resources, infrastructure or capital.
- For companies that sell multiple products, the optimal way of allocating a single limited resource to different products is to do this in order of the highest to the lowest contribution per limiting factor.

Guidelines for determining optimum sales and production mix with one limitation and two or more products:

1. Identify the limiting factor by matching the resources requirements with the supply or capacity of the resources available per period.
2. Calculate the contribution per **unit** for each of the products.
3. Calculate the contribution per **limiting factor** for each of the products.
4. Identify the order in which the limiting factor should be used to manufacture products.
5. Allocate the limiting factor to the products in the identified order until there is nothing left of the limiting factor.
6. Calculate the number of units that should be manufactured (per product, per period) and the associated contribution.

Self-assessment activity

Mustard Seeds (Pty) Ltd. manufactures and sells mustard sauces in bottles of 100 mℓ each. The company uses specialised equipment for crushing and blending the ingredients of its three different flavours of product: Original, English and Honey.

The company is only allowed to use 5 000 kWh (kilowatt hour) of electricity per month. Each kWh costs 75c.

The following information is available about the company's other variable costs:

	Original	**English**	**Honey**
	R/100 ml	**R/100 ml**	**R/100 ml**
Ingredients	6	5	8
Packaging	3	3	3
Selling costs	1	2	1
Other overheads	4	3	2
Labour	2	2	3

REQUIRED

a. Define the concept of a constraint in the context of this company and identify the constraint in the above case study.

b. Calculate the optimal production levels of the three products under the following set of market conditions and energy requirements:

	Original	English	Honey
Demand (number of 100 mℓ bottles)	10 000	10 000	10 000
Market price (R)	25	30	34
kWh per 100 mℓ	0,3	0,6	0,4

Solution to Self-assessment Activity

a. A constraint is a scarce resource that will prevent Mustard Seeds (Pty) Ltd. from manufacturing all the bottles of mustard sauce it can sell. In this case, the scarce resource, potentially, is electricity (kWh).

kWh

Honey	10 000 x 0,4	=	4 000
Original	10 000 x 0,3	=	3 000
English	10 000 x 0,6	=	6 000
Total kWh required		=	13 000 (limited to 5 000 kWh available)

We have now confirmed that the constraint is electricity.

b.

	Original	English	Honey
Contribution per unit	25 – (6+3+1+4+2) = R9	30 – (5+3+2+3+2) = R15	34 – (8+3+1+2+3) = R17
Contribution per kWh	9/0,3 = R30	15/0,6 = R25	17/0,4 = R42,50
Rank	2	3	1

Optimal use of kWh:

Kilowatt hour available			5 000
Honey	10 000 x 0,4	=	4 000 (ie 10 000 units)
Remaining			1 000
Original	10 000 x 0,3	= 3 000, limited to	1 000 (ie 3 333 units)
Remaining			–
English	10 000 x 0,6	= 6 000, nothing left	–

Comprehensive Self-assessment Activity

Eating Excellence (Pty) Ltd. manufactures two different stainless steel kitchen apparatus, namely Mixer and Fixer. The products are sold to retailers, who resell the products to their own customers. The management accountant is busy preparing the monthly budget for the next financial year.

The company's metal-moulding machine's capacity is limited to 480 hours per month. All the other machines have unused capacity and the other resources are readily available. The sales manager has indicated that she can potentially sell 2 000 units of product Mixer (requiring 400 machine hours to produce) and 3 000 units of product Fixer (requiring 150 machine hours to produce) per month to a variety of customers.

The budgeted information per unit for each product is as follows:

	Mixer	Fixer
Selling price	100	80
Raw material	20	20
Variable conversion costs	30	30
Fixed conversion costs (excl. depreciation)	15	8
Depreciation	10	15
Absorption profit per unit	25	7

REQUIRED

a. Determine the number of monthly sales units per product (sales mix) that should be budgeted for for the coming financial year in order to maximise the profit. Then calculate the budgeted total monthly contribution that will be derived from this optimum mix.

b. **During the year**, the company is approached by a potential new customer who requires 200 units of Fixer (this potential sale is additional to the originally estimated potential sales of 3 000 units of Fixer). The customer is prepared to pay R70 per unit for a one-time order. Assume for this part of the question that, if a once-off order is accepted, the company will not be able to decrease the regular sales units of Fixer below 3 000 per month without losing all the regular business relating to Fixer. Determine the minimum price per unit that Eating Excellence (Pty) Ltd. can accept from the potential new customer.

c. Should the additional order referred to in b. above be accepted on a purely quantitative basis? Explain your answer.

d. Assuming that the offer of R70 per unit is accepted, indicate why choosing to sell to the once-off customer might have a negative effect on existing customers' perception of the company's loyalty to them.

Solution to Comprehensive Self-assessment Activity

a i. **Identify the limiting factor**

	Mixer	Fixer
Machine hours required – given	400	150
Total hours required (400 + 150)		550
Available		480
Shortfall/Limitation in **machine hours**		70

ii. **Calculate the contribution per unit for each of the products**

	Mixer R/unit	Fixer R/unit
Selling price	100	80
Less: Variable costs	①(50)	②(50)
Contribution per unit	50	30

① R20 + R30 = R50

② R20 + R30 = R50

NOTE

Fixed conversion costs and depreciation are irrelevant for the optimisation decision, because these are incurred in any case and will not change (within the relevant range) regardless of the production mix. Depreciation is a non-cash cost.

iii. **Calculate the contribution per limiting factor for each of the products**

	Mixer	Fixer
Contribution per unit (R)	50	30
Multiplied by: Output (units) per machine hour	③5	④20
Contribution per machine hour (R)	250	600

③ 2 000 units / 400 machine hours = 5 units per machine hour

④ 3 000 units / 150 machine hours = 20 units per machine hour

NOTE

In this question, the manufacturing of a unit took less than an hour. Where the manufacturing of a unit takes **more** than one hour (eg 75 minutes), express the unit per hour as a fraction (ie 60 ÷ 75 = 0,8 unit per hour) and then multiply with the contribution per unit.

Alternatively:

	Mixer	Fixer
Contribution per unit (R)	50	30
Divide by: Hours per completed unit	⑤0,20	⑥0,05
Contribution per machine hour (R)	250	600

⑤ 400 machine hours / 2 000 units = 0,2 machine hour per unit

⑥ 150 machine hours / 3 000 units = 0,05 machine hour per unit

NOTE

Should you be using the above alternative method and the manufacturing of a unit takes **more** than one hour (eg 75 minutes), express the hours per unit as a fraction:

75 ÷ 60 = 1,25 units per hour and then divide into the contribution per unit.

iv. **Identify the order in which the machine hours should be used to manufacture products**

The order in which the company has to manufacture its products (from highest to lowest contribution per limiting factor) is:

1. Fixer (R600/hour)
2. Mixer (R250/hour)

v. **Allocate the machine hours to the products in the identified order until there are no machine hours left**

		Machine hours
Machine hours available		480
1.	Fixer	150
Remaining		330
2.	Mixer	330
		–

vi. **Calculate the number of units that should be manufactured (per product, per month) and the associated contribution**

		Units	**Contribution**	
1.	Fixer	150 x 20 = 3 000	x R30 =	R90 000
2.	Mixer	330 x 5 = 1 650	x R50 =	R82 500
			Total	R172 500

NOTE

You have to be able to determine by yourself which steps need to be followed. Not all limiting factor/allocation of resources questions can be answered by following the steps in the above question; you therefore need to *understand the principles* involved.

b The once-off order will lead to Eating Excellence (Pty) Ltd. not being able to sell all the products that it usually sells in the market, because it does not have spare capacity. We therefore have to calculate the opportunity cost associated with accepting the once-off order.

Given that Eating Excellence (Pty) Ltd. will not be able to decrease the regular sales units of Fixer below 3 000 units per month, some of the *Mixer* sales to regular customers will have to be forfeited to make it possible for the company to accept the once-off order for 200 units of Fixer.

Machine hours to manufacture Fixer special order = 200 x 150/3 000

= 10

OR

= 200 ÷ 20/hour

= 10

The 10 machine hours reallocated could have been used to produce 10 x 5 = 50 units of Mixer.

	Per unit	Number of units	Total
Lost contribution (opportunity cost)			
– associated with forfeiting sales of 50 units of Mixer	R50	50	R2 500
Incremental variable production costs			
– variable costs for the units of Fixer produced additionally)	R50 (from a.)	200	R10 000
Total relevant costs			R12 500

Therefore the minimum selling price for purposes of the special order will be

R12 500 / 200 units = R62,50 per unit.

NOTE

- If the company accepts an offer of R62,50 per unit for the 200 units, it will lead to a net cash inflow of R0 more than if the company does not accept the R62,50 per unit, and this will not be worth the effort. The price per unit will therefore have to **exceed** R62,50 for a positive net cash inflow to be realised and to make the once-off order worthwhile for the company.
- We based the total lost contribution (total opportunity cost) above on the number of units of which the sales will have to be forfeited if the special order is accepted; that is, the number of **Mixers** of which the sales will have to be given up (50).
- We based the total incremental variable production costs above on the number of units that will have to be additionally produced if the special order is accepted; that is, the number of **Fixers** required in the special order (200).
- Total relevant costs are divided by the number of units required in the special order (ie 200 units of **Fixer**) to arrive at the minimum selling price per unit of Fixer for the purposes of the special order only.

c The minimum price to break even (or to be in a cash neutral position) is R62,50 per unit (see b.)

The customer is offering to pay R70 per unit: the order should therefore be accepted.

Alternatively:

There will be an additional contribution of (R70 – R50) x 200 = R4 000.

The additional contribution of R4 000 will exceed the opportunity cost of R2 500 and therefore the company should accept the once-off order.

d The sales of 50 units of Mixer will have to be given up to make the once-off order possible. The regular customers will have to be informed that there are fewer units of Mixer available for them to buy than usual and this may lead to the regular customers not being able to meet the retail demand for Mixers. The regular customers may be disappointed that Eating Excellence (Pty) Ltd. is willing to compromise its regular customers' position in order to meet the needs of a once-off customer. This may result in the company's regular customers concluding that Eating Excellence (Pty) Ltd. is lacking in customer loyalty.

Additional reading

Drury, C. 2008. *Management and cost accounting*. 7th edition. Stamford, CT: 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.

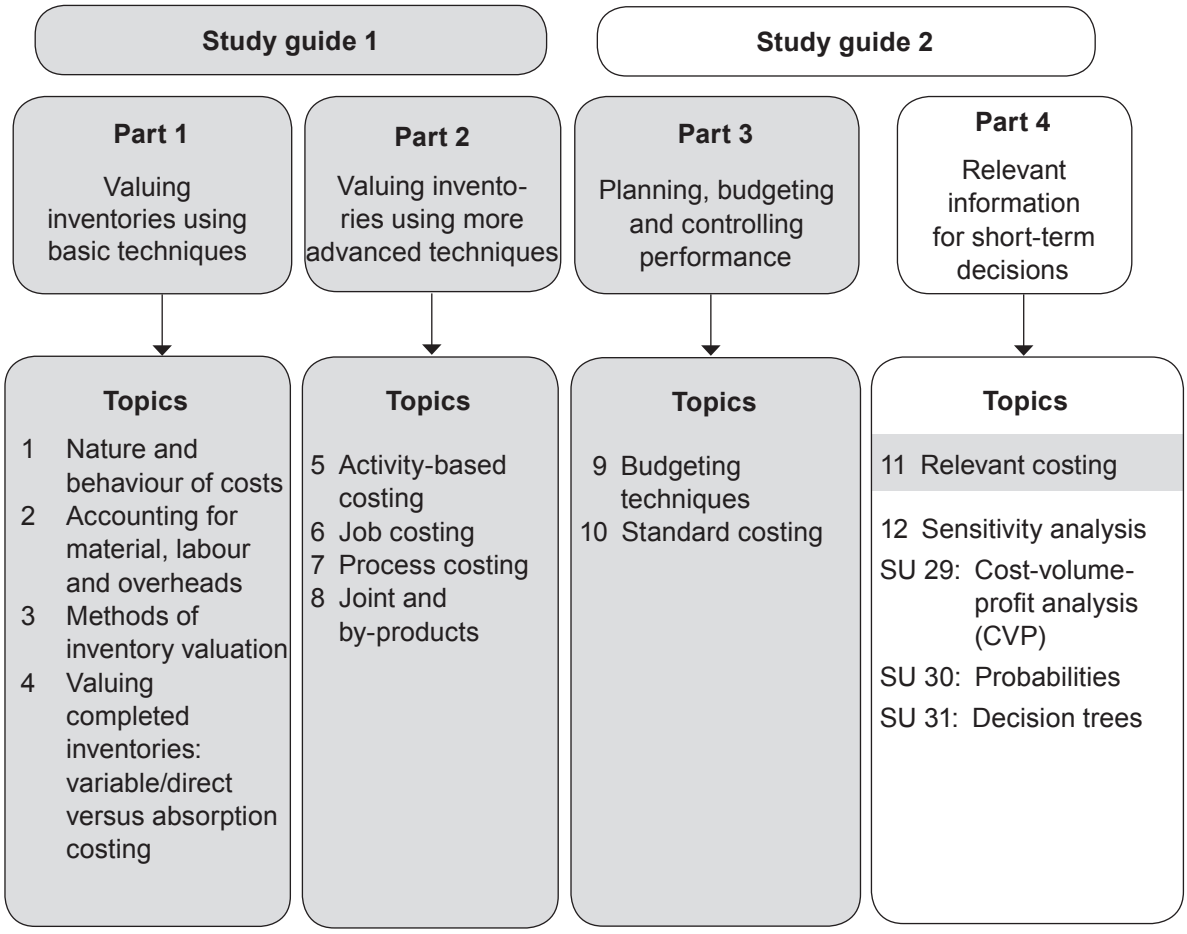
Vigario, F. 2001. *Managerial accounting*. 2nd edition. Durban: Professor F. Vigario.

TOPIC 12
Sensitivity analysis

LEARNING OUTCOMES

After studying this topic, you should be able to:

- use cost-volume-profit analysis, probability calculations and decision trees to determine the expected effect of decisions and events on profit or variables that affect profit
- make suitable recommendations based on the above calculations
- determine the sensitivity of profit to changes in selling prices, costs and volumes
- using appropriate techniques, determine what actions or decisions are required to achieve a predetermined outcome in different scenarios
- differentiate between biased and unbiased probabilities
- describe the different concepts relating to probability measurements
- describe the concepts of a decision tree, the components of a decision tree and conditional profits
- identify qualitative factors that may have to be considered when a decision is made under conditions of risk and uncertainty



STUDY UNIT	TITLE
Study unit 29	**COST-VOLUME-PROFIT ANALYSIS (CVP)**
Study unit 30	**PROBABILITIES**
Study unit 31	**DECISION TREES**

Introduction

The planning and actual performance of the entity and the resulting profitability can be influenced by changes within an entity and/or the environment in which it operates (external changes). In some instances the nature and size of these changes can be determined with certainty, but in other instances some of the details of possible future changes may be vague and involve estimates, as entities operate under *conditions of uncertainty and risk*.

The changes in the entity and the environment in which it operates can include those changes that result from *decisions* made or actions taken by the management of the entity and changes resulting from certain *events* over which the entity has no control.

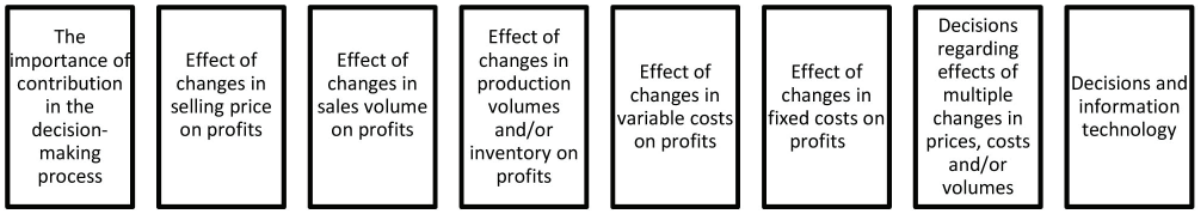
In this Topic, we will be looking at different techniques that could be used to determine the sensitivity of profits to internal and external changes affecting an entity. When we assume no uncertainty as to the nature and size of an internal or external change, we will apply a combination of cost-volume-profit analysis techniques (from Topic 1) and the principles of overhead allocation (Topic 2). This will be discussed in study unit 29.

When some uncertainty exists, we will be using probability calculations and/or decision trees to determine the expected outcome (for example, the expected effect on profit) of decisions and events. This will be discussed in study units 30 and 31.

STUDY UNIT 29

Cost-volume-profit analysis (CVP)

In this study unit



1 Introduction

In this study unit we will be looking at how cost-volume-profit analysis (as discussed in Topic 1: Nature and behaviour of costs) can be used as an **important tool to determine the sensitivity of profits to changes in different types of costs, selling prices and other variables.** We will assume the proposed change or decision is not subject to uncertainty, resulting in the outcome (effect on profit) being 100% sure.

You will be using the formulas and basic underlying assumptions of cost-volume-profit analysis and the direct costing method (contribution approach) to determine the following in different scenarios:

- The **effect** that changes in certain variables will have on profit, break-even, etc.
- The action or decision that will be **required** in order to arrive at a specified profit, increase in profit or other desired outcome under conditions of **certainty**
- The **sensitivity** of profit to changes in prices, costs and volume.

2 The importance of contribution in the decision-making process

In Topic 1, study unit 3, you studied the formulas for calculating contribution and profit as part of cost-volume-profit analysis. You were also introduced to the format of the Contribution statement of profit or loss and other comprehensive income in that study unit, as well as in Topic 4 (Valuing completed inventories: the variable/direct costing method versus the traditional absorption costing method).

NOTE

Make sure that you really know and understand the CVP formulas and the format of the Contribution statement of profit or loss and other comprehensive income, as we are going to use them extensively in this study unit.

The basic format of a Contribution statement of profit or loss and other comprehensive income can also be used when cost-volume-profit calculations are performed. In fact, the formulas in study unit 3 are all derived from the Contribution statement of profit or loss and other comprehensive income!

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

If we have to rewrite the above format in terms of a formula, we will arrive at the following:

(Sales – Variable costs) – Fixed costs = Profit	Equation 1
OR	
Contribution – Fixed costs = Profit	Equation 2
OR	
Sales = Variable costs + Fixed costs + Profit	Equation 3
OR	
Contribution + variable costs = Sales	Equation 4

Recall from your high school mathematics that a "+" becomes a "–" if moved across the "equals to" ("=") sign (and vice versa) and that multiplication on one side can be replaced by division on the other side of the "equals to" sign (and vice versa).

NOTE

Remember that 'Sales' and 'Variable costs' each consist of a **quantity variable** and a **price/cost** per unit variable.

Furthermore, we can replace a variable in the formula(s) or the basic format of the statement of profit or loss and other comprehensive income by its comprising parts in order to derive further formulas or equations. These formulas/equations can then be used to determine the desired changes that need to be made to certain variables to arrive at a specified profit or profit increase, or to see how profitability is affected by given changes in certain variables.

For instance, if sales are replaced by "Sales quantity x selling price", we can work "backwards" to see how many units an entity has to sell or by how many units (or what percentage) the current sales volume has to increase in order for the entity to arrive at a specified profit or profit increase.

Let the sales quantity be *SQ*, the selling price per unit *SP*, variable costs per unit *VC* and fixed costs *FC* and assume an entity would like to arrive at a specified profit.

By rewriting *Equation 1* above, we can isolate the sales quantity which we would like to determine, as follows:

(SQ x SP) – (SQ x VC) – FC	=	Required profit
SQ x (SP – VC)	=	Required profit + FC
SQ x (contribution per unit)	=	Required profit + FC
SQ	=	$\frac{\text{Required profit + FC}}{\text{Contribution/unit}}$

Equation 5

NOTE

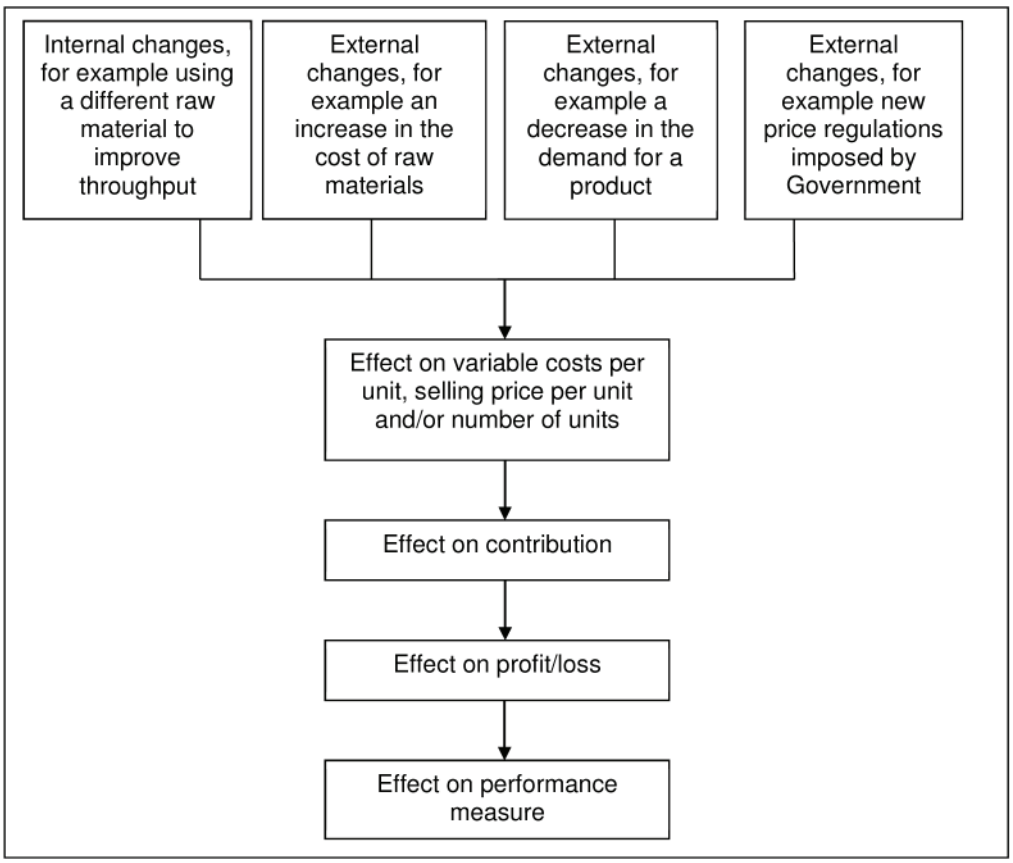
Do you recognize *Equation 5* from above? In study unit 3 you learnt to use that to determine the quantity to be sold in order to achieve a certain profit.

We can either substitute all the information we have into the above derived formula, or we can substitute all the information we have into the original formula and derive and solve an equation with SQ (which we could also have substituted with a symbol like *x*, *y* or *z,* etc.) as the unknown figure.

You should know by now that, in order for an entity to make a profit, its contribution will have to exceed its fixed costs. As fixed costs are not influenced by the level of production activity (within the relevant range) and can usually not easily be adjusted over the short-term, most of the short-term changes in profit will be attributable to changes in contribution per unit and/or changes in quantity (within the relevant range).

The anticipated effect that an internal or external change will have on ***contribution*** is therefore usually the most important factor to consider when short-term decisions are made regarding the operations of an entity. In Topic 11: Relevant costing, the importance of the concept of *contribution* has also been addressed in terms of contribution per unit of the limiting factor.

The diagram below illustrates how internal or external changes could ultimately affect the performance of an entity through affecting its contribution (assume that all units produced, can and will be sold):



Source: Author, 2012.

Figure 29.1 Diagrammatic representation of the effect of internal and external changes on performance

Figure 29.1 illustrates that an internal or external change in the circumstances under which an entity operates, for example decisions or events that affect the variable costs of the entity, could affect contribution. Assuming all other factors remain constant, an increase in contribution will lead to an increase in profit, which will lead to an improvement in the performance if the entity uses a profit-based measure to evaluate performance. On a similar basis, a decrease in contribution could lead to less profit and poorer performance.

NOTE

You will learn more about profit-based performance measures in MAC3701: Application of Management Accounting Techniques.

Next, we will be looking at how profits are generally affected if one or more of the variables in the Contribution statement of profit or loss and other comprehensive income changes. These changes can be measured either in terms of Rand or units (depending on whether it is an amount or volume that changes), or in percentage terms.

PERCENTAGE CHANGE (INCREASE/DECREASE) IN AN ITEM

Any increase or decrease in an item in percentage terms can be determined as follows:

$$\frac{A2 - A1}{A1} \times \frac{100}{1}$$

where:

A2 = Latest figure

A1 = Old (or previous) figure

If the answer is positive, it means that an increase occurred. If the answer is negative, a decrease occurred.

An increase/decrease measured in percentage terms can also be called a *relative* increase. We can refer to A2 – A1 in the formula above as an *absolute* increase/decrease.

The percentage increase/decrease in an item is also a measure of the item's <u>SENSITIVITY</u> to a change!

NOTE

Be careful – if we need to calculate an increase/decrease in figures which are already indicated as percentages (for example the margin of safety *ratio*):

- A2 – A1 (the absolute increase/decrease) will also be a percentage
- The absolute increase/decrease will be a different percentage than the relative increase/decrease

For example, assume the margin of safety ratio changes from 40% to 45%. The absolute increase will be 45% – 40% = 5%, but the relative increase will be:

$$\frac{45\% - 40\%}{40\%} \times \frac{100}{1}$$

= 12,5%

3 Effect of changes in selling price on profits

<u>If all other factors remained constant</u>, an *<u>increase</u>* in the unit selling price of a product will:

- Increase the total revenue from sales of the product (the *sales* line in the Contribution statement of comprehensive income)

- Increase the total contribution from the product's sales, the contribution per unit and the contribution ratio
- Increase profit.

If the selling price decreased, it would result in an opposite effect with sales decreasing in total, contribution decreasing in total and per unit, the contribution ratio decreasing and profit decreasing.

Activity 29.1

Sensitivity of profit to changes in selling prices

Fair Bear (Pty) Ltd. sells teddy bears. The following information is available for the month ended 28 February 20x9:

Variable costs	R20 000
Fixed costs	R15 000
Profit	R15 000

REQUIRED

a. If Fair Bear (Pty) Ltd. wants to increase its profits for the month by 10%, by what percentage does the selling price per bear have to increase?

b. If the selling price per bear increases by 5%, what will the effect be on:

   i. Profit (in percentage or relative terms)?

   ii. Break-even volume (in unit terms) if 1 000 bears were actually sold in February 20x9? There was no inventory on hand at the beginning or end of February 20x9.

   iii. Margin of safety (in percentage or relative terms) if 1 000 bears were actually sold in February 20x9?

Assume in all cases that no change in sales volume, variable cost or fixed cost occurs.

Solution to activity 29.1

a. **Required change in unit selling price**

Required increase in profit = R15 000 x 10% = R1 500.

From the Contribution statement of comprehensive income format and the cost-volume-profit analysis formulas, we know that:

Contribution = Profit + Fixed costs

Thus: Contribution before change in sales = R15 000 + R15 000 = 30 000.

As fixed costs have to remain constant, the only way that profit can increase by R1 500 is if the contribution also increases by R1 500.

Thus: Increased contribution = R30 000 + R1 500 = R31 500

We also know that **Sales = Variable costs + Contribution**

The total variable costs will remain the same as before, as neither variable costs per unit, nor number of units sold, will change. Therefore, the adjusted sales amount = R20 000 + R31 500 = R51 500.

As management in this activity will only be able to change sales revenue via a change in the selling price, the full (51 500 – 50 000) / 50 000 x 100 = 1 500/50 000 x 100 = 3% increase in sales should be attributable to an increase in the selling price per bear.

Selling price therefore has to be increased by 3% per bear in order for Fair Bear (Pty) Ltd. to increase its profit by 10%.

NOTE

- The alternative method applied below would have resulted in the same adjusted sales amount of R51 500:

  Previous sales amount = Variable cost + Fixed cost + Profit
  = 20 000 + 15 000 + 15 000
  = R50 000

  If we think of the format of the Contribution statement of comprehensive income, we will realise that no line item in this statement, other than profit and sales (and therefore also contribution), will be allowed to change. The R1 500 increase in profit required can only be achieved if the sales amount increases by R1 500.

  Therefore:

  New sales amount = Previous sales + Increase (as calculated above)
  = 50 000 + 1 500
  = R51 500

- We did not need to know the selling price per unit in order to calculate the increase in selling price. As sales volumes did not change, the required percentage increase in selling price per unit would be equal to the percentage increase in total sales revenue.
- In this question, an increase in selling price of only 3% will lead to a 10% increase in profit! This is because the change in the sales went straight to the bottom-line without a counter-effect change in variable or fixed costs. However, in real life, an upward change in price may lead to a decrease in sales volume if your customers are very price sensitive. Decreases in prices on the other hand may lead to increases in volumes if they are price sensitive. This may be countered if your competition also decrease their prices. You will learn more about pricing your products in MAC3701.
- If part a. was a MAC2601 exam question, the sections of the suggested solution highlighted in grey would typically form part of your written answer, with the remainder of the suggested solution representing your reasoning in order to arrive at the written answer.

b. **i. Impact on profit**

Profit = Sales – Variable costs – Fixed costs

A 5% increase in selling price will lead to a 5% increase in sales value if the sales volume is unaffected.

Therefore:

New profit = New sales amount – 20 000 – 15 000
= 50 000 (1,05) – 35 000
= 52 500 – 35 000
= R17 500

Increase = (New profit – Old profit) / Old profit
= (17 500 – 15 000) / 15 000
= 2 500 / 15 000
= 16,67% rounded

OR

Absolute change in profit = Change in sales
= 5% x R50 000
= R2 500

Relative change in profit = R2 500 / R15 000 = 16,67%

OR

From part a. of this activity, you will see that a 10% increase in net profit was achieved from a 3% increase in selling price, i.e. 10/3 = 3,333 times (rounded).

One could also conclude then that a 5% increase in selling price will yield a 3,333 x 5% =16,67% increase in net profit.

Note that this relationship (3,333) is relevant to this set of data only!

NOTE

- We did not include the "x 100/1" in the increase or decrease calculation above – as our answer is in percentage, multiplication by 100 is implied, but you are welcome to include it if you prefer.
- The R50 000 sales amount before adjustment for the 5% increase in selling price, comes from the answer to part a. of this activity.

REFLECT:

An increase in the selling price per unit will not affect the variable cost per unit or in total, unless the increase leads to a change in sales volume. Reflect why this is the case.

b. **ii. Impact on break-even units**

Contribution per unit (previously) = Previous total contribution / Number of units sold
= (15 000 + 15 000) / 1 000
= 30 000 / 1 000
= R30

Contribution per unit (new) = New selling price – variable cost per unit
= (50 000 / 1 000 x 1,05) – (20 000 / 1 000)
= (50 x 1,05) – 20
= 52,50 – 20
= R32,50

Old break-even quantity = Fixed costs / Previous contribution per unit
= 15 000 / 30
= 500 units

New break-even quantity = Fixed costs / New contribution per unit
= 15 000 / 32,50
= 461,538... units rounded to 462 units

Effect (in units) = 500 – 462
= 38 units decrease
(or a 38/500 = 7,6% decrease)

NOTE

We use the terms “sales volume”, “sales units” and “sales quantity” interchangeably.

b. **iii. Impact on margin of safety (MoS)**

Old margin of safety = Sales units – old break-even units
= 1 000 – 500 (from b.)
= 500 units

New margin of safety = Sales units – new break-even units
= 1 000 - 462
= 538

Effect (in %) = (538 – 500) / 500
= 38 / 500
= 7,6% increase

NOTE

The margin of safety **ratio** will increase from 50% to 53,8%. This increase of 53,8 – 50 = 3,8% in absolute terms amounts to 3,8/50 = 7,6% in relative terms. See whether you are able to calculate these figures. The relative increase corresponds with the % increase in margin of safety calculated above.

REFLECT:

You will notice that the decrease in break-even volume led to an increase in the margin of safety. Reflect why this is the case.

4 Effect of changes in sales volume on profits

If all other factors remained constant, an *increase* in the number of units of a product sold will:

- Increase the *total* revenue from sales of the product
- Increase the *total* variable costs
- Increase the *total* contribution from the product sales
- Increase profit.

The selling price per unit, variable cost per unit, contribution per unit and the contribution ratio will not be affected by changes in sales volume.

If the sales volume *decreases*, it would result in an opposite effect with sales, variable costs, contribution and profit decreasing *in total*.

REFLECT:

If the volume after the change is still within the relevant range, fixed costs will not be affected. Reflect why this is so.

Activity 29.2

Sensitivity of profit to changes in sales volumes

Assume the information from activity 29.1 above is still applicable; however, management cannot adjust the selling price per bear and will have to increase/decrease sales volumes to obtain the desired 10% increase in profit.

REQUIRED

a. Determine the percentage by which the number of bears sold has to increase/decrease for the desired increase in profit to realise.
b. Assuming 1 000 bears were actually sold in February 20x9, determine by how much (in % or relative terms) the sales volume can change before profit will fall to below R12 400.

Solution to activity 29.2

a. **Change required in number of bears sold**

   We have learnt that an increase in sales volume will give rise to an increase in contribution (assuming other factors remain constant). From this, we can derive that in order to obtain an increase in profit by changing the sales volume, management will have to **increase** the number of units sold.

NOTE

Both total sales revenue and total variable costs will increase if the number of bears sold increases. The selling price per bear, variable cost per bear and the **contribution per bear** will remain as they were before and therefore the increase in total contribution will only result from the increase in bears sold, as:

Total contribution = Contribution per unit x Number of units sold

Just as in activity 29.1, the adjusted contribution amount can be calculated as
= R30 000 + R1 500 = R31 500.

As management in this activity will only be able to change contribution by changing the sales volume, the full (31 500 – 30 000) / 30 000 x 100 = 1 500/30 000 x 100 = 5% increase in contribution should be attributable to the increase in sales volume.

Sales volume therefore has to be increased by 5% in order for Fair Bear (Pty) Ltd. to increase its profit by 10%.

NOTE

- We did not need to know what the number of units sold was to calculate the increase.
- We can test our answer by preparing a Contribution statement of comprehensive income:

	R
Sales (50 000 x 1,05)	52 500
Less: Variable costs (20 000 x 1,05)	(21 000)
Contribution	31 500
Less: Fixed costs	(15 000)
Profit	16 500

The increase in profit is 16 500 – 15 000 = 1 500, which represents an increase in profit of 1 500/15 000 = 10%, which equals the required increase.

- An alternative test for our answer would be to calculate the contribution ratio before the change (30 000 / 50 000 = 60%), apply this to the increased sales we have calculated to arrive at the adjusted total contribution (60% x 52 500 = R31 500) and finally deduct the fixed costs of R15 000 like we did in the Contribution statement of comprehensive income above to see whether we arrive at the desired profit.

b. **Sensitivity in volumes**

Let the new sales volume be z.

Sales	= Variable costs + Fixed costs + Minimum profit required
Sales – Variable costs	= Fixed costs + Minimum profit required
Contribution	= Fixed costs + Minimum profit required
Sales volume x contribution per unit	= 15 000 + 12 400
z x 30 000 / 1 000	= 27 400
z x 30	= 27 400
z	= 27 400 / 30
z	= 913,333 ... rounded **up** to 914 bears
Increase/(decrease)	= (New volume – Old volume) / Old volume
	= (914 – 1 000) / 1 000
	= –86 / 1 000
	= 8,6% **decrease**

NOTE

- The above allowable decrease is an indication of how sensitive profit is to a change in sales volume.
- An alternative calculation of the contribution per unit could have been 50 000 / 1 000 – 20 000 / 1 000 = 50 – 20 = R30.
- If we rounded the 913,333 ... to the nearest integer, we would have arrived at a sales volume of 913 bears. However, selling only 913 bears would result in the following profit:

	R
Contribution (913 x 30)	27 390
Less: Fixed costs	(15 000)
Profit	12 390

R12 390 is less than the required minimum profit of R12 400 and therefore will not be enough.

Based on the principle illustrated here, we generally round *up* sales volumes when we calculate break-even quantity or the required sales quantity to achieve a required (minimum) level of profit.

5 Effect of changes in production volumes and/or inventory on profits

In the cost-volume-profit calculations in Topic 1, we always assumed that sales units equalled production units and that there was no inventory on hand at the beginning or the end of the period involved (or it remains unchanged as production equals sales!).

However, when we have opening and/or closing inventory on hand, the sales volume and production units will not necessarily be the same. The levels of inventory will affect

the profits. This is complicated by whether inventories are valued at direct cost only or at absorption cost.

Topic 4 covers the effect of changes in inventory levels on profits to a sufficient extent for purposes of MAC2601. The issue will therefore not be discussed in further detail in the current topic.

6 Effect of changes in variable costs on profits

If all other factors remained constant, an *increase* in the variable cost **per unit** will:

- Increase the variable cost in total
- Decrease the contribution per unit and in total
- Decrease the contribution ratio
- Decrease profit.

If the variable cost per unit *decreased*, contribution per unit will increase and, therefore, also total contribution. An increase in total contribution will lead to an increase in profit.

If all other factors remained constant, an *increase* in the variable cost **in total** will lead to a decrease in the total contribution and therefore also to a decrease in profit. A *decrease* in total variable costs will have the opposite effect on contribution and profit.

Sales – Variable costs = Contribution

S – VC = CONTR

Thus: VC ↑ then CONTR ↓

and VC ↓ then CONTR ↑

Activity 29.3

Sensitivity of profit to changes in variable costs

Assume that the information from activity 29.1 is still applicable, but that Fair Bear (Pty) Ltd. can only increase its profit by means of a change in the variable cost per unit.

REQUIRED

a. If Fair Bear (Pty) Ltd. still wants to increase its profit by 10%, determine the relative change (%) in variable cost per unit manufactured that the entity will have to make.
b. Assume that 1 000 bears were manufactured and sold. Determine the absolute amount of change required in the variable cost per unit to achieve the 10% increase in profit. There was no opening inventory.

Assume that selling prices per unit, sales volumes and fixed costs remain unchanged.

Solution to activity 29.3

a. **Relative change in variable cost per unit**

From activity 29.1, we know that the required profit *after* a 10% increase is = R16 500. This is a required *increase* of R1 500.

Selling prices and fixed costs remains unchanged. We are only allowed to change the variable cost. To increase profits, it means the **variable costs should be reduced** in total by R1 500.

% change = R1 500 / R20 000
= 7,5%

As the number of units will remain unchanged, the % change in the total variable cost will be the same as the % change in the variable cost per unit.

Variable cost per unit therefore has to be decreased by 7,5% per bear in order for Fair Bear (Pty) Ltd. to increase its profit by 10%.

NOTE

We did not need to know the variable cost per unit in order to calculate the percentage change in variable cost per unit. As sales volumes did not change, the required percentage decrease in variable cost per unit would be equal to the percentage decrease in total variable cost.

b. **Absolute change in variable cost per unit**

Previous variable cost per unit = R20 000 / 1 000
= R20

7,5% x R20 = R1,50

NOTE

- An alternative method that we could have followed is the following:

	R
Sales (from activity 29.1)	50 000
Less: Variable costs (balancing figure 2)	(18 500)
Contribution (balancing figure 1)	31 500
Less: Fixed costs (given)	(15 000)
Profit (15 000 + 1 500 (from activity 29.1))	16 500

Balancing figure 1 = 16 500 + 15 000 = R31 500
Balancing figure 2 = 50 000 – 31 500 = R18 500

New variable cost per unit = 18 500 / 1 000 = R18,50
Previous variable cost per unit = 20 000 / 1 000 = R20
Required saving in variable cost per unit = 20 – 18,50 = R1,50

- Another alternative would be to simply divide the required increase in contribution of R1 500 (calculated in activity 29.1) by the 1 000 units, which will give us R1,50 per unit. We can do this as the full increase in contribution has to result from a decrease in variable cost per unit.

7 Effect of changes in fixed costs on profits

Although most of the operating decisions of an entity are based on the anticipated effect of certain events or actions on the contribution of the entity, changes in fixed costs will also have an effect on the profitability of the entity. In order to break even or achieve a certain level of profit, the entity will have to adjust the number of units produced and sold if changes in fixed costs will occur. It is therefore important that we also have a look at what happens to profit when fixed costs increase or decrease.

If all other factors remained constant, an *increase* in the total fixed costs will:

- Lead to a decrease in profit
- Not affect the contribution per unit
- Not affect the total contribution or contribution ratio.

Similarly, a *decrease* in fixed costs will lead to an increase in profit without affecting contribution per unit, in total or as a percentage of sales.

Activity 29.4

Sensitivity of profit to changes in fixed costs

The following information is available for Fair Bear (Pty) Ltd. for the month ended 30 November 20x9:

Margin of safety	120 units
Break-even quantity	600 units
Contribution	R41 760

The entity rents a workshop and showroom in a shopping centre. The shopping centre has indicated that the monthly rent will increase by 8% in December 20x9. No other fixed costs were incurred in November 20x9 and no other fixed costs will be incurred in December 20x9.

December 20x9 selling prices, sales volumes and variable costs per unit will remain the same as in November 20x9.

REQUIRED

Calculate the effect that the increase in fixed costs in December 20x9 will have on:

a. Profit (in percentage or relative terms)
b. The break-even quantity (in unit and percentage terms)
c. The margin of safety (in unit and percentage terms).

Solution to activity 29.4

a. **Effect on profit**

Step 1 – calculate the actual fixed cost

As we need to determine the effect of the increase in fixed costs, we will have to calculate the original amount of fixed costs on which the increase was based.

If we think of our cost-volume-profit analysis formulas in the light of the information that has been given, it seems that we may be able to use the following formula, as this formula contains the break-even quantity, contribution (even though it is per unit and our information states it in total) and fixed costs (the unknown variable that we are attempting to calculate):

Break-even quantity = Fixed costs / contribution per unit

The break-even quantity has been given as 600 units, so if we can find the contribution per unit we will be able to calculate our fixed costs before the increase. As the contribution in *total* has been given, we will need to know what the sales volume for November was in order to calculate the contribution *per unit*.

We have also been given the margin of safety in units. The formula for this is:

Margin of safety (in units) = Actual sales quantity - Break-even quantity

If we let actual sales quantity be "*x*" and we substitute the information we have into this formula, we get to the following equation:

120 = *x* – 600

Solve *x*:

x = 120 + 600

x = 720 units

Therefore 720 units were sold in November 20x9.

Now we can calculate the contribution per unit for November:

R41 760 / 720 units = R58 per unit

If we substitute the contribution per unit into our original break-even formula, we get:

600 = Fixed costs / R58

Thus fixed costs = 600 x 58 = R34 800.

If the monthly rent increases by 8%, the December 20x9 fixed costs will be:

34 800 x 108/100 = R37 584

Step 2 – Calculate actual profit and change in profit

December profit = Contribution – Dec. fixed costs
= 41 760 – 37 584
= R4 176

November profit = Contribution – Nov. fixed costs
= 41 760 – 34 800
= R6 960

OR

You will recall from study unit 3 that the total profit in any period is attributable to the contribution from the margin of safety sales. Therefore, we could also calculate the November profit as = margin of safety sales x contribution per unit

= 120 x R58
= R6 960

Therefore there will be an increase/decrease in profit of:

$$\frac{4\,176 - 6\,960}{6\,960} \times \frac{100}{1}$$

= –40%

The minus sign (–) is indicative of a *decrease* and this means that there will be a decrease of 40% in profit from November 20x9 to December 20x9.

NOTE

Even though fixed costs have only increased by 8%, profit has decreased by 40%. This is because of fixed costs being high in relation to the contribution. The higher the fixed costs as a percentage of contribution, the larger the proportional (%) effect on profit of a change in fixed costs. This is also referred to as the operating leverage and you will learn more about it in later MAC modules.

b. **Effect on break-even quantity**

Break-even quantity = Fixed costs / Contribution per unit

Therefore:

Nov. break-even quantity = 600 units (given)

Dec. break-even quantity = 37 584 / 58
= 648 units

Absolute effect (in units) = 648 – 600
= 48 units increase

Relative effect (in %) = (648 – 600) / 600
= 48 / 600
= 8% increase

NOTE

A higher break-even quantity / smaller margin of safety than before is a disadvantage to the entity, as it means that the entity will in future have a smaller "safety net" to protect it against losses. The size of a sudden drop in sales volumes that the entity will be able to handle will be smaller than before. Such a sudden drop could for example result from the worsening of economic conditions.

c. **Effect on MoS**

Old margin of safety	= 120 units (given)
New margin of safety	= Sales units – new break-even units = 720 (from part a.) – 648 = 72
Absolute effect (in units)	= 120 – 72 = 48 units decrease
Relative effect (in %)	= (120 – 72) / 120 = 40% decrease

NOTE

- We have used the words "unit" and "bear" interchangeably in activities 29.1–29.4 as each "unit" that Fair Bear (Pty) Ltd. sells is represented by one teddy bear.
- If we have a look at the margin of safety *ratio* instead, we will find the following (recall that **Margin of safety ratio = (Sales quantity – Break-even quantity) / Sales quantity**):

Old margin of safety ratio	= 120 / 720 = 16,67% rounded
New margin of safety ratio	= 72 / 720 = 10%
Relative effect	= (16,67 – 10) / 16,67 = 40,01% decrease

REFLECT:

- Have you noticed that the unit decrease in margin of safety equals the unit increase in break-even quantity? Reflect why this should always be the case.
- The relative effect on the margin of safety *ratio* will be the same as the effect on the margin of safety units (there might be a slight difference due to rounding like in the activity above). Reflect why this should always be the case.

Guidelines for CVP questions:

The following questions could come in handy when you do CVP questions in which one or more variables change:

- Will my contribution in **total** be affected by the change?
- Will my contribution **per unit** be affected by the change?
- Will my contribution **ratio** be affected by the change?
- Will my break-even or margin of safety **value** be affected by the change?
- Will my break-even or margin of safety **quantity** be affected by the change?

8 Decisions regarding effects of multiple changes in prices, costs and/or volumes

It is important to note from the above sections that, depending on the specific circumstances, changes in sales and/or production quantities, inventory, selling prices or costs can ALL have an effect on profits.

If an entity wishes to achieve or maintain a certain level of profit despite changes within or outside of the entity, management should consider whether changes in selling prices and/or production and sales quantities are possible and desirable, and if the entity will be able to save on its costs.

A variety of changes can take place at the same time and a variety of simultaneous decisions may be necessary.

NOTE

CVP analysis, together with sensitivity analysis, are very handy tools to use during the development stage of the budget process or any other planning process. It is used in scenario planning to obtain an indication of the change in outcomes (targets or key performance indicators) that will occur if certain changes are made in one or more variables.

9 Decisions and information technology

Computer packages can make sensitivity analysis by means of cost-volume-profit analysis quicker and easier. For example, absolute references can be used in MS Excel to determine the effect of changes in prices, production levels, inventory levels, sales volumes and/or costs. Absolute references are discussed in AIN2601: Practical accounting data processing, but use of MS Excel is **not** examinable for **MAC2601**.

The following activity is not examinable for MAC2601, but could provide you with valuable practical insight if you are an AIN2601 student or if you were enrolled for AIN2601 in the past.

Enrichment activity 29.5

Sensitivity analysis in MS Excel

REQUIRED

a. Perform the calculations in activity 29.4 by means of an Excel spreadsheet, using absolute references where appropriate and verify whether you get the same answers.

b. Create your own multiple CVP scenarios in an Excel spreadsheet where you change different input cells and calculate the percentage change in certain fields.

10 Summary

In this study unit you learnt that:

- The concepts of contribution and break-even are important for the use of this technique.
- Cost-volume-profit analysis can be used as a sensitivity analysis technique to determine what the effect of certain internal decisions of management or external changes will be on profits, break-even and margin of safety figures.
- CVP can also be used in reverse to determine what certain inputs should be to arrive at a specified profit.
- CVP is used to calculate sensitivities (% change allowed or resulting) in profits, break-even and margin of safety figures, as well as in certain inputs.
- If all other factors were kept constant, the following would be examples of changes that will lead to an *increase* in profit:
  - Increase in selling price per unit
  - Increase in sales volumes
  - Decrease in variable cost per unit
  - Decrease in total fixed costs
- If all other factors were kept constant, the following would be examples of changes that will lead to a *decrease* in profit:
  - Decrease in selling price per unit
  - Decrease in sales volumes
  - Increase in variable cost per unit
  - Increase in total fixed costs
- Changes in production volumes and inventory levels can also lead to changes in profit which depend on the method of inventory valuation being used and the specific production and inventory holding requirements. This was covered in Topic 4.

NOTE

The impact on sales volumes (demand) due to changes in unit selling prices depends on the demand elasticity or inelasticity of the product. It means that, for example, beyond a certain point, decreases in selling prices will not lead to further volume increases, and vice versa. This will be dealt with in more detail in MAC3701.

In the next study unit we are going to learn how probability theory can be applied to calculate the expected effect of possible internal or external changes on an entity and to recommend appropriate actions when we are uncertain what the exact outcome of events and decisions will be.

Self-assessment activity

QUESTION 1

Great Wyte (Pty) Ltd. sells branded rugby merchandise in KwaZulu-Natal. The entity is considering the possible effects of some external changes regarding one of its product lines, Head-for-the-Tryline - a supporters' hat.

The following actual and budgeted information is available for the Head-for-the-Tryline Division:

20x6 actual sales amounted to R2 500 000.

The 20x6 selling price per hat was R80.

Variable manufacturing costs per unit (20x6):

Direct material	R6
Direct labour	R9
Overheads	R4

Other information:

- Variable selling cost per hat was R3 in 20x6 and R5 per hat is budgeted for 20x7.
- Direct material cost per unit (mainly consisting of the cost of the fabrics used) increases by 12,5% per year and manufacturing overheads per unit by 6,25%. Variable direct labour costs per unit were incurred on casual labour and are expected to remain the same as in 20x6.
- The workers' union has settled for a 10% increase in the 20x7 salaries of permanent employees. The salaries of the permanent factory supervisors (R550 000 in total for 20x6) are the only fixed manufacturing costs incurred by the division.
- Administration costs (fixed) were R50 000 in 20x6 and are expected to remain unchanged in 20x7.
- The value of the opening and closing inventory for 20x6 was Rnil and it is expected that production will equal sales units in 20x7.
- Management budgets that the number of hats sold will increase by 21,6% in 20x7 due to an aggressive marketing campaign started in 20x6. The cost of the campaign was R200 000 for 20x6 and the yearly cost is expected to increase by R25 000 in 20x7.

- Although one of the provincial sports bodies is putting pressure on the entity to lower the selling price per hat, the owners of Great Wyte (Pty) Ltd. has indicated a targeted increase in after-tax profit of at least 12% for the Head-for-the-Tryline product line in 20x7.

REQUIRED

a. Determine the maximum percentage by which management could allow the selling price per hat to drop without missing the owners' target. Assume a tax rate of 28% and that the budgeted sales volumes will realise independent of selling price changes.
b. Compare the break-even sales units of the two years and comment.
c. Calculate the margin of safety percentage (ratio) of the two years and comment.

QUESTION 2

Refer back to the information provided in activity 29.1.

REQUIRED

a. Calculate the maximum percentage by which each of the following variables can change before break-even will not be achieved anymore, assuming all other variables remain constant:
    i. Sales volume
    ii. Selling price per unit
    iii. Variable cost per unit
    iv. Fixed costs

b. To which one of the variables in a. does the entity have to pay attention to the most urgently? Motivate your answer.

QUESTION 3

Complete the following table:

	1	2	3	4	5	6	7	8	9	10
Sales (R)		4 180	750		17 100	22 400		600	1 500	
Variable costs (R)			375							
Fixed costs (R)	320	836		60						
Net profit (R)	160					1 680			270	30
Contribution (R)							3 000			
Contribution ratio		20%		25%	60%		50%	20%		60%
Break-even sales (R)	800						5 000		960	
Margin of safety (R)					7 100					
Margin of safety ratio			32%	20%		15%		30%		20%

QUESTION 1

a. **Percentage change in selling price**

Great Wyte (Pty) Ltd.
Contribution statement of comprehensive income (actual 20x6 and budgeted 20x7)

	20x6 Actual	**20x7 Budgeted**
Sales	2 500 000	???
Less: Variable costs		
(593 750① + 93 750②)	(687 500)	
(760 000① + 190 000②)		(950 000)
Contribution	1 812 500	⑥2 014 000
Less: Fixed costs	⑤(800 000)	⑤(880 000)
Profit before tax	1 012 500	④1 134 000
Income tax @ 28%	(283 500)	④(317 520)
Profit after tax	729 000	③816 480

Calculations:

① Calculation of variable production costs

Number of units produced and sold

20x6: 2 500 000 / 80 = 31 250
20x7: 31 250 x 1,216 = 38 000

Variable production costs per unit

20x6: 6 + 9 + 4 = R19
20x7: (6 x 1,125) + 9 + (4 x 1,0625)
= 6,75 + 9 + 4,25
= R20

Variable production costs in total

20x6: 31 250 x R19 = R593 750
20x7: 38 000 x R20 = R760 000

② Calculation of variable selling costs

20x6: 31 250① x 3 = R 93 750
20x7: 38 000① x 5 = R190 000

③ Calculation of desired profit for 20x7

R729 000 (contribution statement of comprehensive income) x 112/100 = R816 480

④ Calculation of profit before tax for 20x7

Income tax for the year: 816 480③ x 28/72 = 317 520

(Remember that taxation is based on the profit before tax (100%), whereas the profit after tax represents 100% - 28% = 72% of the profit before tax.)

Add back the income tax to arrive at profit before tax of 816 480③ + 317 520 = R1 134 000.

⑤ Calculation of fixed costs

	20x6	20x7
Factory supervisors' salaries (110/100 x 550 000)	550 000	605 000
Administration costs	50 000	50 000
Marketing costs (200 000 + 25 000)	200 000	225 000
	R800 000	R880 000

⑥ Calculation of contribution for 20x7 (balancing figure)

1 134 000④ + 880 000⑤ = R2 014 000

⑦ Calculation of budgeted selling price for 20x7

Sales = Contribution plus variable costs

Thus:

Sales = 2 014 000⑥ + 760 000① + 190 000②
= R2 964 000

Let selling price per unit be y:
Sales = Sales volume x selling price
2 964 000 = 38 000① x y
y = 2 964 000 / 38 000
= R78

Maximum allowable *decrease* in selling price per unit:

$$\frac{78 - 80}{80} \times \frac{100}{1}$$

= 2,5%

NOTE

- Did you notice that you have also used your budgeting (Topic 9) skills to complete this activity? CVP is an important tool for testing the sensitivity of the budgeted figures to various changes and to determine which of the scenarios on the table will meet the targets set by top management!
- You may have noticed that although the selling price per unit *decreased*, an *increase* in profit still realised. A sufficient increase in sales volume could lead to an increased sales revenue value despite a lower selling price. Sometimes a decrease in selling prices could lead to customers buying more of the product (an increase in sales volume). In this activity, however, the increase in sales volume can be attributed to the aggressive marketing campaign.
- A short-cut to get to the desired profit **before** tax for 20x7 (R1 134 000) would be to simply take the profit **before** tax for 20x6 and multiply it by 112/100, as the same tax rate applies to both years.

b. **Break-even analysis**

Break-even (units) = Fixed costs / Contribution per unit

20x6: 800 000 / (1 812 500 / 31 250) = 800 000 / 58 = 13 793,103... rounded **up** to 13 794 units
20x7: 880 000 / (2 014 000 / 38 000) = 880 000 / 53 = 16 603,773... rounded **up** to 16 604 units

Difference in units = 16 604 – 13 794 = 2 810 units increase
Difference in % = 2 810 / 13 794 = 20,37% increase (rounded)

The number of hats that the entity will have to sell in 20x7 in order to break-even, will be 2 810 (or 20,37%) more than the number of hats the entity had to sell to break even in 20x6. This indicates that the internal (increase of 10% in fixed costs) and external changes (pressure on selling price pushing contribution per unit down) affecting the entity in 20x7 will generally have a negative net impact on the entity, as it would be more difficult to achieve break-even in 20x7 than in 20x6.

In summary, reduced selling prices, combined with increases in both variable costs per unit and fixed costs in total, have a negative effect on break-even point in 20x7.

c. **Margin of safety analysis**

Margin of safety (%) = Sales – break-even sales / Sales

20x6: (31 250 – 13 794) / 31 250 = 55,86%
20x7: (38 000 – 16 694) / 38 000 = 56,07%

Even though the absolute number of units required to break even has increased, the increase in the estimated sales in 20x7 has countered this risk. The margin of safety percentage indicates that the relative risk has remained unchanged (reduced very slightly).

A margin of safety percentage of more than 50% is very healthy. It indicates that Great Wyte's unit sales can decline by 55-56% before they run the risk of making losses (assuming the selling prices and cost structure remains the same). It would really take a major unforeseen event for this to materialise.

QUESTION 2

a. Maximum allowable change per variable (sensitivity):

Variable	**Allowable change**
i. Sales volume	50% decrease③
ii. Selling price per unit	30% decrease④
iii. Variable cost per unit	75% increase⑤
iv. Fixed costs	100% increase⑥

NOTE

All the sensitivity calculations are based on one point of departure: What will it take for the existing profit of R15 000 to disappear? Then you express that change as a relative percentage.

Explanatory notes:

① Calculation of CURRENT break-even value:

Break-even value = Fixed costs / Contribution ratio (or contribution margin)
= 15 000 / 0,6②
= R25 000

② Calculation of contribution ratio:

Sales = Variable costs + Fixed costs + Profit
= 20 000 + 15 000 + 15 000
= R50 000

Contribution (from activity 29.1, part a.) = R30 000

Contribution ratio = Contribution / Sales
= 30 000 / 50 000
= 60% or 0,6

③ Current profit = R15 000. This profit is derived from the contribution of the margin of safety sales.

If all else, but volume stays constant, this profit will disappear if sales decline by:
Sales of R15 000 / 0,6 = R25 000.

Sensitivity in volume = R25 000 / R50 000 = 50%

Proof:

Sales (R50 000 x 50%)	R25 000
Variable costs (R20 000 x 50%)	R10 000
Contribution	R15 000
Fixed costs	R15 000
Profit	0

OR

If the contribution ratio remains to be 60%, the current sales value of R50 000② can decrease by 50 000 – 25 000 = R25 000 with break-even still being achieved. This is equal to the margin of safety sales value!

25 000 / 50 000 = 50%, therefore sales value can decrease by up to 50% without break-even being given up.

As Sales quantity (volume) x Selling price per unit = Sales value, the sales quantity (volume) can also change by up to 50% if the selling price per unit is constant, as sales quantity will not affect the contribution ratio.

You will recall that a **decrease** in sales quantity will result in a decrease in sales value; therefore, sales quantity can decrease by up to 50% before break-even will have to be forfeited.

NOTE

The sensitivity to volume changes is always expressed as the margin of safety ratio. The allowable decrease in sales value of 50% is also our margin of safety ratio!

MoS ratio = (R50 000 – R25 000)/R50 000 = 50%

④ Current profit is R15 000. Selling prices therefore need to decline by R15 000.

Reduction in sales value / previous sales value
= R15 000 / R50 000
= 30%

Proof:

Sales (R50 000 – R15 000)	R35 000
Variable costs – as before	R20 000
Contribution	R15 000
Fixed costs	R15 000
Profit	0

OR

A change in selling price per unit without a counter effect change in variable cost per unit will result in a change in the break-even value, as the contribution ratio will be affected.

Let the sales quantity be "z" and the selling price per unit "y" (both at break-even point).

At break-even point:

Sales – variable costs – fixed costs = 0

(y x z) – 20 000 – 15 000 = 0

y x z = 35 000

As the sales quantity (z) had to remain constant, the change in sales value from R50 000 to R35 000 can only be attributed to a change in selling price (y).

The allowable decrease in sales value = (35 000 – 50 000) / 50 000 = -15 000 / 50 000 = 30% decrease.

You will recall that a **decrease** in selling price per unit will result in a decrease in sales value if sales volume remains constant.

Therefore, a decrease in selling price per unit of up to 30% can be allowed before the entity will not reach break-even point anymore.

NOTE

The variable costs in total remains at R20 000 as no change took place in either the variable cost per unit, or the number of units sold.

⑤ Current profit is R15 000. Variable costs therefore need to increase by R15 000.
Increase in variable costs / previous variable costs
= R15 000 / R20 000
= 75%

Proof:

Sales	R50 000
Variable costs (R20 000 + R15 000)	R35 000
Contribution	R15 000
Fixed costs	R15 000
Profit	0

OR

If the variable cost per unit changes without a counter effect change in selling price per unit, the contribution ratio will change and lead to a new break-even value.

Let the sales quantity be "a" and the variable cost per unit "b" (both at break-even point).

At break-even point:

Sales – variable costs – fixed costs = 0
50 000 – (a x b) – 15 000 = 0
a x b = 35 000

As the sales quantity (a) had to remain constant, the change in total variable costs from R20 000 to R35 000 can only be attributed to a change in b.

The allowable increase in variable costs = (35 000 – 20 000) / 20 000 = 15 000 / 20 000 = 75%.

You will recall that an **increase** in variable cost per unit will result in an increase in total variable cost if sales volume remains constant.

Therefore, an increase in variable cost per unit of up to 75% can be allowed before the entity will not reach break-even point anymore.

⑥ Current profit is R15 000. Fixed costs therefore need to increase by R15 000.
Increase in fixed costs / previous fixed costs
= R15 000 / R15 000
= 100%

Proof:

Sales	R50 000
Variable costs	R20 000
Contribution	R30 000
Fixed costs (R15 000 + R15 000)	R30 000
Profit	0

OR

Let fixed costs at break-even point be "c".

At break-even point:
Sales – variable costs – fixed costs = 0
50 000 – 20 000 – c = 0
c = 30 000

Fixed costs can therefore increase from the current R15 000 to R30 000 without the entity forfeiting break-even.

This allowable increase amounts to (30 000 – 15 000) / 15 000 = 15 000 / 15 000 = 100%.

b. Most critical variable:

Selling price per unit in ii. is the variable that Fair Bear (Pty) Ltd. needs to pay attention to the most, as the percentage allowable change (30%) is the ***smallest***. This variable will therefore trigger the entity to operate below break-even point the soonest and is therefore the most dangerous.

The selling price per unit is regarded as the most sensitive to changes (of all four variables in this question), as it will result in a loss if it decreases by more than 30% per unit.

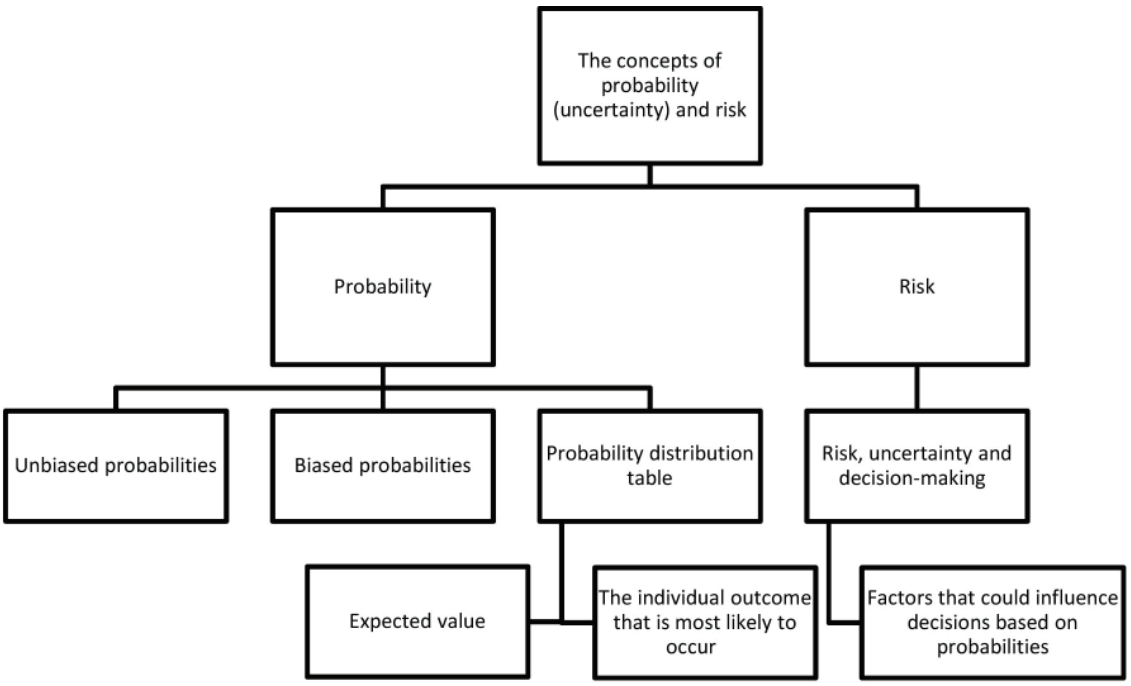
QUESTION 3

	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Sales (R)	1 200	4 180	750	300	17 100	22 400	6 000	600	1 500	250
Variable costs (R)	720	3 344	375	225	6 840	11 200	3 000	480	750	100
Fixed costs (R)	320	836	255	60	6 000	9 520	2 500	84	480	120
Net profit (R)	160	0	120	15	4 260	1 680	500	36	270	30
Contribution (R)	480	836	375	75	10 260	11 200	3 000	120	750	150
Contribution ratio	40%	20%	50%	25%	60%	50%	50%	20%	50%	60%
Break-even sales (R)	800	4 180	510	240	10 000	19 040	5 000	420	960	200
Margin of safety (R)	400	0	240	60	7 100	3 360	1 000	180	540	50
Margin of safety ratio	33,33%	0	32%	20%	41,52%	15%	16,67%	30%	36%	20%

STUDY UNIT 30

Probabilities

In this study unit



1 Introduction

In the previous study unit we assumed that all our predictions regarding the outcome of our decisions, or market factors, will realise as predicted. This implies a probability of 100%! All risks and uncertainties have therefore been ignored.

Where risk and uncertainty exist, the action or decision that is the most appropriate cannot guarantee that the *desired* outcome is achieved. Often, both the **value** of a possible outcome *and* the **probability** associated with the outcome cannot be determined with certainty. However, these have to be anticipated by management as accurately as possible in order for the most appropriate decision to be made under the circumstances.

In this study unit, we will be investigating what the concept of *probability* refers to and how to determine the *expected value* from a list of probabilities. We will also be looking at how to determine from such a list of probabilities which *individual* outcome is most likely to occur under circumstances of risk and uncertainty.

Finally, we will also use what we have learnt about probabilities to recommend optimal decisions in basic scenarios of uncertainty and risk.

NOTE

You might have encountered some of the concepts in your DSC1630: Introductory Financial Mathematics module. We will revisit the basic concepts, but demonstrate the application in a business context for making business decisions (and not for purely statistical applications).

2 The concepts of probability (uncertainty) and risk

As mentioned in study unit 29, entities are exposed to uncertainty and risk and the results ("outcomes") of future events are mostly unknown. To make optimal decisions, it is often necessary for the management of the entity to make an estimate of what the future holds, based on one or more of the following:

- what actually happened in the past
- a list of assumptions about the future
- logic
- their attitude towards risk

NOTE

There is a difference between risk and uncertainty. Risk entails the possibility of a negative consequence, e.g. the equipment may break down in the middle of a crucial order, or sales may be less than the break-even value. Uncertainty can be applied to potential positive outcomes as well, e.g. the probability of you winning the Lottery is one in 45 million. This is uncertainty, there is no risk attached.

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 one of the following:

- a percentage, for example 30%; or
- a fraction, for example 0,3.

RISK AVERSE, RISK SEEKING, RISK NEUTRAL

The attitude/approach of a person/entity to risk can be classified into three groups:

- Risk averse: When a person/entity tries to avoid risk as far as possible.
- Risk seeking: When a person/entity likes/prefers to take risks.
- Risk neutral: When the person/entity is indifferent to risk, i.e. neither risk averse, nor risk seeking.

REFLECT:

How would you consider your own attitude towards risk? Would that change if you were working with other people's (shareholders' / owners') money? Reflect on this.

3 Unbiased probabilities

If the probability can be determined with certainty, for instance when a computer is programmed to select a random number between 1 and 10 (also including both 1 and 10 as options), no assumptions have to be made. Using statistics, it can be determined what the exact chance is of a specific number, e.g. 7, to be picked by the computer. Even though uncertainty still exists regarding which number will be selected, we know that number 7 definitely has a one-out-of-ten or 10% chance of being selected – there is no judgement involved. If this is the case, we can refer to the probability as being *unbiased*, or **objective**.

4 Biased probabilities

More often than not it is the case with probabilities that certain assumptions have to be made by management about what will happen in the future. Sometimes these assumptions are based on what actually happened in the past, but sometimes the past provides no evidence of what may happen in future specific circumstances which may result in a higher level of uncertainty being associated with decisions made under such conditions.

An example of a *biased* (or **subjective**) probability would be how likely it would be that a tourism business will increase its overall profit by opening up another hotel just before the city in which it operates will host a large sporting event, for example a world cup tournament.

Activity 30.1

Probabilities and past experience

Rally Tally (Pty) Ltd. provides members of the public with the opportunity to experience driving instruction lessons with famous motor racing stars. Over the past ten years, the entity has experienced three years in which the competition racing schedules of the stars involved in the business did not allow the entity to have any operations in August.

In the past, there were no other months in which operations had to be suspended. The racing drivers' competition schedules never poses a potential problem, except in August!

Although the competition racing schedule for 20x2 is not yet available, the entity has to prepare a budget for 20x2.

REQUIRED

a. Calculate the probability that the entity will be able to operate in August 20x2 based on past events.
b. Indicate whether the probability is biased or unbiased and motivate your answer.
c. How will your answer to a. change if competition racing schedules could always, and can in the future, lead to suspension of operations for any given month?

Solution to activity 30.1

a. **Probability of not operating in August 20x2**

   i. Identify the outcome for which the probability needs to be determined:

   The racing schedule will disallow Rally Tally (Pty) Ltd. to operate in August 20x2.

ii. Summarise how often this outcome has realised in the past and how often not:

- 3 occurrences
- 7 non-occurrences
- 10 total events

iii. Express the probability as a percentage or fraction:

Based on what happened in the past, the chance is 3 out of 10 that the racing schedule will disallow Rally Tally (Pty) Ltd. to operate in August 20x2, therefore the probability can be calculated as 3 divided by 10, which amounts to 0,3. This probability can also be expressed as 30%.

b. **Biased or not?**

Using statistics (%) is an attempt to be unbiased. However, ten observations (events) could statistically be too few to be representative of what happened in the past, or what may happen in the future, so the 30% probability may be subjective!

c. **Change in competition schedule**

i. Identify the outcome for which the probability needs to be determined:

The racing schedule will disallow Rally Tally (Pty) Ltd. to operate in August 20x2.

ii. Summarise how often this outcome has realised in the past and how often not:

- 3 occurrences
- (10 years x 12 months per year) – 3 months = 117 non-occurrences
- 120 total events

iii. Express the probability as a percentage or fraction:

Based on what happened in the past, the chance is 3 out of 120 that the racing schedule will disallow Rally Tally (Pty) Ltd. to operate in any specific month, including August 20x2. Therefore, the probability can be calculated as 3 divided by 120, which amounts to 0,025. This probability can also be expressed as 2,5%.

---

5 Probability distribution table and expected value

When all the possible outcomes of a future event are determined, probabilities can be assigned to each of these outcomes. It is **important to know that the full list of probabilities need to add up to 1,0 or 100%**.

When all possible outcomes are listed with their associated probabilities, it is possible to determine the *expected value* of a specific variable, for example, number of units sold, profit or number of months in which operations will be possible.

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.

For example, assume the following list of probabilities regarding an entity's profit for the coming year:

Outcome number	Outcome value	Probability
1	R300 000	0,4
2	R250 000	0,6
Total		1,0

To calculate the weighted average of outcomes 1 and 2, we will have to:

- multiply the value of each outcome by its probability

  (R300 000 x 0,4 = R120 000 for outcome 1; R250 000 x 0,6 = R150 000 for outcome 2)
- add up the weighted value of all outcomes

  (R120 000 + R150 000 = R270 000)

The R270 000 is the expected value of the entity's profit for the coming year. It can be incorporated in a schedule as below (a probability distribution table):

Outcome number	Outcome value	Probability	Weighted Outcome	
1	R300 000	0,4	R120 000	R300 000 x 0,4 = R120 000
2	R250 000	0,6	R150 000	R250 000 x 0,6 = R150 000
Total		1,0	R270 000	

Activity 30.2

A list of probabilities

Rally Tally (Pty) Ltd. wishes to determine the expected value of its sales quantity for 20x3, i.e. the expected quantity of driving instruction lessons which will be provided based on a set of probabilities.

Based on the results of the past few years, management has determined that, at full capacity, the average number of lessons provided per instructor would be four lessons per operating day. The entity makes use of five instructors. The entity bases its calculations on the assumption of 26 operating days per month and twelve months in the year.

Information about the possible outcomes and probabilities is provided below:

- There is a 20% chance that the business will not operate in April, August and December
- There is a 10% chance that the entity will operate in all months, except for November
- There is a 15% chance that one of the instructors will go on extended leave for two months in the year
- There is a 20% chance that working hours will be reduced in the three winter months resulting in one lesson less than the daily average per instructor

- Management has determined that the only possible other outcome is that the entity will provide its average number of lessons per month for the full twelve months.

REQUIRED

Calculate the expected value of the sales quantity (number of lessons) for 20x3 using a list of probabilities. Round each individual weighted sales quantity to the nearest integer.

Solution to activity 30.2

i. Identify the outcome(s) for which the probability need(s) to be determined:

The average number of lessons per year based on full capacity can be calculated as 5 x 4 x 26 x 12 = 6 240.

Let us number the possible outcomes for easy reference.

Outcome 1: For three out of the twelve months, the entity will not operate. This is estimated to result in 9/12 x 6 240 = 4 680 lessons being provided. (Alternative: 5 x 4 x 26 x 9 = 4 680.)

Outcome 2: For one out of the twelve months, the entity will not operate. This is estimated to result in 11/12 x 6 240 = 5 720 lessons being provided. (Alternative: 5 x 4 x 26 x 11 = 5 720.)

Outcome 3: For two out of the twelve months, one of the instructors will not operate. This is estimated to result in 6 240 (maximum number of lessons) – (1 x 4 x 26 x 2), or 6 240 – 208 = 6 032 lessons being provided. (Alternative: (5 x 4 x 26 x 10) + (4 x 4 x 26 x 2) = 5 200 + 832 = 6 032.)

Outcome 4: For three out of the twelve months, each instructor will provide 1 lesson per day less than the average. This is estimated to result in 6 240 (maximum number of lessons) – (5 x 1 x 26 x 3), or 6 240 - 390 = 5 850 lessons being provided. (Alternative: (5 x 4 x 26 x 9) + (5 x 3 x 26 x 3) = 4 680 + 1 170 = 5 850.)

Outcome 5: The entity will operate at the maximum level of 6 240 lessons being provided during the year.

ii. Prepare the list of probabilities indicating the following:

- all outcomes
- the probability of each outcome
- the weighted value of each outcome
- finally also the expected value

Outcome number	Outcome value	Probability	Weighted sales quantity	
1	4 680	20%	936	②
2	5 720	10%	572	③
3	6 032	15%	905	④
4	5 850	20%	1 170	⑤
5	6 240	① 35%	2 184	⑥
Total		100%	5 767	⑦

Calculations:

① The probabilities have to add up to 100% and therefore the probability of the only outcome for which a probability has not been specified, will be:

100% – 20% – 10% – 15% – 20% = 35%

② 4 680 x 20% = 936

③ 5 720 x 10% = 572

④ 6 032 x 15% = 904,8 rounded to 905

⑤ 5 850 x 20% = 1 170

⑥ 6 240 x 35% = 2 184

⑦ The total of all five weighted sales quantities is 5 767. The 5 767 is the expected value that we have been required to calculate. You will notice that the expected value is a weighted average of all the outcomes, where each individual outcome's weight is determined by the probability of the specific outcome.

NOTE

You will notice that the expected value in the activity above is a **quantity** (here number of lessons). Expected value does not always have to be a Rand amount.

6 The individual outcome that is most likely to occur

We will use the probability distribution table, indicating all possible outcomes of an event, to find the individual outcome that is **most likely to occur**.

MOST LIKELY TO OCCUR

The individual outcome that is most likely to occur is the **outcome with the highest probability** of occurring.

Activity 30.3

Individual outcome most likely to occur

Refer to the information provided in Activity 30.2 above.

REQUIRED

Identify the individual level of sales quantity that Rally Tally (Pty) Ltd. is most likely to achieve in 20x3.

Solution to activity 30.3

Outcome 5: *The entity will operate at the maximum level of 6 240 lessons being provided during the year* has the highest probability on the list of probabilities (35%) and the individual level of sales quantity that Rally Tally (Pty) Ltd. is most likely to achieve in 20x3 is therefore 6 240 lessons.

7 Risk, uncertainty and decision-making

To make appropriate decisions in practice requires proper consideration and analysis of information about events that will definitely occur and those future events of which the occurrence is uncertain. The information used in the decision-making process should be accurate and timely in order for managers to be able to make appropriate decisions in a complex and ever-changing world.

The decisions of management regarding possible future events (which could be influenced by the entity's attitude toward risk) and their reactions to anticipated and unanticipated events play a very important part in how well the entity performs. The sensitivity of profits to possible internal and external changes should therefore be carefully determined and the actual changes should be effectively managed by the entity if and when they occur.

NOTE

In MAC2602: Principles of strategy, risk and financial management techniques, a significant portion of the module is devoted to the Risk Management process, and the interaction between risk and strategy development.

Factors which could affect decisions based on probabilities

There is a variety of other factors that may also need to be considered when a decision is made based on probability theory. Examples of such factors can include the following:

- Management's approach/attitude to risk (i.e. how much risk the management of the entity is willing to take):
  - Is management *risk averse*?
  - Is management *risk seeking*?
  - Is management *neutral* to risk?
- Whether it is better to work with a range of values than a single expected value?
- Whether management was perhaps too optimistic or too pessimistic when they assigned probabilities to the outcomes by means of assumptions?
- What is the worst that can happen if the decision based on the probabilities goes wrong – will the entity be able to recover?
- Is the decision reversible if things do not turn out as planned?

8 Summary

In this study unit we learnt that:

- "Probability" is the chance that a future event will result in a specific outcome.
- An unbiased probability can be determined with certainty; however, a biased probability requires judgement. Business decisions require a lot of judgements.
- The expected value can be determined from a list of probabilities by calculating the weighted average of all the outcomes as determined by their probabilities.
- The individual outcome that is most likely to occur is the outcome with the highest probability of all the possible outcomes.
- Probability calculations can be used to make decisions in business, but other factors may also need to be considered in making an appropriate decision.

In the next study unit you are going to learn how decision trees can be applied as a visual tool to assist decision making under conditions of uncertainty. You will also learn how to use a decision tree to determine the expected outcome of decisions and events. The concepts of probability and expected values will be used again!

Self-assessment activity

QUESTION 1

Komane Kids (Pty) Ltd. owns a venue where birthday parties for children can be hosted. The entity wants to estimate what effect there will be on profits if a coffee shop for parents is built on the premises. The entity has gathered information from competitors who have similar venues and who have put coffee shops on their premises.

The table below indicates the extent to which profits changed after the coffee shops were opened and the number of competitors that experienced the specific change in profits:

Percentage increase / (decrease) in profit	Number of competitors
(75%)	1
(50%)	0
(25%)	8
0%	6
25%	13
50%	8
75%	4

REQUIRED

a. i. Prepare a list of probabilities based on the information obtained from competitors.
   ii. Calculate the expected effect of constructing the coffee shop on the profit of Komane Kids (Pty) Ltd. Round the weighted outcome values to three decimals.

b. Identify the individual effect on profit that is most likely to occur if Komane Kids (Pty) Ltd. constructs the coffee shop.

c. The management of Komane Kids (Pty) Ltd. will only build the coffee shop if the expected increase in profit is at least 25%. Based on your answer in (a), indicate whether the coffee shop should be built or not.
d. If management makes decisions based on the individual outcome that is most likely to occur, will they build the coffee shop, or not?

QUESTION 2

Hooked on Books (Pty) Ltd. is a publisher of books. When a new book manuscript is accepted for publication by the entity, estimates of the possible sales quantities for the first six months after the book launch are made. Further financial decisions are based on probability calculations concerning these estimates, as well as relevant costing techniques.

All copies of the book are printed once-off by the publisher (based on the initial six-month estimated sales quantity) before actual demand (sales orders from book stores) for the book is known.

The publisher will not be able to sell any books that were printed, but for which there are no actual demand and closing stock at the end of the initial selling period will therefore have to be written off as obsolete.

Where actual demand in the first six months exceeds the quantity produced, a second print run may be considered based on potential further orders. However, the six-month delay usually results in waning interest in buyers and second print runs are unusual. The only exception is books by well-known or prize-winning authors.

A manuscript of a novice author has been accepted for publishing and the entity estimated that for the initial print run there is:

- A 35% chance that 10 000 copies of the book will be sold.
- A 30 % chance that 20 000 copies of the book will be sold.
- A 20% chance that 30 000 copies of the book will be sold.
- A 10% chance that 40 000 copies of the book will be sold.
- A 5% chance that 50 000 copies of the book will be sold.

REQUIRED

a. i. Prepare a probability distribution table for the initial print run based on the information above.
   ii. Calculate the expected value for the sales quantity of the specific new book.
b. Identify the individual sales quantity that is most likely to occur.
c. The variable costs to print one copy of the book amounts to R80. The entity will incur once-off costs of R140 000 relating to the printing plates on which the manuscript will be set. Determine the relevant cash flows of printing the estimated number of copies of the book if the selling price per copy is R150.
d. How many copies of the book should the publisher print to break even?
e. Assume that the author will receive royalties of 8% per copy sold and that all costs associated with printing and selling the book, will be borne by the publisher. If the book can only be printed in batches of 10 000 up to a maximum of five batches, how many books will the author want the publisher to print if each copy can be sold at R150?

Solution to self-assessment activity

QUESTION 1

a. Probability list and expected value

Answer to (i)		
Outcome value	**Probability (%) ①**	**Weighted effect**
(75%)	2,5	-1,875
(50%)	0,0	0,000
(25%)	20,0	-5,000
0%	15,0	0,000
25%	32,5	8,125
50%	20,0	10,000
75%	10,0	7,500
Total	100,0	**18,750**

Answer to (ii)

The expected effect on the profit of Komane Kids (Pty) Ltd. is therefore an increase of 18,75%.

Explanatory notes:

① The probabilities were calculated by determining the total number of competitors from which the information was obtained and then dividing the number of competitors associated with the specific outcome by the total.

Total = 1 + 0 + 8 + 6 + 13 + 8 + 4 = 40

Probability of a 75% decrease in profit = 1/40 = 0,025 = 2,5%
Probability of a 25% decrease in profit = 8/40 = 0,2 = 20%
etc.

b. Increase in profits of 25% (the probability of 32,5% is the highest).

c. No, an increase of 18,75% is smaller than the required increase of 25%.

d. Yes, an increase of 25% meets the requirement of management.

REFLECT:

If you were the business owner, what decision would you have made?

QUESTION 2

a. Probability list and expected value

Answer to (i)		
Outcome value	**Probability (%)**	**Weighted effect**
10 000	35	3 500
20 000	30	6 000
30 000	20	6 000
40 000	10	4 000
50 000	5	2 500
Total	100	**22 000**

Answer to (ii)

The expected value of the sales quantity of the specific book is therefore 22 000 copies.

b. 10 000 copies (the probability of 35% is the highest).

c. Relevant cash flows

	R
Sales (22 000 x R150)	3 300 000
Variable costs (22 000 x R80)	(1 760 000)
Contribution cash flow	1 540 000
Incremental fixed costs – printing plates	(140 000)
Incremental net cash inflow	1 400 000

d. Break-even = incremental fixed costs ÷ cash contribution per book
= R140 000 ÷ (R150 – R80)
= R140 000 ÷ R70
= 2 000 books

e. 50 000 copies.

The author's income is determined by the number of books sold. Therefore, the author would prefer that the **maximum** possible number of books is printed, no matter what the actual demand is. If actual demand cannot be met as the number of copies printed was too low, it will lead to an opportunity cost for the author, as he will not be earning a royalty on sales missed due to book stores being out of stock.

The author will carry NO risks associated with printing too many copies (copies that will never be sold due to a lack of actual demand). The excess of the copies printed over the actual demand will result in obsolete inventory, which will be the loss of the publisher as the variable costs cannot be recovered.

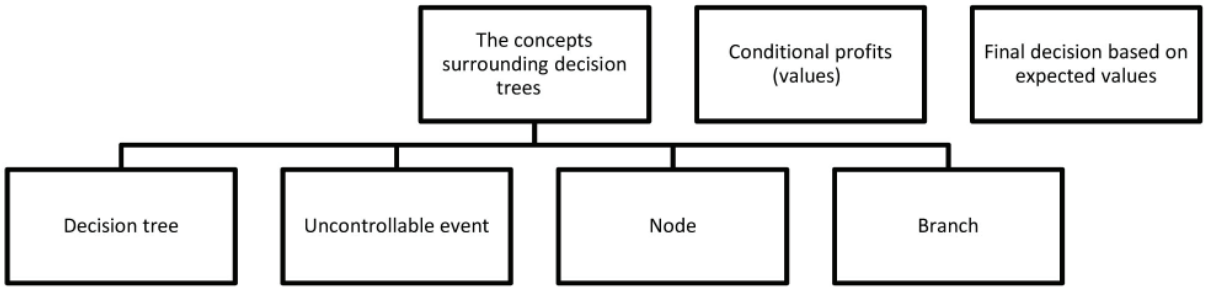
NOTE

In MAC2601, we use "÷", "/" [forward slash] and fractions interchangeably to show that we are performing the operation of division.

STUDY UNIT 31

Decision trees

In this study unit



1 Introduction

In the previous study unit, we discussed the impact of uncertainty on business decisions. You learnt about probabilities and the expected outcome. In this study unit, you will also apply many of the probability principles that you have learnt about in study unit 30.

In this study unit, we will be looking at decision trees as a tool to use to:

- Recommend appropriate decisions
- Determine the expected outcome of decisions and events
- Determine the sensitivity of profit to decisions and events

when risk and uncertainty exist.

2 The concepts surrounding decision trees

DECISION TREE

A graphic representation of decisions to be made and the uncontrollable events that could affect these decisions.

UNCONTROLLABLE EVENT

Something that takes place independent of management's actions, i.e. management cannot control what happens under the specific circumstances.

This graphic representation (picture) looks (with the use of a bit of imagination!) like a tree that you will find in a garden. This "tree" will also have "branches".

A decision tree generally consists of the following two elements:

- nodes
- branches

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.

In MAC2601, we will be indicating the different nodes as follows:

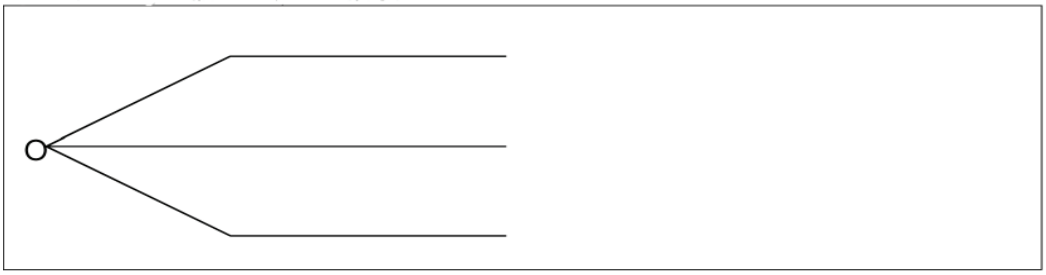
Type of node	Graphic representation	Symbol
Decision	Box	□
External event	Circle	O

BRANCH

A *branch* connects one node to the following. In MAC2601, a branch will be represented by a solid line.

A set of nodes and branches is also called a *subtree*. A decision tree can consist of many subtrees and some of these subtrees can be grouped into larger subtrees.

The following is an example of a subtree:



Source: Author, 2012.

Figure 31.1: Example of a subtree

3 Conditional profits (values)

If we follow the nodes and branches up to the end of a specific subtree, we will find the final outcome (net cash inflow or outflow) of all the events and decisions that led to this point. The profit (or other amount/quantity, depending on the specific scenario) at this point is called the *conditional profit (value)* or a *possible outcome* of the decision tree.

NOTE

This value is calculated before weighting with its probability!

Just like in study unit 30, we can also determine the *expected value* of our profit (or other quantity or amount) by calculating the weighted average of all relevant possible outcomes, where each weight is determined by the probability that the specific outcome will realise.

In the case of decision trees, however, we will be calculating an expected value for each set of possible outcomes relevant to the decision and compare these expected values to one another in order to determine the most appropriate route to follow (i.e. the most appropriate decision(s) to make).

In Activity 31.1 you will be required to prepare a decision tree for a specific set of circumstances. We will also be using this decision tree in activity 31.2.

Activity 31.1

Calculating conditional profits

All-to-Africa (Pty) Ltd. manufactures T-shirts with African motives and concentrates on the tourist market in South Africa. As it was recently announced that South Africa's bid for the 20x8 Olympic Games was successful, the entity is considering whether to start a new product line with an Olympics theme.

Additional information:

- It has been budgeted that the profit from existing products would be R1 200 000 if the new product line is not added (probability 1,0).
- Research and product design in respect of the new line has already been done at a cost of R300 000.
- Additional fixed costs to be incurred if the new product line is added, will amount to R500 000.
- Market research indicates that there is an eighty percent probability that customers will support the new product line.
- Management estimates that the overall contribution of the entity will increase by only R200 000 if the product line is added, but customers do not support the product. If the product line is added, but customers do not support the product, the entity will have to discontinue the product line at the end of the year at an additional fixed cost of R100 000.
- If the customers support the new product:
  - There is a 30% chance that a high sales volume will occur
  - There is a 20% chance that a low sales volume will occur
  - If neither a high, nor a low sales volume occurs, the sales volume will be medium in size.
- The expected effect on current budgeted profit (R1 200 000) at the various possible levels of sales volume are as follows:

Volume level	① Net effect on profit
High	30% increase
Medium	20% increase
Low	10% increase

① The above expected net effects already include (accounts for) the effects of the additional fixed cost associated with adding the new product line.

REQUIRED

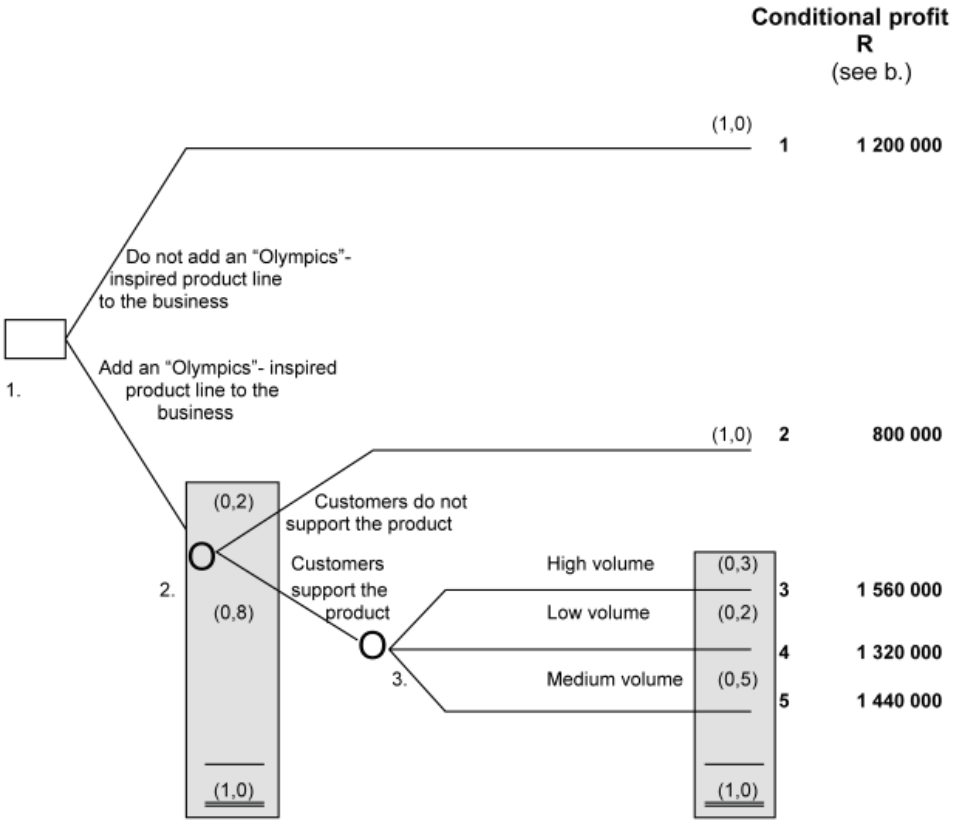
a. Draw a decision tree, depicting all the decision and event nodes relevant to the above information.

b. Calculate the conditional profit/(loss) associated with each possible outcome in the decision-tree in a.

c. Using the decision tree that you have drawn, read off what the conditional profit will be if the new product line is added and customers do not support the product.

Solution to activity 31.1

a. **Decision tree – step one: conditional profit**



There are three nodes:

1. Decision node: Management will have to **decide** whether to add or not to add the product line to the business (this is the leftmost part or the "highest" level of the decision tree – where it all starts)
2. Event node: If the new product line is added, customers could either **support it or not**.
3. Event node: If the new product line is added *and* customers support the product, there are three **possible effects on the profit** of the entity (this is the lowest level of the decision tree – as determined by the final possible decision(s)/event(s) if we follow the decision tree chronologically).

NOTE

- You will note from the above decision tree that to do "nothing" is also a decision that can be taken – this is always the case.
- For ease of reference, we have numbered the possible outcomes of the decision tree.
- The probabilities of the outcomes of an event node will add up to 1. See shaded areas for probabilities of event nodes 2 and 3.

b. Identify/calculate the conditional profit associated with each outcome

Outcome number	Description of outcome	Conditional profit (R)	Calculation
1	No change in profit - given	1 200 000	
2	Profit changes due to customers not supporting the new product	800 000	②
3	Profit increases by 30% due to customers supporting the product and buying high volumes	1 560 000	③
4	Profit increases by 10% due to customers supporting the product and buying low volumes	1 320 000	④
5	Profit increases by 20% due to customers supporting the product and buying high volumes	1 440 000	⑤

Calculations:

For all five different outcomes, we will start off with the profit which the entity expects to achieve if the new product line is not added, namely R1 200 000.

The costs of R300 000 incurred on research and product design is a *sunk cost* (refer Topic 11: Relevant Costing) and will not affect our decisions (as it is irrelevant to the decision being made).

②	Budgeted profit	R1 200 000	
	Less: Net incremental costs	400 000	(500 000 + 100 000 – 200 000)
	Conditional profit	800 000	

Both the fixed cost of adding the new product line (R500 000) and the cost of discontinuing the new product line (R100 000) will have to be incurred if customers DO NOT support the product. Incremental contribution of R200 000 will have to be deducted from these incremental costs to determine the net incremental costs.

③ R1 200 000 x (100 + 30) / 100 = R1 560 000

④ R1 200 000 x (100 + 10) / 100 = R1 320 000

⑤ R1 200 000 x (100 + 20) / 100 = R1 440 000

c. Reading off the decision tree

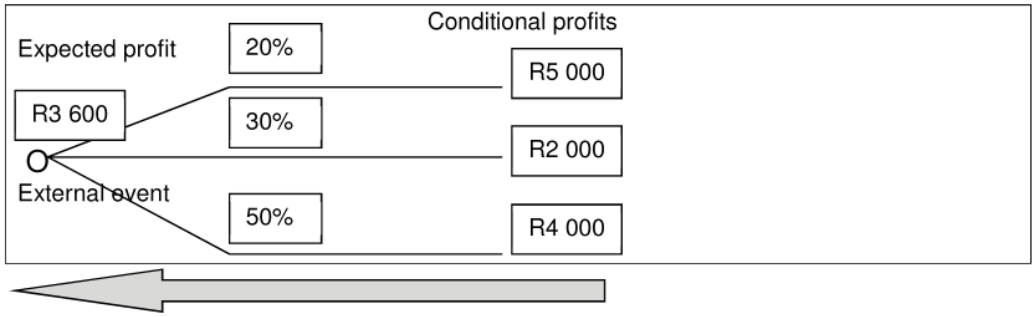
R800 000. Follow the decision tree from the starting point (far left – "highest" level) to the relevant expected/conditional profit (far right), this will lead us to the conditional profit associated with outcome 2, which has been determined in calculation ② above.

4 Final decision based on expected values

To determine an appropriate decision based on a decision tree with more than one external event node, we generally start by calculating the expected value(s) associated with the "lowest" level (right) of the decision tree (let's call this value A for the decision tree in this activity – refer to the decision tree populated at the end of the next activity). We will then gradually build up our expected value level-by-level (moving from right to left) until we reach the first decision node of the decision tree where we will have to choose between a number of expected values.

NOTE

- In MAC2601, we will draw decision tree nodes to chronologically follow from left-to-right, i.e. the event/decision that happens first, will be on the leftmost side of the decision tree. We will call the first decision to be made, the "highest" level of the decision tree. (This will also be the only decision to be made if our decision tree has only one decision node.)
- The further we are moving to the right-hand side of the decision tree, the "lower" the level of the decision tree.



In the next activity, we will now learn how to use the decision tree to arrive at an optimal decision.

Activity 31.2

Calculate and compare the expected values to arrive at an appropriate decision

Refer to Activity 31.1 and the information provided below.

REQUIRED

a. Use the decision tree and the expected values and decide whether the new product line should be added or not.

b. Revise your decision based on each of the following independent conditions:

   i. A new product line should only be added if the expected value of adding the product line exceeds the budgeted profit by at least 15%.

   ii. A new product line should only be added if there is a more than 50% chance that adding the product will lead to an increase in profit of more than 10%.

c. What will the expected profit be if the new product line is added and customers support the product?

Solution to activity 31.2

a. If we take a careful look at the decision tree, we will see that there are only three nodes. This means that there are only three events/decisions that can influence our final expected profit (expected value).

Step 1 – Calculate the expected value associated with the lowest level ("A" in the decision tree at the end of this activity)

Outcome number	Conditional profit (R)	Probability	Weighted profit
3	1 560 000	0,3	468 000
4	1 320 000	0,2	264 000
5	1 440 000	0,5	720 000
Total		1,0	1 452 000

NOTE

You will notice that we calculate an expected value of a set of outcomes just like in study unit 30. We have, however, replaced the term "outcome value" with "conditional profit" (in this case).

Step 2 – Calculate the expected value associated with the second lowest level ("B" in the decision tree at the end of this activity)

Outcome number/Level	Conditional profit (R)	Probability	Weighted profit
2	800 000	0,2	160 000
A	(from step 1) 1 452 000	0,8	1 161 600
Total		1,0	1 321 600

Step 3 – Make a decision by comparing the expected values ("C").

We have now reached the level (node) where the **decision** has to be made. The decision will be between adding the new product line to the business (with an expected value of R1 321 600) or not adding the new product line (certain profit of R1 200 000 – the amount is certain, as the probability involved is 1,0 or 100%).

Without any further conditions, the logical decision would be to launch the new product as its expected profit is higher than the status quo (existing situation (where nothing is done)).

b. i. Increase in profit = (1 321 600 – 1 200 000) / 1 200 000 = 10,13% rounded. The increase is less than 15% and therefore management has to select the option of not adding the product line.

ii. If the product line is added there is a 0,64 (or 64%) chance that profit will increase by more than 10%. This is more than 50% and management therefore has to select the option of adding the product line. The 64% has been determined as follows:

Out-come number	Decrease/increase	Probability	In accounting for the total probability of an increase
2	Decrease (800 < 1 200)	0,20	Ignore
3	**30% increase**	0,8 x 0,3 = 0,24	**Select**
4	10% increase (i.e. *not more* than 10%)	0,8 x 0,2 = 0,16	Ignore
5	**20% increase**	0,8 x 0,5 = 0,40	**Select**
		1,00	

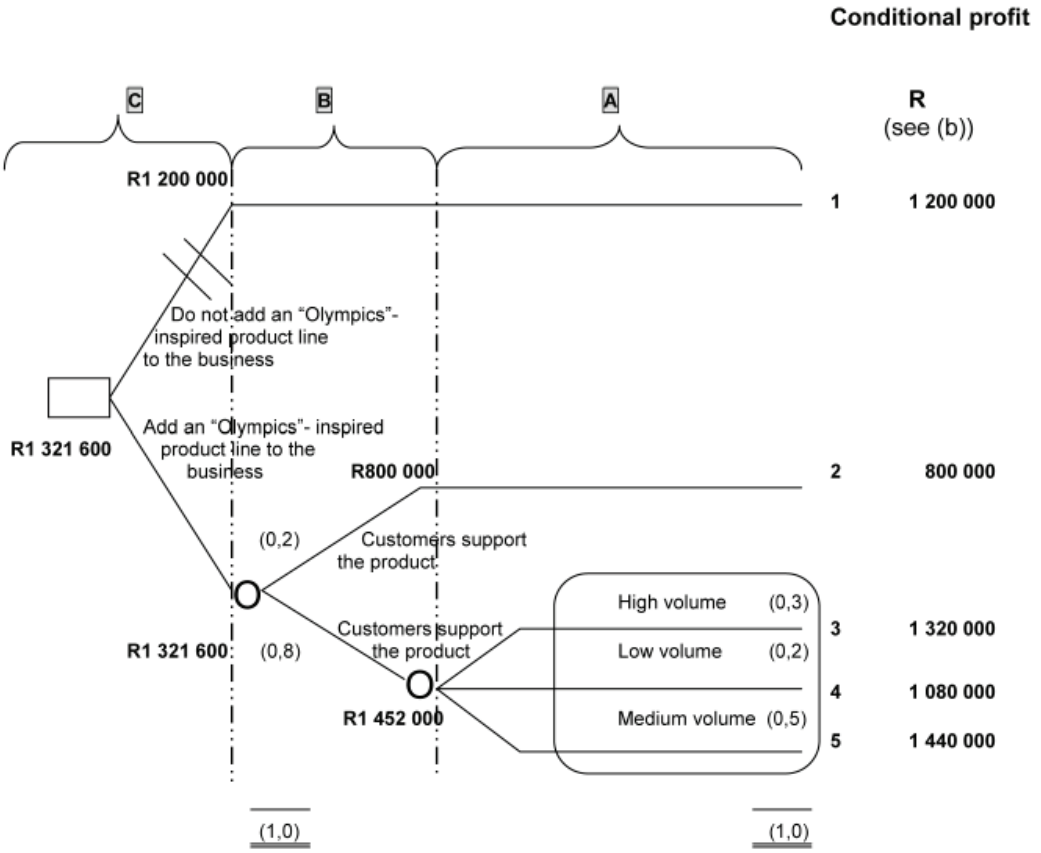
Total chance of increase of more than 10% if new product line is added = (0,24 + 0,40) = 0,64. There is a 36% chance that the increase in profits will be 10% or less (including the chance of a decrease) in profits.

NOTE

Do not get confused between the probability that the outcome will occur and the percentage by which the profits will change.

c. R1 452 000 (follow the decision tree from the highest level to the relevant expected / conditional profit – in this question, this will lead us to the expected value of level A).

The updated decision tree below shows the three levels of the decision tree in activity 31.1 above, where C represents the "highest" level and A the "lowest". The conditional profits and expected values that we have used in making our decisions are also shown.



NOTE

All alternatives that should not be selected can be graphically "eliminated" by drawing two lines through the main branch associated with each of these specific alternatives. The eliminated alternative in the decision tree above relates to part a.

5 Summary

In this study unit we learnt that:

- Decision trees graphically represent decisions to be made and the uncontrollable events that could affect these decisions.
- Decision trees consist of nodes and branches, which can be grouped into different subtrees.
- The conditional profit or possible outcome is the final result or outcome of all the events and decisions that lead to a specific point, before weighting with probabilities.
- To determine an appropriate decision based on a decision tree, the expected values of the relevant sets of possible outcomes should be compared in the light of any specific requirements/information in the question.
- Work from right to left to calculate the estimated value of each event node and ultimately make the decision between the options at the decision node.

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.

Self-assessment activity

QUESTION 1

Fancy Vacations (Pty) Ltd. sells luxury holiday packages at R10 000 each. The entity can either put together their own packages by purchasing individual products and services from a number of suppliers of the products and services involved or they can buy and resell "ready-made" packages from a travel agency.

The entity's business is dependent on the state of the economy. The estimated number of packages to be sold in 20x2 can be determined from the table below:

State of the economy	Probability	Estimated number of packages sold
Recession (R)	0,2	500
Economic stability (S)	0,6	750
Economic growth (G)	0,2	1 000

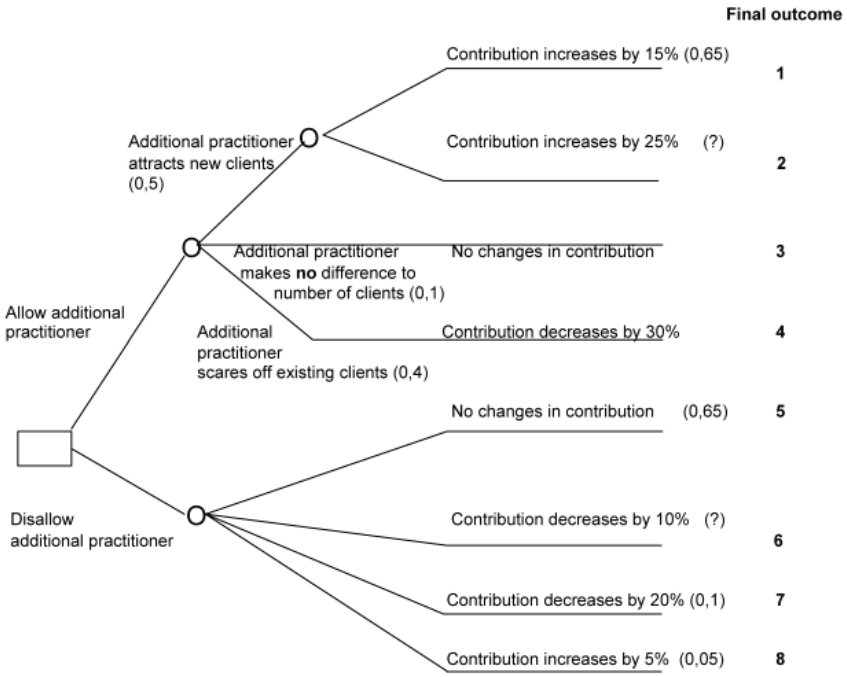
If the entity puts together its own packages, the cost per package will amount to R8 000. However, if the travel agency is used, each of the first 750 packages will cost R8 250 and every package bought in excess of 750 packages will cost only R7 000 per package. Packages can be bought from the travel agency in any quantity, but any packages not sold in the current year cannot be transferred to the following year.

REQUIRED

Using a decision tree, indicate which course of action the entity should take in order to maximise its profit for 20x2.

QUESTION 2

The business analyst of Better Soon (Pty) Ltd., a consortium of doctors and other health practitioners, has provided you with the following decision tree:



Additional information:

- Each practitioner shares in the profit of the consortium.
- The entity has to decide whether to allow a very well-known, but controversial practitioner into their consortium.
- The budgeted contribution of the consortium for the year ended 30 April 20x7 was R5 000 000 before it was known that the controversial practitioner would apply to join the consortium.
- If the additional practitioner is allowed into the consortium:
  - He may attract new clients to the consortium as a result of bringing in some of his existing clients, who could make use of his services and/or some of the other practitioners' services.
  - His existing clients may decide not to "move" with him to his new practice.
  - He may scare off some of the other practitioners' clients due to the controversy associated with him or with his admittance.
- If the additional practitioner is **not** allowed into the consortium, it may have:
  - No effect on the consortium's current business.
  - A positive effect on the current business due to potential clients taking note of and approving of the refusal to allow the controversial practitioner.
  - A negative effect on the current business due to existing clients taking note of and disapproving of the refusal to allow the controversial practitioner.

REQUIRED

a. From a quantitative perspective, should the consortium allow the additional practitioner in the business or not? Complete the decision tree to arrive at an answer and motivate your answer with appropriate calculations.

b. The consortium will also have to consider qualitative factors in their decision-making. Identify two qualitative factors that should possibly be considered regarding the specific decision and explain them briefly in the context of this scenario. *(Hint: Revisit study unit 26, section 4, for examples of qualitative factors.)*

c. Assume that the additional practitioner is allowed in the consortium and that he attracts new clients. What will the expected value of the consortium's contribution be?

d. The quantitative analysis excluded fixed costs. Identify two incremental fixed costs that may arise if the additional practitioner is allowed in the consortium.

QUESTION 3

Refer to Question 2 - Hooked on Books (Pty) Ltd. in the self-assessment activity of study unit 30. The same relevant cash flow information applies to the new manuscript.

Assume that the only options of the publisher are to print either 10 000 or 20 000 copies of the book, i.e. the machines can only execute print runs in quantities of 10 000 (no partial runs allowed).

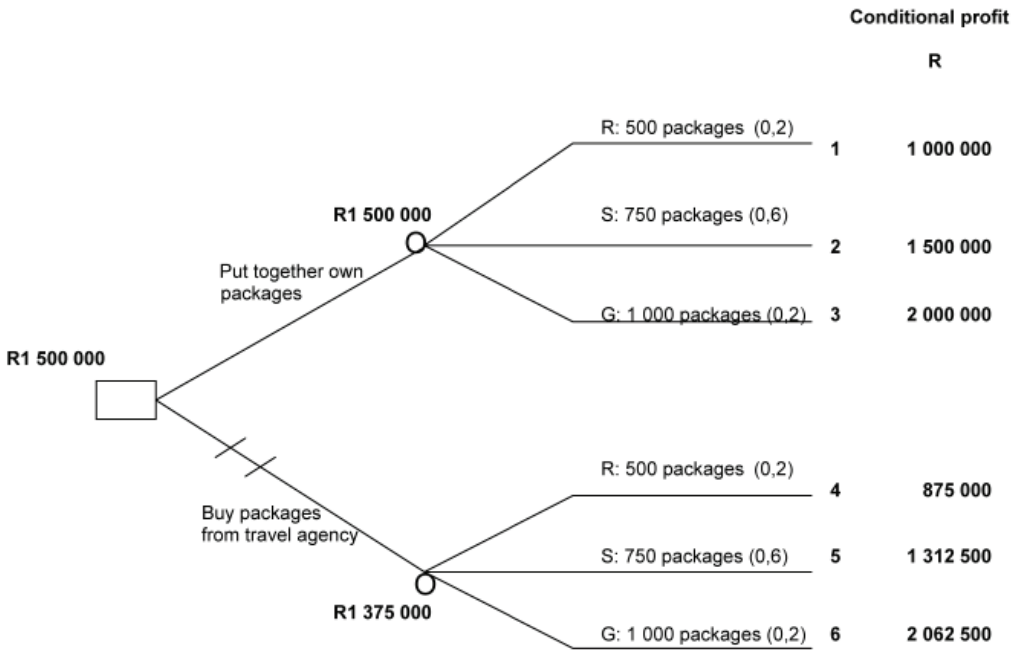
There is a 50% chance that the demand for the book will be 10 000 copies and a 50% chance that the demand for the book will be 20 000 copies.

REQUIRED

Use a decision tree and recommend how many copies of the book the publisher should print.

Solution to self-assessment activity

QUESTION 1



Group of outcomes	Outcome number	Conditional profit	Probability	Weighted profit
1 – 3	1	1 000 000[1]	0,2	200 000
	2	1 500 000[2]	0,6	900 000
	3	2 000 000[3]	0,2	400 000
Total for the group			**1,0**	**1 500 000**
4 – 6	4	875 000[4]	0,2	175 000
	5	1 312 500[5]	0,6	787 500
	6	2 062 500[6]	0,2	412 500
Total for the group			**1,0**	**1 375 000**

The highest expected value is the R1 500 000 for the group of outcomes associated with the decision to put together own packages.

Conclusion: In order to maximise its profit, the entity should put together its own packages, as this alternative renders the highest expected value (profit).

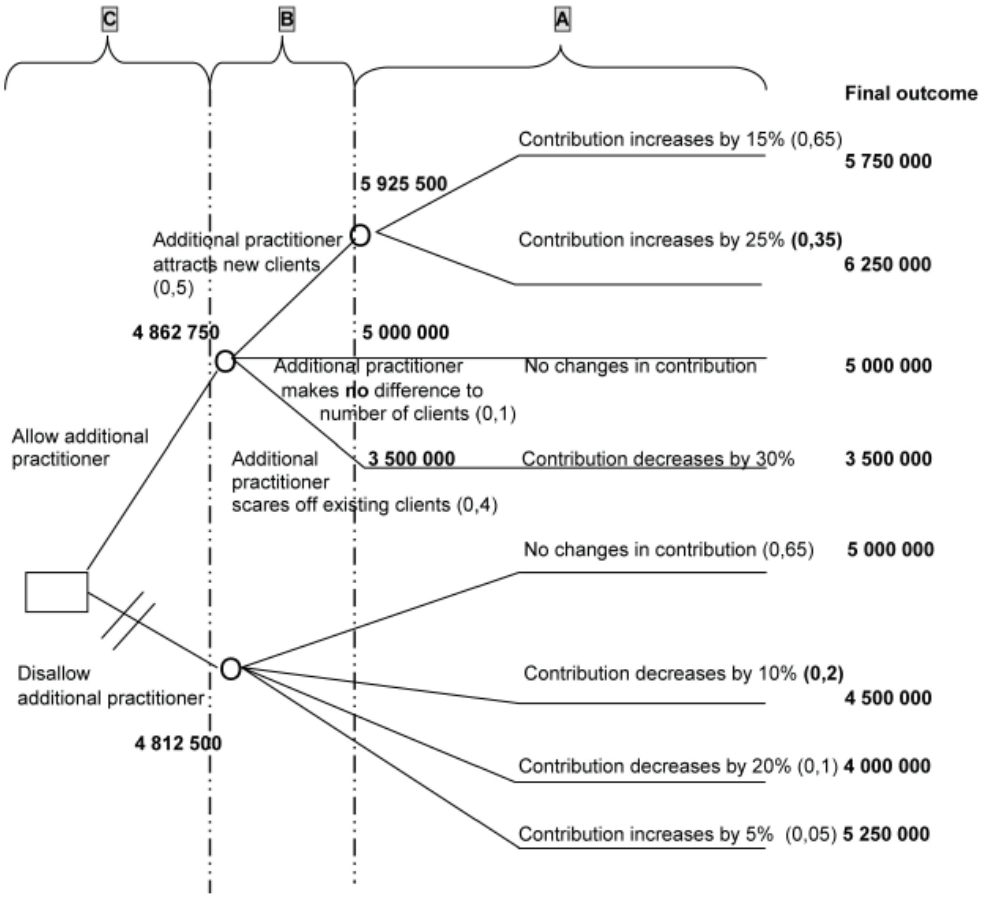
Explanatory notes:

In this question, all the possible outcomes are on the same level. However, two groups of outcomes exist on this level (some of the outcomes are linked to the one event; the remainder of the outcomes are linked to the other event) and we therefore need to calculate two separate expected values for our costs.

Calculation	Estimated income	Estimated expenses	Estimated (conditional) profit
1	500 x 10 000 = 5 000 000	500 x 8 000 = 4 000 000	1 000 000
2	750 x 10 000 = 7 500 000	750 x 8 000 = 6 000 000	1 500 000
3	1 000 x 10 000 = 10 000 000	1 000 x 8 000 = 8 000 000	2 000 000
4	500 x 10 000 = 5 000 000	500 x 8 250 = 4 125 000	875 000
5	750 x 10 000 = 7 500 000	750 x 8 250 = 6 187 500	1 312 500
6	1 000 x 10 000 = 10 000 000	6 187 500 + 250 x 7 000 = 7 937 500	2 062 500

QUESTION 2

a. Completed decision tree



Calculation step 1 - Calculate the expected values associated with the lowest level groups (level A in the completed decision tree):

Group of outcomes	Outcome number	Conditional contribution	Probability	Weighted contribution
1 – 2	**1**	5 750 000[1]	0,65	3 737 500
	2	6 250 000[2]	1,00 – 0,65 = 0,35	2 187 500
Total for the group			**1,00**	**5 925 500**
3	**3**	5 000 000[3]	1,00	5 000 000
Total for the group			**1,00**	**5 000 000**
4	**4**	3 500 000[4]	1,00	3 500 000
Total for the group			**1,00**	**3 500 000**

NOTE

- Outcomes 3 and 4 were treated as "groups" on the lowest level (named level A in this question) for completeness' sake. At this level, the probability associated with each of outcomes 3 and 4 is 1,00. [If we apply this concept to activity 31.2, we could have included outcome 2 of activity 31.2 in the specific activity's step 1 (as 800 000 x 1,00 = R800 000) and outcome 1 of activity 31.2 in the specific activity's step 2 (as 1 200 000 x 1,00 = R1 200 000)].

- The alternative of disallowing the additional practitioner did not involve *any* decision nodes on the lowest level (named level A in this question) and therefore we only included outcomes 5–8 in calculation step 2 below (i.e. in calculations involving the second lowest level, "B").

Calculation step 2 – Calculate the expected values associated with the second lowest level groups (level B in the completed decision tree)*:*

Group of outcomes	Outcome number	Conditional contribution (from step 1)	Probability	Weighted contribution
1–2, 3, 4	**1–2**	5 925 500	0,50	2 962 750
	3	5 000 000	0,10	500 000
	4	3 500 000	0,40	1 400 000
Total for the group			**1,00**	**4 862 750**
5–8	**5**	5 000 000[5]	0,65	3 250 000
	6	4 500 000[6]	1,00 – 0,65 – 0,10 – 0,05 = 0,20	900 000
	7	4 000 000[7]	0,10	400 000
	8	5 250 000[8]	0,05	262 500
Total for the group			**1,00**	**4 812 500**

Explanatory notes:

Outcome	Estimated (conditional) contribution
1	5 000 000 x 1,15 = R5 750 000
2	5 000 000 x 1,25 = R6 250 000
3	5 000 000 x 1,00 = R5 000 000 (no change)
4	5 000 000 x 0,70 = R3 500 000
5	5 000 000 x 1,00 = R5 000 000 (no change)
6	5 000 000 x 0,90 = R4 500 000
7	5 000 000 x 0,80 = R4 000 000
8	5 000 000 x 1,05 = R5 250 000

Calculation step 3 – Make a decision by comparing the expected values

We have now reached the level (node) where the **decision** has to be made. The decision will be between allowing the additional practitioner in the business (with an expected value of R4 862 750 – refer step 2) or disallowing the additional practitioner (with an expected value of R4 812 500 – refer step 1).

From a purely quantitative perspective, the logical decision would be to allow the additional practitioner in the business as the expected contribution associated with this option is higher than the expected contribution associated with the option of disallowing the practitioner.

NOTE

Instead of working with the total contribution in the question above, students could also have used the **incremental** contribution to arrive at the same conclusion. For example, final outcome 1 would be R750 000 (i.e. the difference between the increased contribution and the basis of R5 000 000) instead of R5 750 000 (total contribution as adjusted for the increase); final outcome 4 would be (R1 500 000), the difference between the decreased contribution of R3 500 000 and the basis of R5 000 000, etc. In the calculations the incremental contribution would have been weighted (instead of the total contribution) and thereafter compared between the two alternatives.

b. i. **Responsibility of the entity to the public:** The consortium will have to consider what the nature of the controversy around the possible additional practitioner is. If it is because of something like **doubtful ethical conduct** of the practitioner or prescribed treatments that may be harmful to patients, the entity should not allow the practitioner in the business as this action will not represent good governance. If it is because of treatments, etc. that varies from the usual, but that will not be **potentially harmful** to patients, the consortium could still allow the practitioner in the business if they are not against his approach.

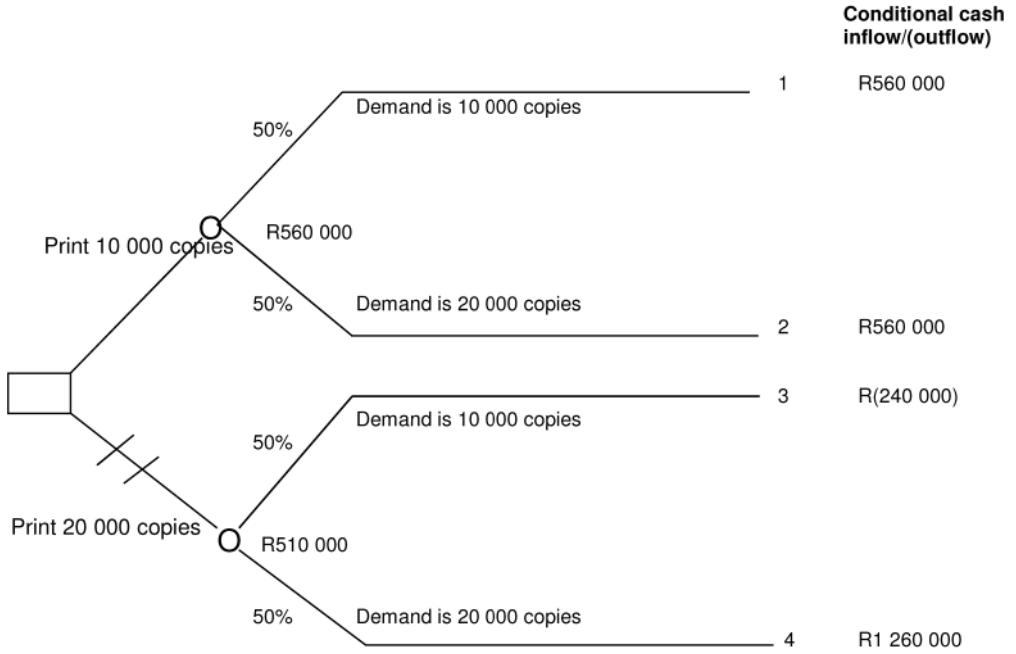
ii. **Effects of the decision on the public's perception about the consortium:** Even if the consortium has the true facts and know that the practitioner's conduct is ethical and his approaches are not potentially harmful to patients, the public may have a different perception. Accepting the practitioner in the business may result in the **public perception** that the consortium approves of unethical behaviour or potentially harmful practices. If it is probable that such a negative perception will arise, the consortium should rather not allow the practitioner in the business. In such a case, it could be a good idea to discuss the reason for not allowing the practitioner in the business, with the practitioner in order not to damage the consortium's relationship with the practitioner.

c. R5 925 500 (follow the decision tree from the decision node to the relevant final outcomes and determine the expected value of the relevant group of final outcomes. This will be the group consisting of final outcomes 1 and 2: refer to the weighted profit of this group in part a. of the solution).

d. Examples of potential incremental fixed costs:

- Fixed salary costs should an additional nurse be required.
- Fixed salary costs should an additional receptionist be required.
- Cost of extending the building for an additional consulting room.
- Cost of extending the building for an additional waiting area for increased patient numbers.
- Additional IT costs.

QUESTION 3



Probability list and expected value:

	Conditional cash flow	Probability (%)	Weighted effect R
1	[10 000 x (R150 – R80)] – R140 000 = R560 000	50	280 000
2	[10 000 x (R150 – R80)] – R140 000 = R560 000	50	280 000
		100	**560 000**
3	[10 000 x (R150 – R80)] –(10 000 x R80) – R140 000 = (R240 000)	50	(120 000)
4	[20 000 x (R150 – R80)] – R140 000 = R1 260 000	50	630 000
		100	**510 000**

Hooked on Books (Pty) Ltd. should only print 10 000 books as this option's expected incremental cash inflow is the highest.

NOTE

If the entity only printed 10 000 books and the actual demand is higher, it will only be able to sell the 10 000 books produced. The excess of the demand over 10 000 books are lost.

Where the entity produces more than the actual demand, it gives rise to closing inventory which is obsolete. As the obsolete (closing) inventory will be written off, the value of closing inventory will be Rnil at the end of the selling period.

Additional reading

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Hodgkinson, GP & Starbuck, WH, eds. 2008. *The Oxford handbook of organizational decision making*. Oxford: Oxford University Press.

Julyan, FW & Nel, C. 2005. *Managerial Accounting*. Volume 1, 2nd edition. Centurion: Imprenta.

VERY IMPORTANT NOTE

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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*.

TERM / CONCEPT	DEFINITION / EXPLANATION
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.

TERM / CONCEPT	DEFINITION / EXPLANATION
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 alternatives.
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. This can be expressed as a percentage.
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).
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.

TERM / CONCEPT	DEFINITION / EXPLANATION
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 (INCREMENTAL) APPROACH TO RELEVANT COSTING	When we use the *differential (or incremental) 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.

TERM / CONCEPT	DEFINITION / EXPLANATION
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 (FIRST-IN-FIRST-OUT)	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/ COMPLETED 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.
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 the topic on budgeting, 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.

TERM / CONCEPT	DEFINITION / EXPLANATION
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 include 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.

TERM / CONCEPT	DEFINITION / EXPLANATION
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.
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*.

TERM / CONCEPT	DEFINITION / EXPLANATION
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 (note that products can be produced without incurring these costs.): ● ***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.
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.

TERM / CONCEPT	DEFINITION / EXPLANATION
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/PRIMARY 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.
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.
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
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.

TERM / CONCEPT	DEFINITION / EXPLANATION
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*.

TERM / CONCEPT	DEFINITION / EXPLANATION
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.
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 overheads 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.

TERM / CONCEPT	DEFINITION / EXPLANATION
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.